AIRSPACE MODERNISATION AIRSPACE CHANGE PROPOSAL

STEP 2A APPENDIX A - COMPREHENSIVE LIST OF OPTIONS ENGAGEMENT SLIDE PACK AND TECHNICAL APPENDIX

Heathrow

Table of Contents

All airspace design options in this document are subject to change throughout the airspace change process, as options are matured in detail and refined in accordance with safety requirements, design principles, appraisals and stakeholder engagement and consultation.

November 2022

Airspace Modernisation: Airspace Change Proposal

Stage 2A Engagement – Comprehensive List of Options

Heathrow

Workshop Agenda

1. Airspace Modernisation at Heathrow
2. Purpose of this Workshop
3. Our Approach to developing a Comprehensive List of Options
4. Creating our Options: PBN Departures
5. Creating our Options: PBN Arrivals
6. Creating our Options: Concepts
7. Next Steps
8. Glossary & FAQs

Airspace Modernisation at Heathrow

Heathrow is developing an Airspace Change Proposal (ACP) to introduce Airspace Modernisation at the airport

Heathrow has committed to modernise its airspace to help deliver the Government's **Airspace Modernisation Strategy** (AMS), along with other major airports and airfields in the UK.

The majority of UK flight paths were designed decades ago, at a time when aircraft and navigation were much less sophisticated than today. A nationwide airspace modernisation programme is therefore underway across UK airports.

The aims of the strategy are to:

- ✓ Make airspace more efficient,
- ✓ Reduce delays,
- ✓ Reduce CO_2 emissions,
- ✓ Reduce noise;
- ✓ Enhance safety; and
- ✓ Ensure there is capacity to meet future demand.

"Deliver quicker, quieter, and cleaner journeys"

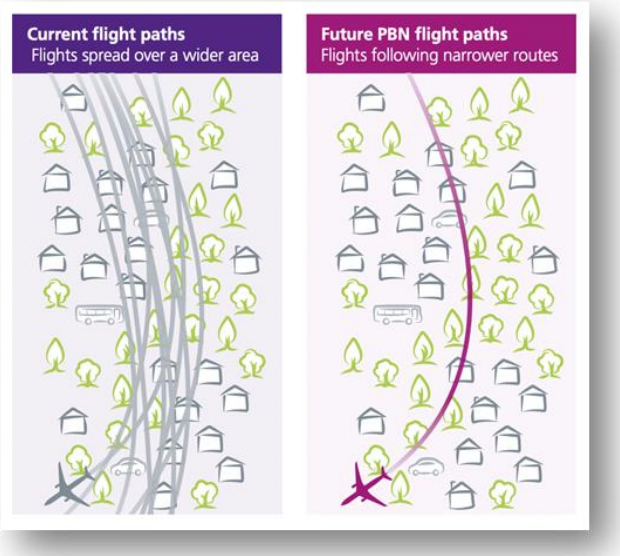
The introduction of performance-based navigation (PBN) is key to achieving airspace modernisation

Our new flight paths will use PBN.

PBN improves the accuracy of where aircraft fly by using modern satellite navigation and moving away from outdated and conventional navigation techniques using ground-based beacons (it is similar to GPS "sat nav" devices that most people use in their cars today).

PBN allows more flexible positioning of routes and enables aircraft to fly them more accurately. This helps improve operational performance and reduce delays. It also provides opportunities to avoid noise sensitive areas.

We understand that narrower flight paths due to the introduction of PBN is a concern to some local communities. We are looking at options for mitigating the potential impacts of PBN through our new airspace design.



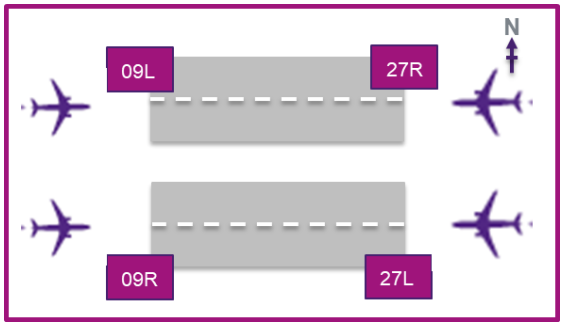
We are responsible for designing flight paths to and from our two runways up to 7,000 feet

This ACP will result in changes to Heathrow's flight paths and to the areas overflown by them.

We have identified the area that could potentially be affected by this airspace change. This area may change as the proposal develops.

Heathrow is responsible for the airspace design (flight paths) up to 7,000ft Above Ground Level: other airports also operate within this area.

NATS is responsible for the airspace design above 7,000ft



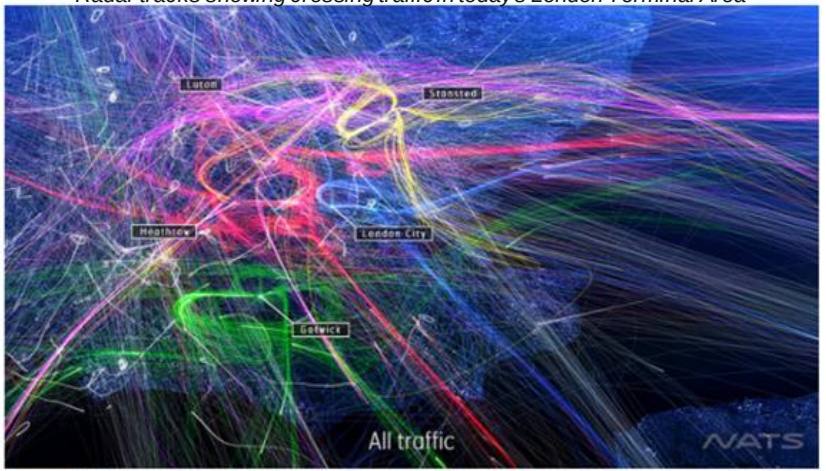
Heathrow's Two Runways

In designing our airspace, we need to consider integration with other airports and with NATS

Other UK airports are undertaking their own ACPs for airspace modernisation, and NATS is designing the airspace above 7,000ft: our airspace design below 7,000ft is dependent on their new airspace designs.

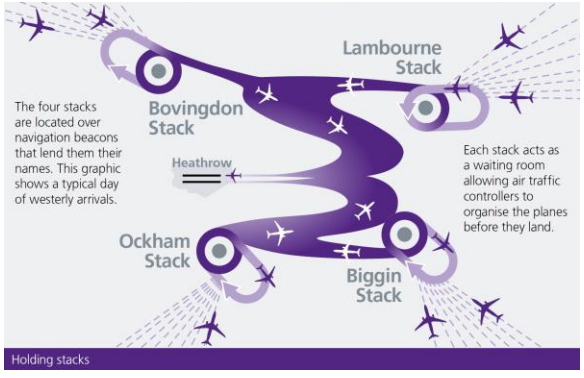
All options shared with you today are subject to change as the airspace designs of other airports and NATS are matured and refined in accordance with safety requirements, Design Principles, appraisals and stakeholder engagement and consultation.

Radar tracks showing crossing traffic in today's London Terminal Area



Source: NATS

NATS is responsible for designing the arrivals mechanism that will replace today's holding stacks. Today's departures can be "held down" at 6,000ft until clear of our arriving aircraft. Therefore, **the position and format of the new arrivals mechanism will impact the position of our future flight paths for both arrivals and departures.**



Today's holding stacks

The CAA's Airspace Change Process

- We are following the CAA's Airspace Change Process, known as "CAP1616" and we are now at Stage 2, known as "Develop and Assess"
- This is the stage where we develop a comprehensive list of options that address the Statement of Need and align with the Design Principles we set last year at Stage 1
- At this stage we are required to engage with our stakeholders to ensure we have understood and accounted for stakeholder concerns specifically related to the design options

The CAA's CAP1616 Process

Stage 1 DEFINE	Step 1A	Assess requirement
	Step 1B	Design principles
		DEFINE GATEWAY
Stage 2 DEVELOP and ASSESS	Step 2A	Option development
	Step 2B	Options appraisal
		DEVELOP AND ASSESS GATEWAY
Stage 3 CONSULT	Step 3A	Consultation preparation
	Step 3B	Consultation approval
		CONSULT GATEWAY
	Step 3C	Commence consultation
	Step 3D	Collate & review responses
Stage 4 UPDATE and SUBMIT	Step 4A	Update design
	Step 4B	Submit proposal to CAA
Stage 5 DECIDE	Step 5A	CAA assessment
	Step 5B	CAA decision
		DECIDE GATEWAY
Stage 6 IMPLEMENT	Step 6	Implement
Stage 7 PIR	Step 7	Post-implementation review

WE ARE HERE

CAP1616 requires us to develop options that meet our Statement of Need and Design Principles we set at Stage 1

Our Statement of Need summarises why the airspace change is needed:

The Government's Airspace Modernisation Strategy (AMS) lays out a national programme to modernise and upgrade the UK's airspace.

A masterplan is now being created by the Airspace Change Organising Group (ACOG) to coordinate the delivery of airspace change across the UK.

Heathrow's current departure and arrival procedures were designed decades ago, at a time when aircraft and navigation were much less sophisticated than today.

Through airspace modernisation Heathrow will make use of modern navigation technology to enable better aircraft performance, reduce delays and manage traffic in ways that mitigate, where possible, the impact on local communities.

Our Design Principles were developed at Stage 1 with input from a wide range of stakeholders

Our Design Principles for Airspace Modernisation: Approved by CAA in Feb 2022		
1	Our new airspace design **must**	Be safe
2		Remain in accordance with the CAA's published Airspace Modernisation Strategy and any current or future plans associated with it and all other relevant UK policy, legislation and regulatory standards(for example, Air Navigation Guidance). This includes preventing any worsening of local air quality due to emissions from Heathrow's aircraft movements, to remain within local authorities' limits
3		Use noise efficient operational practices to limit and, where possible, reduce adverse impacts from aircraft noise
4		Reduce the contribution to climate change from CO_2 emissions and other greenhouse gas emissions arising from Heathrow's aircraft activities
5		Enable Heathrow to make the most operationally efficient and resilient use of its existing two runways, to maximise benefits to the airport, airlines and cargo handlers, passengers, and local communities
6	And **should** also	Provide predictable and meaningful respite to those affected by noise from Heathrow's movements
7		Seek to avoid overflying the same communities with multiple routes including those to/from other airports
8		Contribute to minimising the negative impacts of night flights
9		Keep the number of people who experience an increase in noise from the future airspace design to a minimum
10		Keep the total number of people who experience noise from the future airspace design to a minimum
11		Enable the efficiency of other airspace users' operations
12		Minimise the impact to all stakeholders from future changes to Heathrow's airspace

The first 5 Principles are all requirements that we ***must*** meet

The remaining 7 are Principles that we ***should also*** meet

There is no prioritisation of the Principles beyond this grouping into "must" and "should"

We are required to develop options that address our Design Principles:

1. Some DPs can be addressed through design of the flight paths over the ground;
2. Some DPs are addressed through operational concepts that can be applied to each option;
3. Some DPs can be considered in the design of options at this stage, but may require some refinement of designs once we have additional information.

Purpose of this Workshop

Purpose of this Workshop

The purpose of this engagement is to **explore and test our approach** to developing our comprehensive list of options. We will use your feedback to ensure that we understand and take account of any concerns raised as we evaluate how the options respond to the Design Principles.

This stage of engagement <u>is</u> to:

- Show our approach to developing a list of options based on the Design Principles set at Stage 1
- Answer questions relating to our approach
- Seek your feedback on our approach

This stage of engagement <u>is not</u> to:

- Examine the detailed specific geographical position of the options
- Discuss the pros and cons of individual route options
- Describe impacts of the route options
- Seek feedback on individual route options

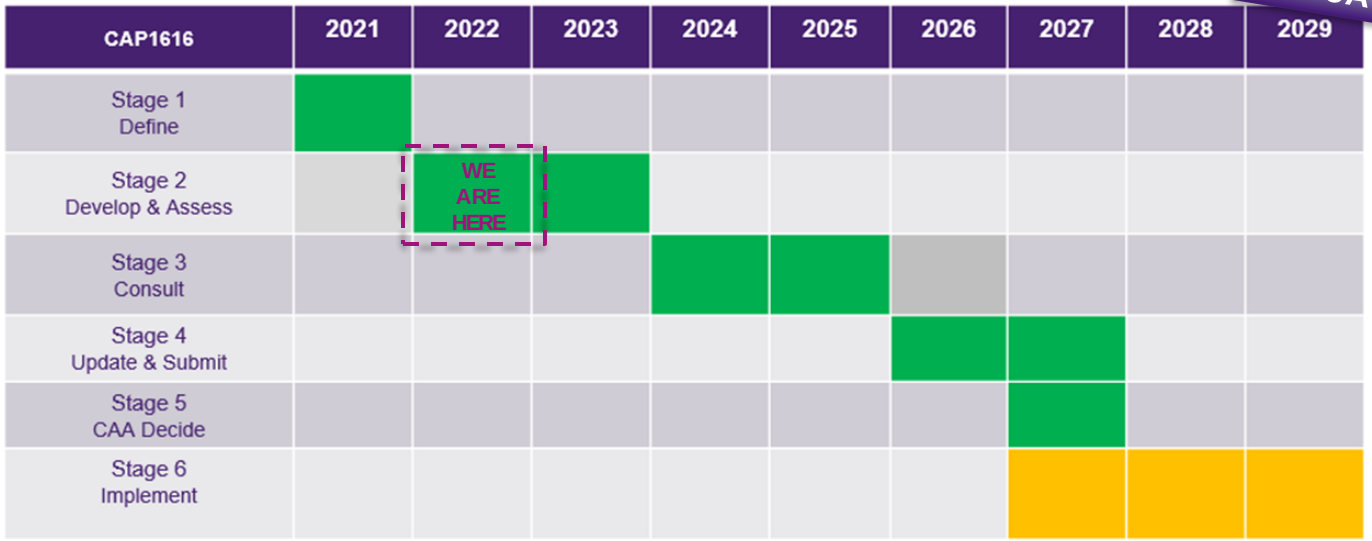
This Airspace Change relates to Heathrow's existing 2 runways only. It is not related to Heathrow's previous (and paused) airspace change proposal for flight paths to an expanded airport.

This engagement will take place later, at Stage 3

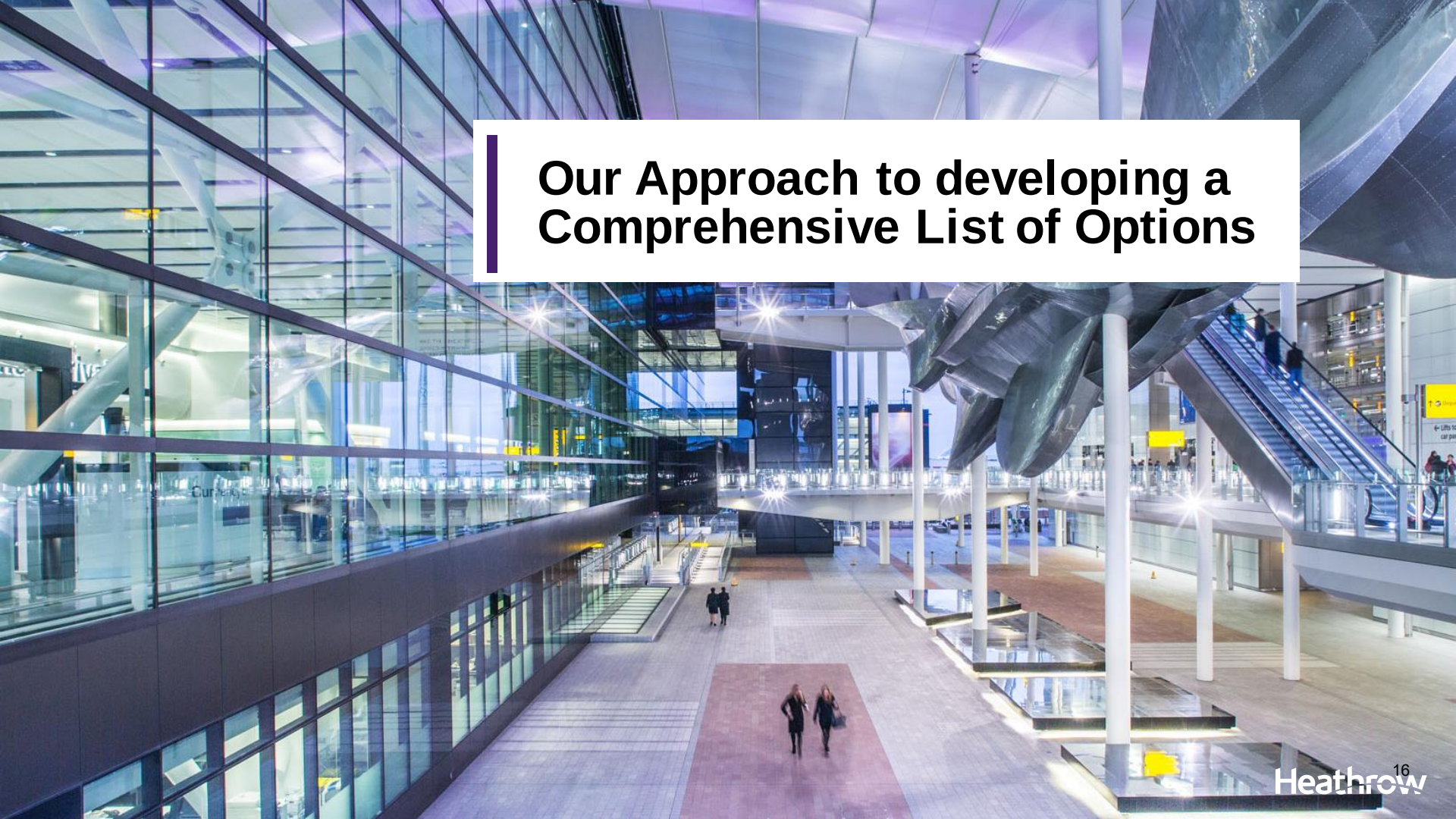
Our Airspace Modernisation Programme

Following this engagement and stakeholder feedback, we will produce a Design Principle Evaluation (DPE): this will demonstrate how each option from our comprehensive list responds to each Design Principle in turn. The results of our DPE will be shared with you and with the CAA.

INDICATIVE

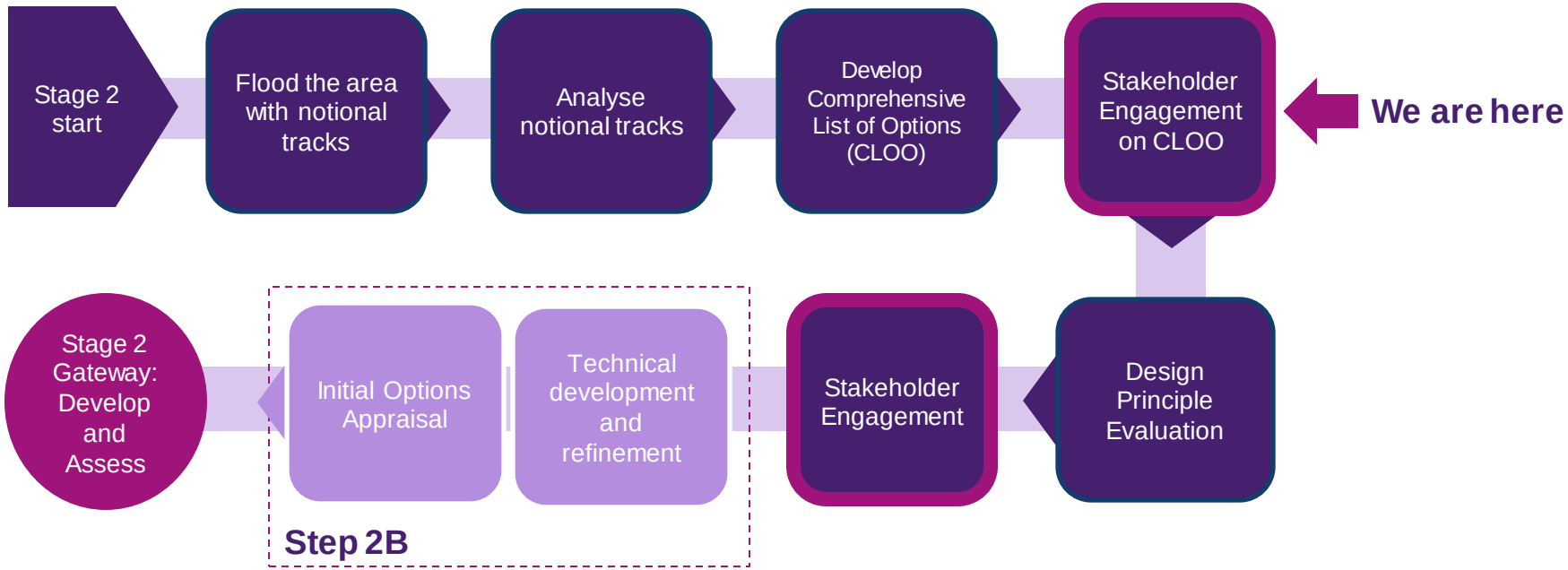


Note: The progress of our ACP is dependent on the progress of other airports, NATS, and the Masterplan which is being developed by the Airspace Change Organising Group (ACOG)



Our Approach to developing a Comprehensive List of Options

We developed a data-driven approach to creating a comprehensive list of options



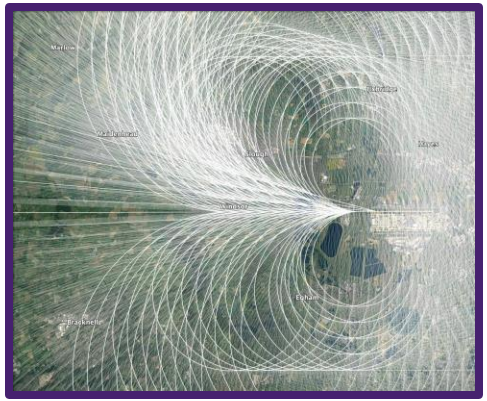
A "Comprehensive List of Options" are airspace design options that would address the Statement of Need and that align with the Design Principles set at Stage 1

We generated notional tracks to ensure we investigated as many route positionings as possible

Notional tracks are lines drawn to/from a runway end to/from a point in the airspace network. They are based on basic principles of airspace design, but they cannot be considered ‘flyable’ flight paths. They are used to collect data on the areas that would be "overflown" by them.

We flooded the area with over 650,000 notional tracks:

- Notional tracks were used to generate data, and to inform option creation in line with the Design Principles
- The notional tracks were drawn from Heathrow to points within the higher airspace network where aircraft typically fly today since destination points are likely to remain similar in the future



Sample of notional tracks for westerly departures from the northern runway – known as “27R departures”

Selection of the notional departure tracks from 27R to the “Dover” network point

Metrics were generated for each notional track to inform the development of options

- Data relevant to our Design Principles was generated for each notional track
- This data was then used to inform us on where we might create options that would meet our Design Principles
- Data was supplemented by Technical expertise from the wider team of Air Traffic Controllers, airspace designers and noise and environmental experts
- Not all Design Principles can be addressed through data/metrics but this process ensured we were informed by as much information as possible when generating options

Metrics calculated for notional tracks
Total population overflown* between the runway and 7,000ft
Population newly overflown (>20 times a day on average) between the runway and 7,000ft
Population exposed to noise at a 70 decibel SEL level (based on an A320 aircraft)
The area (Km^2) of Areas of Outstanding Natural Beauty (AONB) or National Parks overflown
Distance in nautical miles between the runway and points within the airspace network

* *"Overflown" is defined as "an aircraft in flight passing an observer at an elevation angle of 48.5˚ from the ground at an altitude below 7000ft" (CAA).*

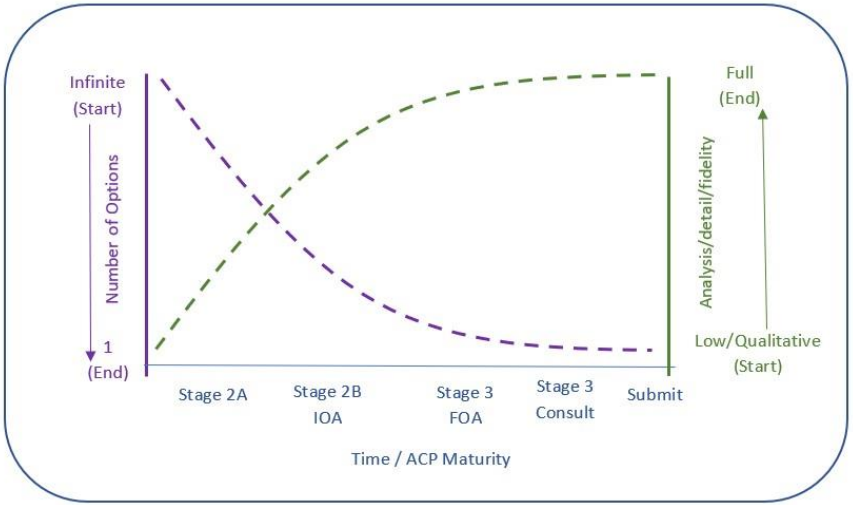
Some Design Principles influence the position of a route; others are concepts that can be applied to all options

		Our Design Principles for Airspace Modernisation	Our Consideration during options development
1	Our new airspace design **must**	Be safe	Initial consideration applied to all options: further assessment required at Step 2B
2		Remain in accordance with the CAA's published Airspace Modernisation Strategy and any current or future plans associated with it and all other relevant UK policy, legislation and regulatory standards(for example, Air Navigation Guidance). This includes preventing any worsening of local air quality due to emissions from Heathrow's aircraft movements, to remain within local authorities' limits	Flight path options developed
3		Use noise efficient operational practices to limit and, where possible, reduce adverse impacts from aircraft noise	Concepts developed: to be applied to any of the flight path options
4		Reduce the contribution to climate change from CO_2 emissions and other greenhouse gas emissions arising from Heathrow's aircraft activities	Flight path options developed
5		Enable Heathrow to make the most operationally efficient and resilient use of its existing two runways, to maximise benefits to the airport, airlines and cargo handlers, passengers, and local communities	Flight path options developed
6	And **should** also	Provide predictable and meaningful respite to those affected by noise from Heathrow's movements	Concepts developed: to be applied to any of the flight path options
7		Seek to avoid overflying the same communities with multiple routes including those to/from other airports	Initial consideration applied to all options: to be refined as other airports share more information
8		Contribute to minimising the negative impacts of night flights	Concepts developed: to be applied to any of the flight path options
9		Keep the number of people who experience an increase in noise from the future airspace design to a minimum	Flight path options developed
10		Keep the total number of people who experience noise from the future airspace design to a minimum	Flight path options developed
11		Enable the efficiency of other airspace users' operations	Initial consideration applied to all options: to be refined as other airspace users share more information
12		Minimise the impact to all stakeholders from future changes to Heathrow's airspace	Initial consideration applied to all options: to be refined as future industry and airport requirements become clearer

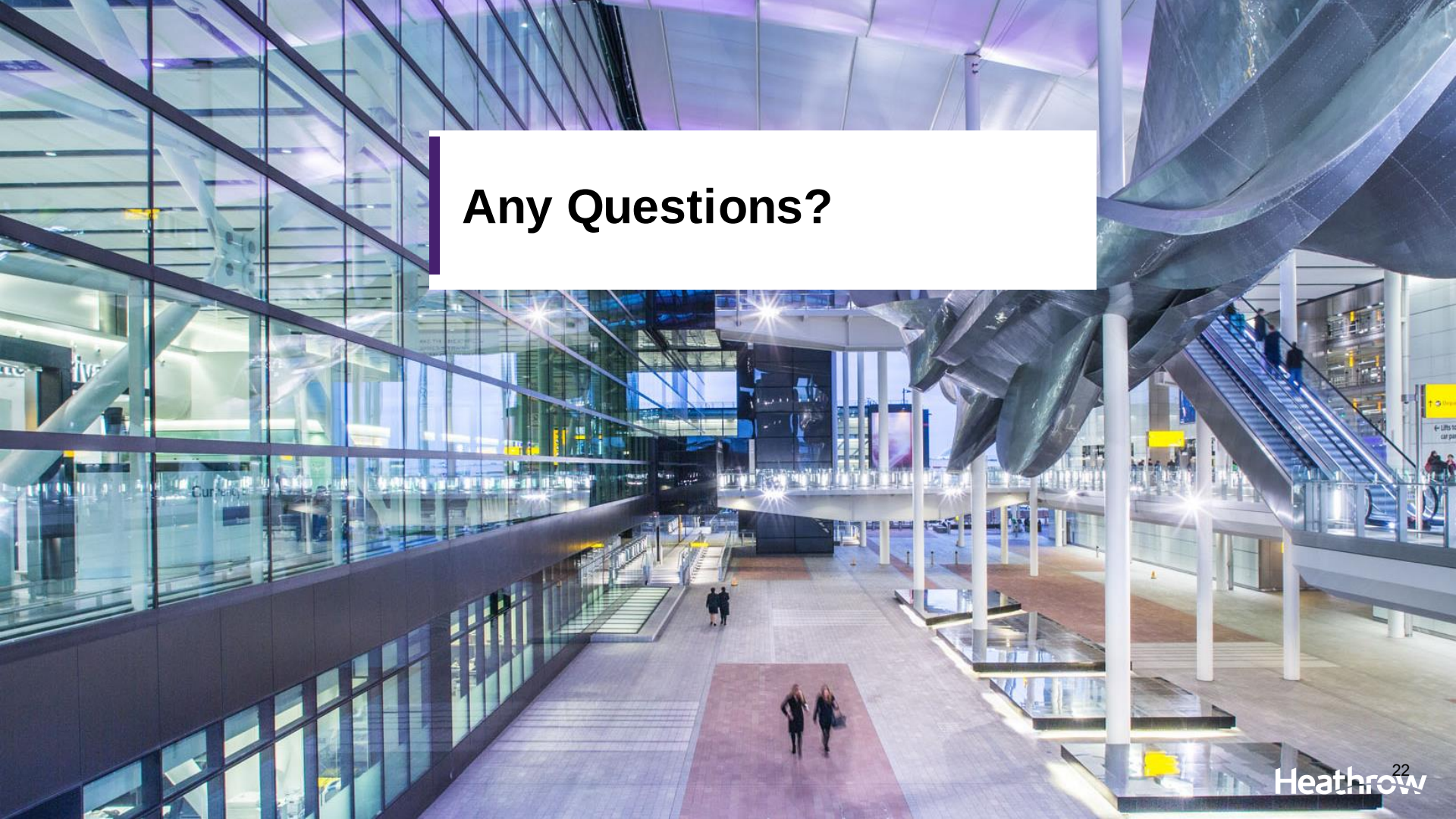
Options will be refined and matured throughout the design process

Airspace design is a complex process and the CAA's airspace change process takes many years to complete for an airspace change of this scale.

We begin with an infinite number of options and use data analysis and assessment to shortlist options over the course of the Airspace Change Proposal (ACP).



The number of options decreases as analysis, detail, and data fidelity increase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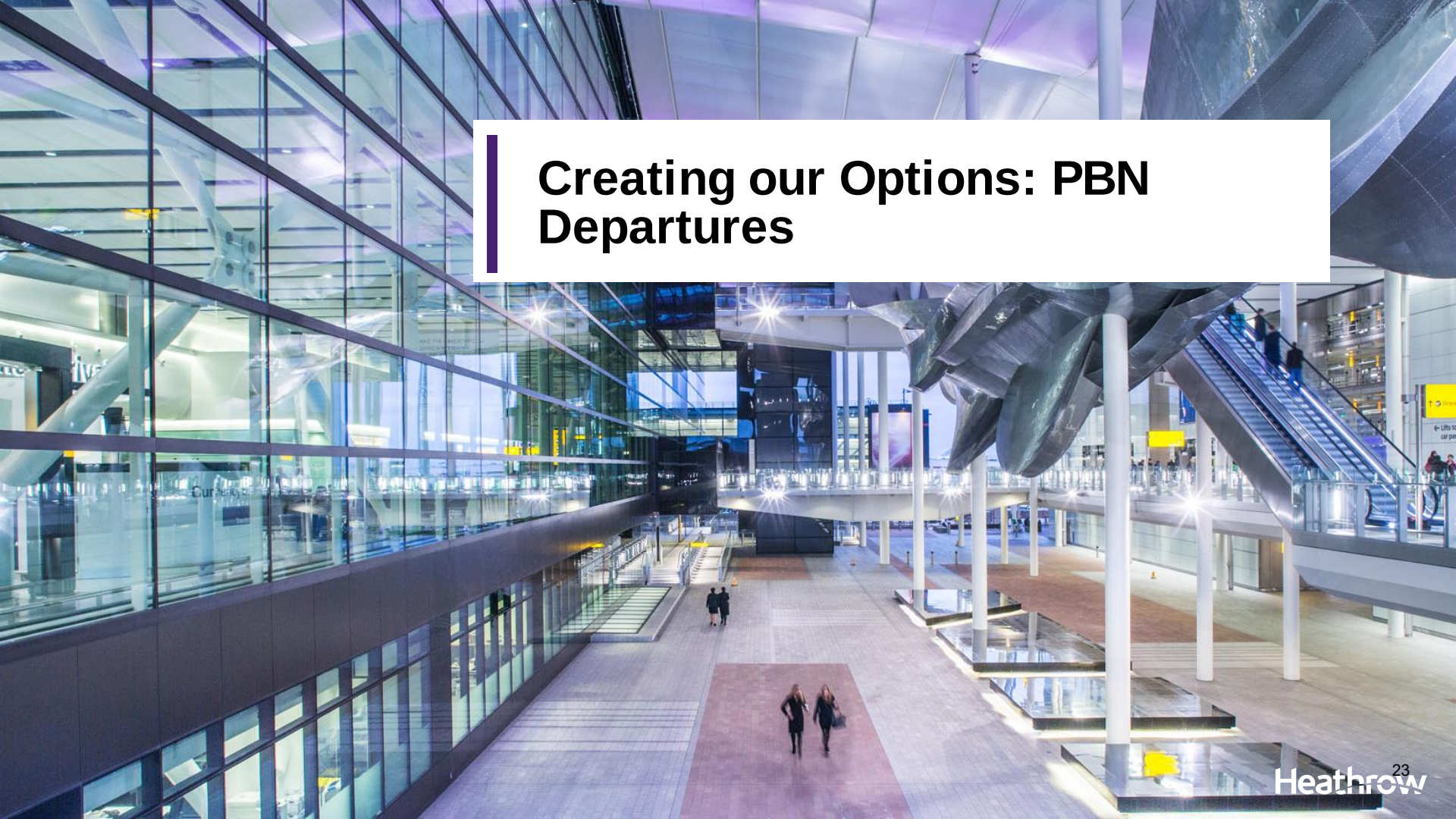


Creating our Options: PBN Departures

We started developing notional tracks for departures by setting out a list of initial inputs

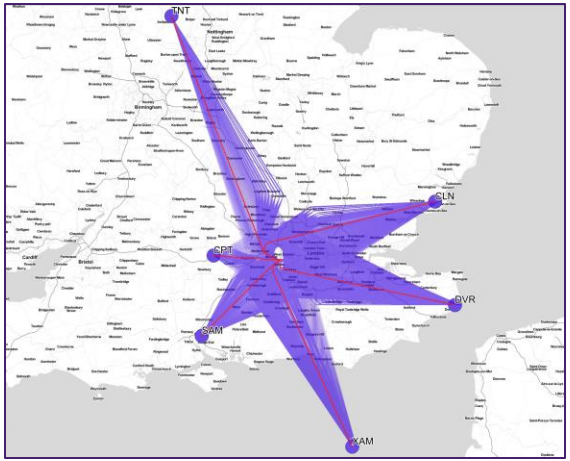
Flood the area with notional tracks

For departures, this included:

- Departure flight paths are needed from each runway end towards six waypoints in the wider NATS network (these waypoints are assumed to be the same as today)

- Notional tracks are based on inputs such as:
  - Climb gradient of 5.5%
  - Continuous Climb assumed to 7,000ft
  - Small portions of airspace allocated to RAF Northolt and London City

- Noise metrics are based on an A320 aircraft (the most common aircraft at Heathrow): different aircraft types will be input at the next stage



Example of notional tracks to each of the 6 waypoints

These inputs helped us to develop notional tracks: departure assumptions will be refined at the next stage of design

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Notional tracks were analysed to identify operationally viable options that best meet each Design Principle

Analyse notional tracks

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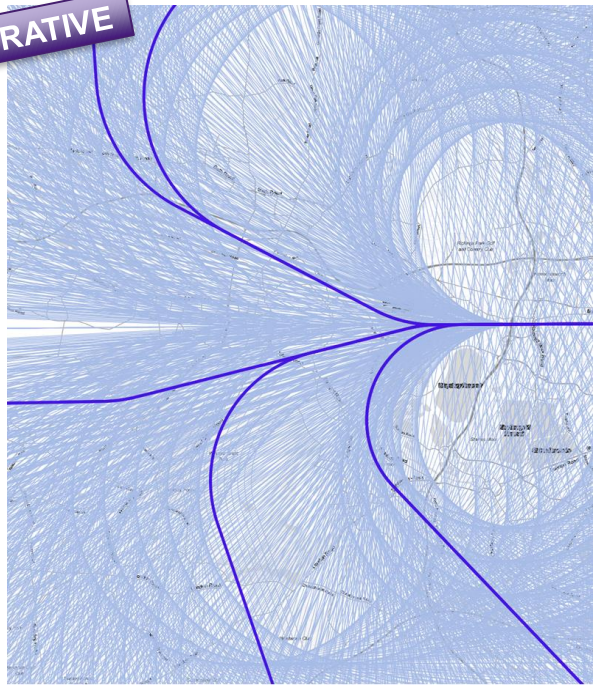

Illustration of the selection of notional tracks

The Airspace Design Team analysed the data produced for each notional track to identify the highest performing track for a Design Principle.

The team's air traffic control expertise was applied at this stage to select notional tracks that are likely to be operationally viable by considering issues such as:

- Safety;
- Surrounding airports;
- Aircraft capability; and,
- Sufficient separation from other routes.

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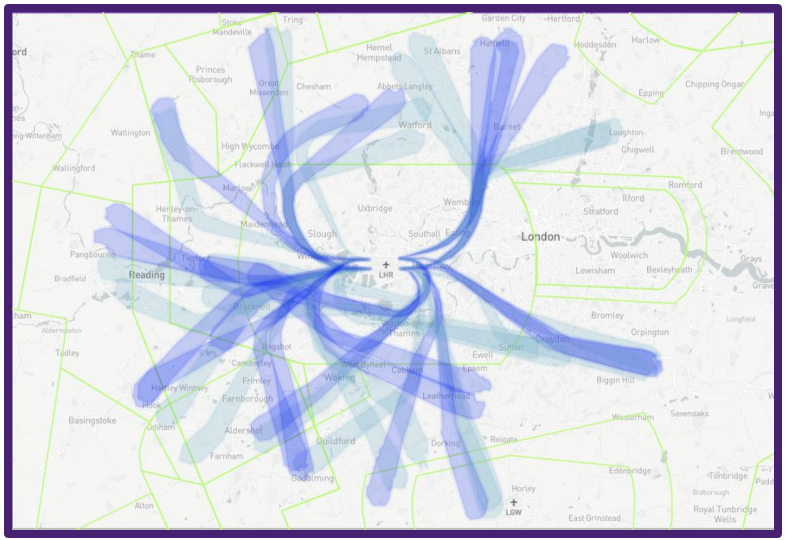
Departure options to meet Design Principle 2

Analyse notional tracks

This image shows all the departure flight paths identified to specifically meet Design Principle 2, from each of Heathrow's four runway ends.



All flight path options designed to meet Design Principle 2

Design Principle 2:	"Remain in accordance with the CAA's published Airspace Modernisation Strategy and any current or future plans associated with it and all other relevant UK policy, legislation and regulatory standards(for example, Air Navigation Guidance). This includes preventing any worsening of local air quality due to emissions from Heathrow's aircraft movements, to remain within local authorities' limits"
Approach:	These options were designed to minimise the number of people exposed to noise up to 7,000ft, whilst also considering CO_2 and AONBs (but to a lesser extent than population)
Inputs used:	1. Population exposed to 70 decibel SEL 2. Population overflown (below 7,000ft) 3. Track mileage between runways and points within the network 4. AONB (km^2)

Flight path options are shown as overflight cones which identify the areas likely to be perceived as overflown up to 7,000ft. Overflight cones are suitable for showing areas potentially overflown at this early stage of the design process.

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

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We created two sets of options for Design Principle 2 to reflect the Government's Air Navigation Guidance

Analyse notional tracks

ANG2017 states: *"in the airspace at or above 4,000 feet to below 7,000 feet, the environmental priority should continue to be minimising the impact of aviation noise in a manner consistent with the government's overall policy on aviation noise,* ***unless the CAA is satisfied that the evidence presented by the sponsor demonstrates this would disproportionately increase CO_2 emissions***"

We have created two sets of options for Design Principle 2:

1. Minimise the number of people exposed to noise up to 7,000ft whilst also considering CO_2 and AONBs but to a lesser extent than population;

2. Minimise the number of people exposed to noise up to 4,000ft and then minimise track miles from 4,000ft.

Both sets of options are included in the comprehensive list of options for further assessment at the next stage

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

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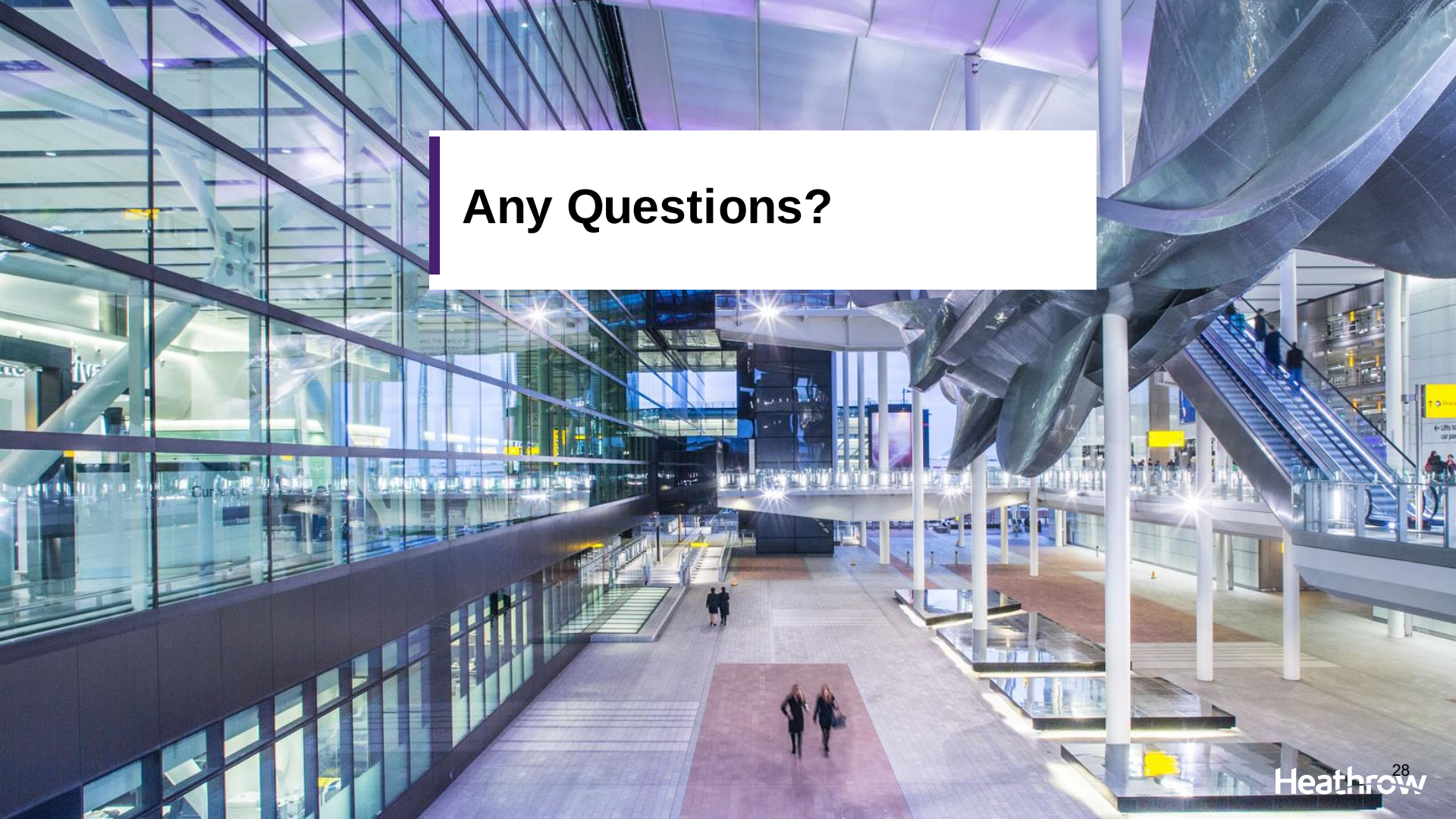
Any Questions?

Departure options to meet Design Principle 4

Analyse notional tracks

This image shows all the departure flight paths identified to specifically meet Design Principle 4, from each of Heathrow's four runway ends.

All flight path options designed to meet Design Principle 4

Design Principle 4:	"Reduce the contribution to climate change from CO_2 emissions and other greenhouse gas emissions arising from Heathrow's aircraft activities"
Approach:	These options were designed to minimise the number of track miles flown
Inputs used:	Track length (nautical miles) from runway end to the relevant point in the upper airspace network

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

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Departure options to meet Design Principle 5

Analyse notional tracks

This image shows all the departure flight paths identified to specifically meet Design Principle 5, from each of Heathrow's four runway ends.

All flight path options designed to meet Design Principle 5

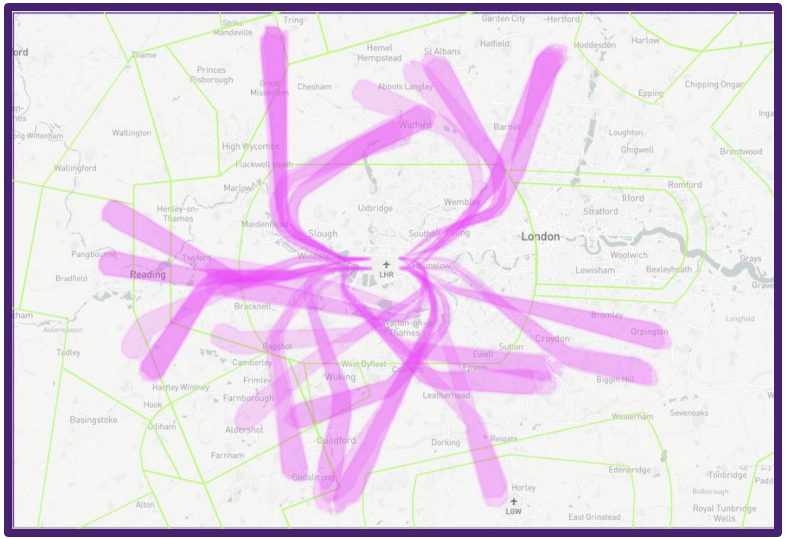
Design Principle 5:	"Enable Heathrow to make the most operationally efficient and resilient use of its existing two runways, to maximise benefits to the airport, airlines and cargo handlers, passengers, and local communities"
Approach:	These options were designed to maximise departure rates
Inputs used:	Technical Team's input on air traffic control procedures and Heathrow's operation

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

Departure options to meet Design Principle 9

Analyse notional tracks

This image shows all the departure flight paths identified to specifically meet Design Principle 9, from each of Heathrow's four runway ends.



All flight path options designed to meet Design Principle 9

Design Principle 9:	"Keep the number of people who experience an increase in noise from the future airspace design to a minimum"
Approach:	These options were designed to minimise the number of people newly overflown
Inputs used:	1. Population newly overflown (below 7,000ft, at least 20 times a day on average) 2. Population exposed to 70 decibel SEL We also included centrelines of today's departure routes

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

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Departure options to meet Design Principle 10

Analyse notional tracks

This image shows all the departure flight paths identified to specifically meet Design Principle 10, from each of Heathrow's four runway ends.

All flight path options designed to meet Design Principle 10

Design Principle 10:	"Keep the total number of people who experience noise from the future airspace design to a minimum"
Approach:	These options were designed to minimise the number of people exposed to noise up to 7,000ft.
Inputs used:	1. Population exposed to 70 decibel SEL 2. Population overflown (below 7,000ft)

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

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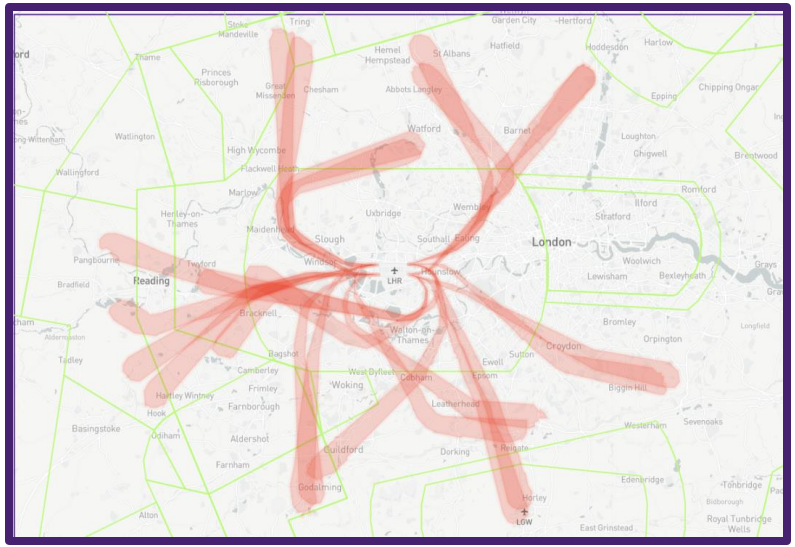
Departure options to meet a blend of Design Principles 2, 4, 9 and 10

Analyse notional tracks

These options are based on a weighted average of all the metrics we have considered. Since different stakeholders would apply different weightings to different metrics, we have applied all possible weighting combinations to identify the highest performing tracks against the full set of data.



All flight path options designed to meet the blend of Design Principles

Approach:	These options were designed to identify the options that perform well (on average) across all of the metrics with no prioritisation
Inputs used:	• Population exposed to 70 decibel SEL • Population overflown (below 7,000ft) • Track mileage between runways and points within the network • AONB (km2) • Population newly overflown (below 7,000ft, at least 20 times a day on average)

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

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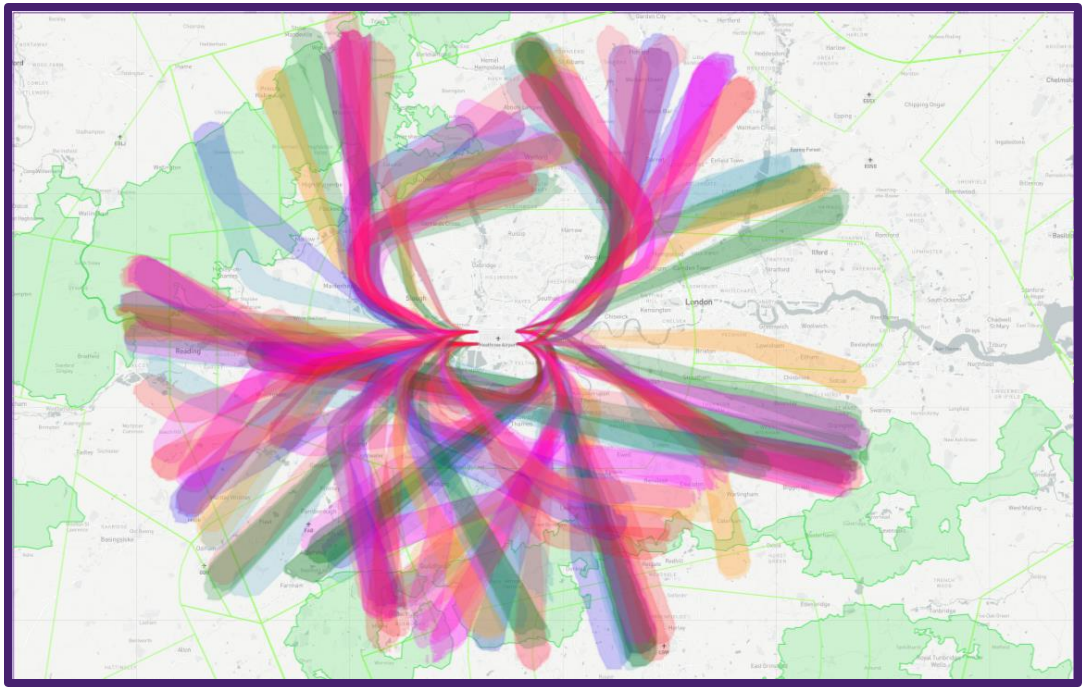
Our comprehensive set of departure flight path options has been developed based on the Design Principles

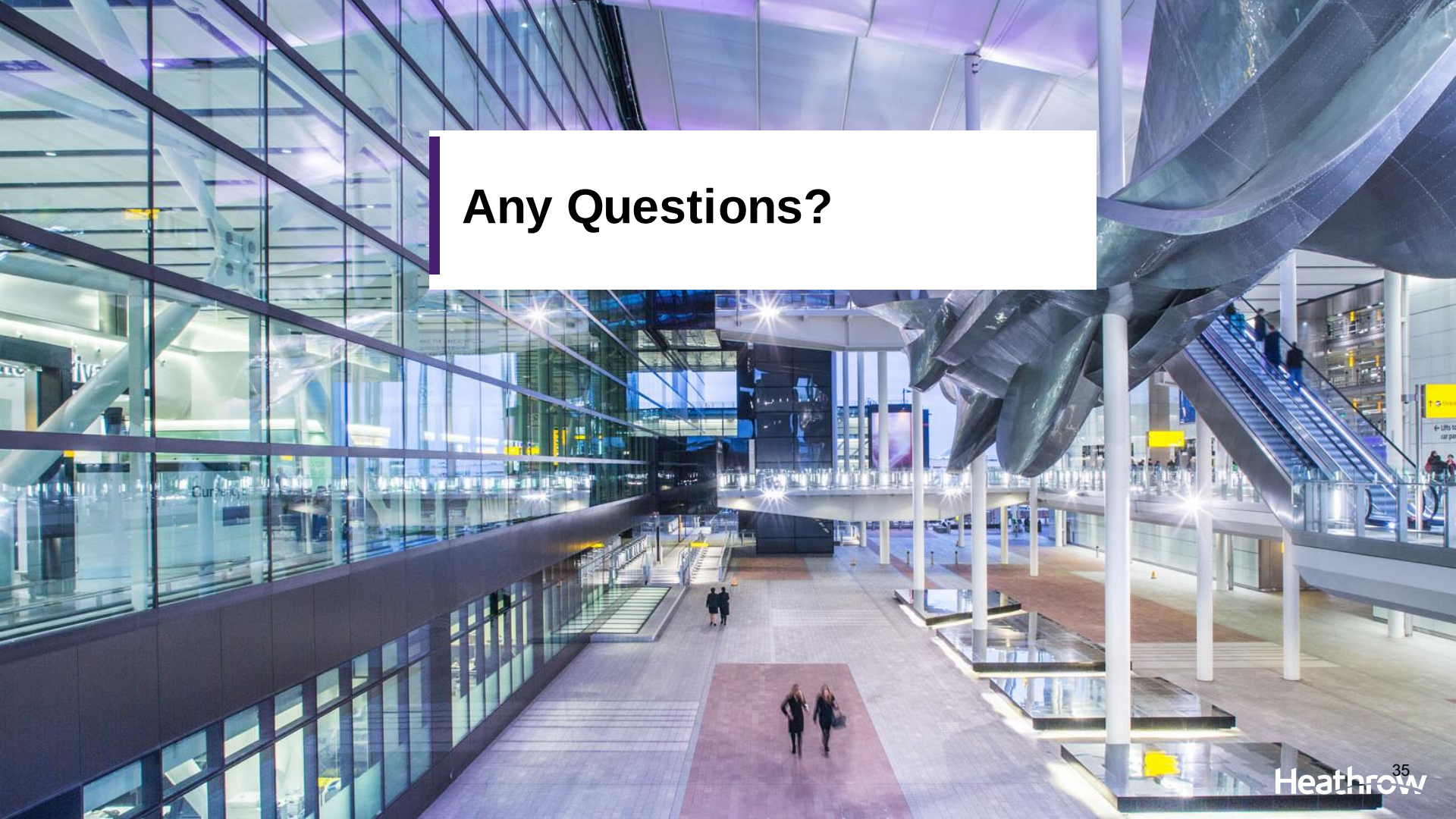


The comprehensive list of departure options

This image shows all departure flight path options, from each of Heathrow's four runway ends.

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

Options will also be refined as we understand more about the future airspace design of other airports and NATS, and as we consider a broader range of aircraft types and practices.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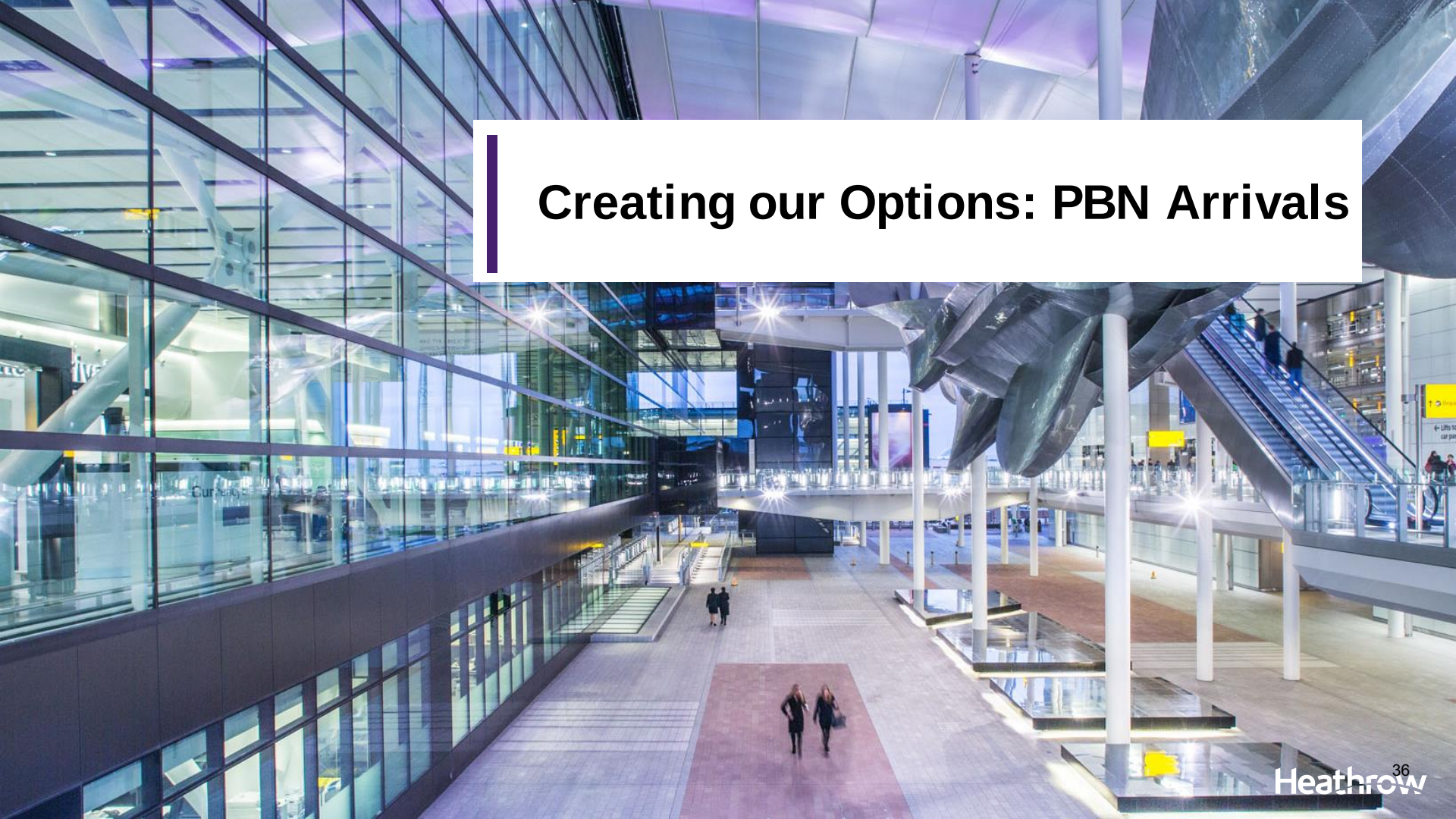


Creating our Options: PBN Arrivals

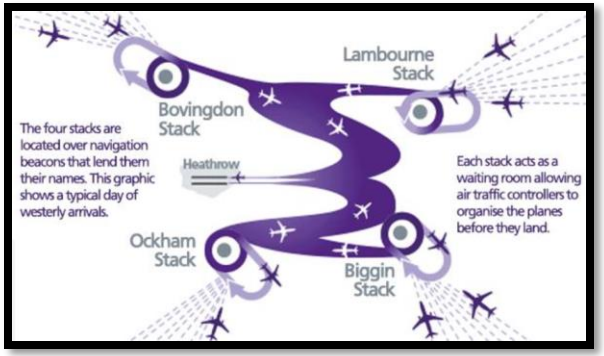
We have developed PBN arrival options, however aircraft on arrival routes could still be "vectored" by controllers

It is likely that we will still need Air Traffic Controllers to “vector” some aircraft onto final approach to the runway to ensure accurate spacing can be maintained between arriving aircraft. Aircraft can be spaced more closely together by Air Traffic Controllers than on systemised PBN routes because controllers can take account of the various sizes and speeds of aircraft, and of changing weather conditions. **However, PBN arrivals all the way to the runway could be used some of the time.**

Heathrow has only one runway for arrivals throughout most of the day (and one runway for departures) and it would be difficult to achieve the required throughput during core hours using PBN arrival routes.

We expect that a new form of arrivals mechanism will replace today's holding stacks. NATS is responsible for designing this, so we are working closely with NATS to ensure our flight path options will integrate with the new design. We expect that any new holding mechanism will be required less often and that stacks will be higher than today.

Today's holding stacks



We started developing notional tracks for PBN arrivals by setting out a list of initial inputs

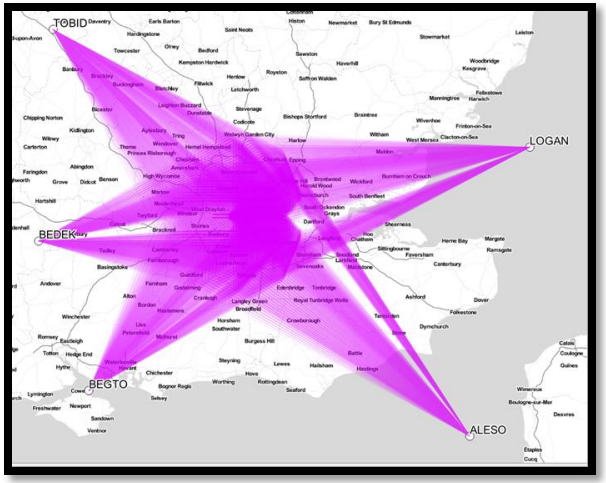
Flood the area with notional tracks

For PBN arrivals, this included:

- Arriving aircraft will establish onto final approach by 3 nautical miles from the runway

- Notional tracks are based on inputs such as:
  - Descent gradient of 5.24% (3.0˚)
  - Continuous Descent assumed from 7,000ft
  - Small portions of airspace allocated to RAF Northolt and London City

- Notional tracks are based on an A320 aircraft (the most common aircraft at Heathrow): different aircraft types will be input at the next stage



Example of notional tracks from each of the 5 waypoints

These inputs helped us to develop notional tracks: arrival assumptions will be refined at the next stage of design

Notional tracks were analysed to identify operationally viable options that best meet each Design Principle

Analyse notional tracks

EXAMPLE

Illustration of the selection of notional tracks

The Airspace Design Team analysed the data produced for each notional track to identify the highest performing track for a Design Principle.

The Technical team's air traffic control expertise was applied at this stage to select notional tracks that are likely to be operationally viable by considering issues such as:

- Safety;
- Surrounding airports;
- Aircraft capability; and,
- Sufficient separation from other routes.

In some cases, additional tracks needed to be included to ensure the options are suitable for all aircraft types: in the example above, the highest performing notional track to Runway 27R for this Design Principle is shown in **dark pink**. However, this notional track joins final approach very close to the runway, so only aircraft with a very high technical capability would be able to fly this route.

The Technical team therefore revisited the data to identify the next high performing notional track that would be suitable for all aircraft using Heathrow: this is the **light pink track**. Both notional tracks were found likely to be operationally viable routes and were included in the comprehensive list of options.

PBN arrivals options to meet Design Principle 2

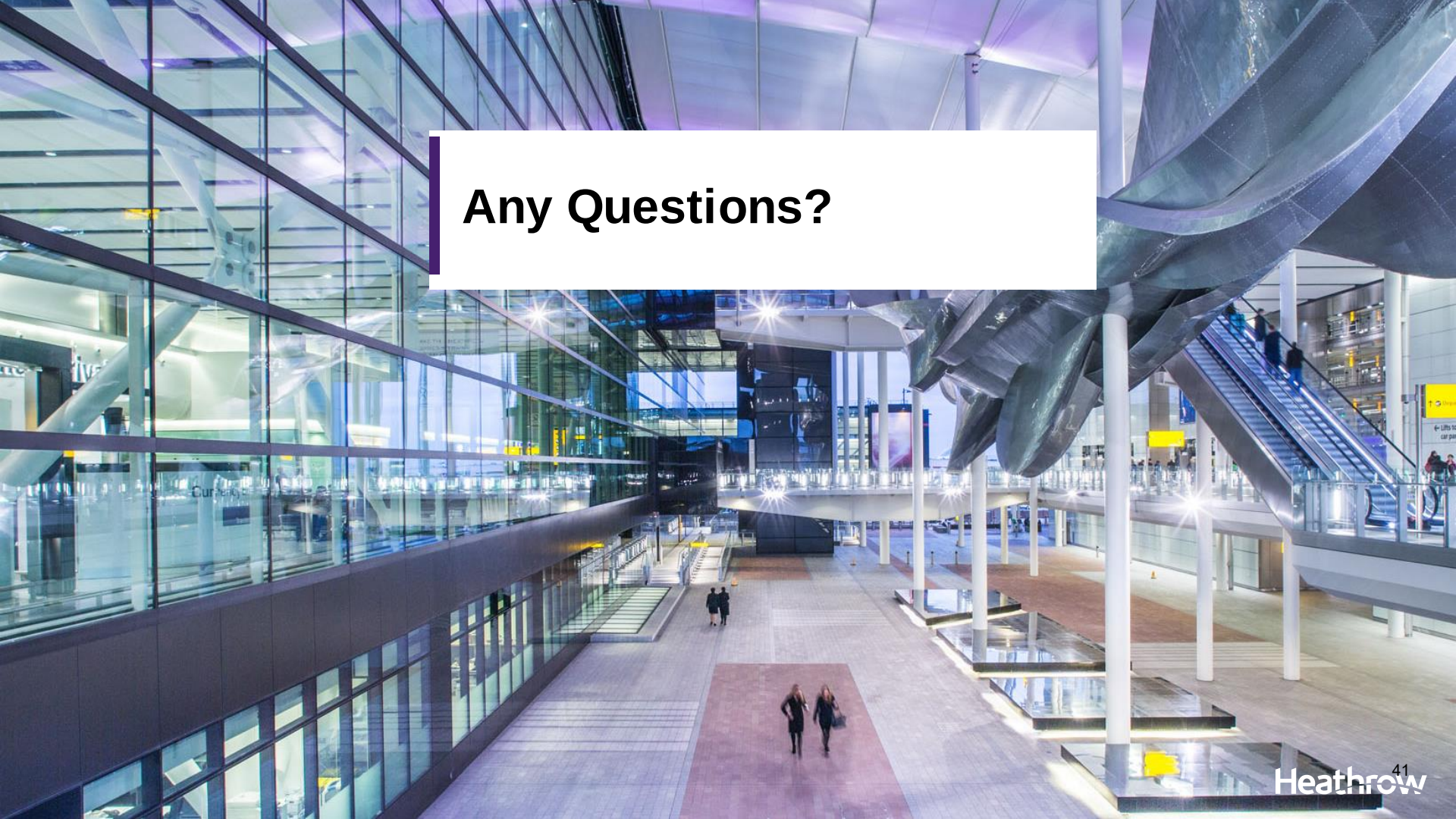
Analyse notional tracks

This image shows all the PBN arrivals flight paths identified to specifically meet Design Principle 2, to each of Heathrow's four runway ends.

All PBN Arrivals flight path options designed to meet Design Principle 2

Design Principle 2:	"Remain in accordance with the CAA's published Airspace Modernisation Strategy and any current or future plans associated with it and all other relevant UK policy, legislation and regulatory standards(for example, Air Navigation Guidance). This includes preventing any worsening of local air quality due to emissions from Heathrow's aircraft movements, to remain within local authorities' limits"
Approach:	These options were designed to minimise the number of people exposed to noise up to 7,000ft, whilst also considering CO_2 and AONBs (but to a lesser extent than population)
Inputs used:	1. Population exposed to 70 decibel SEL 2. Population overflown (below 7,000ft) 3. Track mileage between runways and points within the network 4. AONB (km^2)

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.


Any Questions?

PBN arrivals options to meet Design Principle 4

This image shows all the PBN arrivals flight paths identified to specifically meet Design Principle 4, to each of Heathrow's four runway ends.

All PBN Arrivals flight path options designed to meet Design Principle 4

Design Principle 4:	"Reduce the contribution to climate change from CO_2 emissions and other greenhouse gas emissions arising from Heathrow's aircraft activities"
Approach:	These options were designed to minimise the number of track miles flown
Inputs used:	Track length (nautical miles) from runway end to the relevant point in the upper airspace network

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

Heathrow

PBN arrivals options to meet Design Principle 9

Analyse notional tracks

This image shows all the PBN arrivals flight paths identified to specifically meet Design Principle 9, to each of Heathrow's four runway ends.

All PBN Arrivals flight path options designed to meet Design Principle 9

Design Principle 9:	"Keep the number of people who experience an increase in noise from the future airspace design to a minimum"
Approach:	These options were designed to minimise the number of people newly overflown
Inputs used:	1. Population newly overflown (below 7,000ft, at least 20 times a day on average) 2. Population exposed to 70 decibel SEL

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

PBN arrivals options to meet Design Principle 10

Analyse notional tracks

This image shows all the PBN arrivals flight paths identified to specifically meet Design Principle 10, to each of Heathrow's four runway ends

All PBN Arrivals flight path options designed to meet Design Principle 10

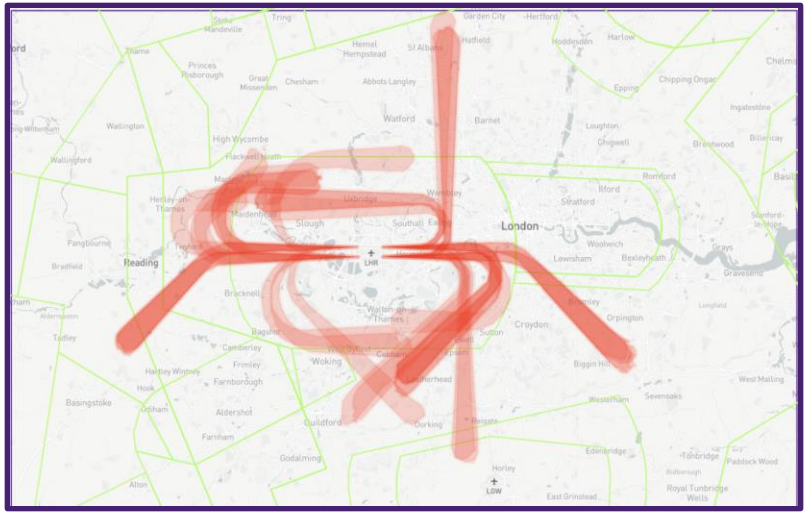
Design Principle 10:	"Keep the total number of people who experience noise from the future airspace design to a minimum"
Approach:	These options were designed to minimise the number of people exposed to noise up to 7,000ft.
Inputs used:	1. Population exposed to 70 decibel SEL 2. Population overflown (below 7,000ft)

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

PBN arrivals options to meet a blend of Design Principles 2, 4, 9 and 10

Analyse notional tracks

These options are based on a weighted average of all the metrics we have considered. Since different stakeholders would apply different weightings to different metrics, we have applied all possible weighting combinations to identify the highest performing tracks against the full set of data.



All PBN Arrivals flight path options designed to meet the blend of Design Principles

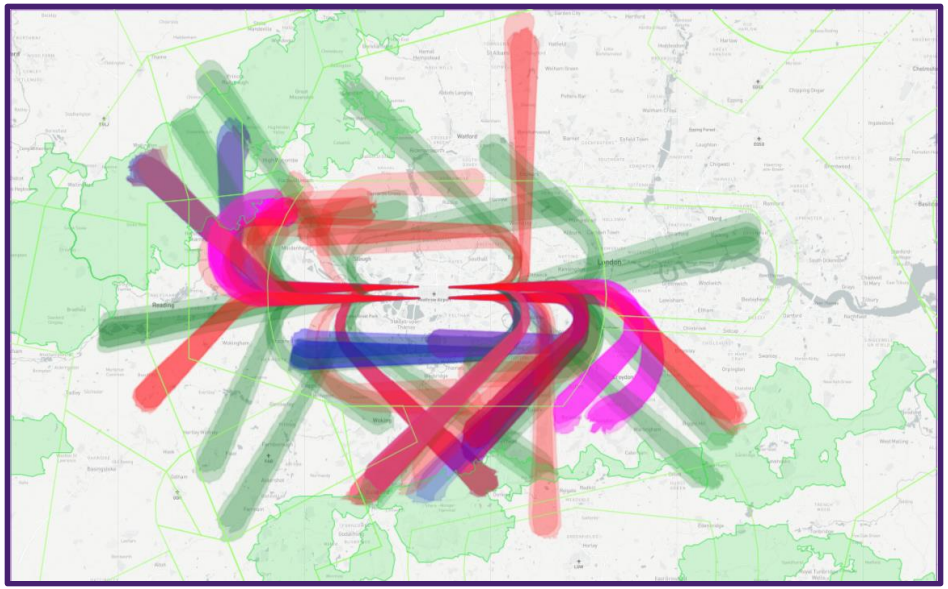
Approach:	These options were designed to identify the options that perform well (on average) across all of the metrics with no prioritisation
Inputs used:	• Population exposed to 70 decibel SEL • Population overflown (below 7,000ft) • Track mileage between runways and points within the network • AONB (km2) • Population newly overflown (below 7,000ft, at least 20 times a day on average)

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

Heathrow

Our comprehensive set of PBN arrival flight path options has been developed based on the Design Principles

Develop Comprehensive List of Options (CLOO)



The comprehensive list of PBN arrival options

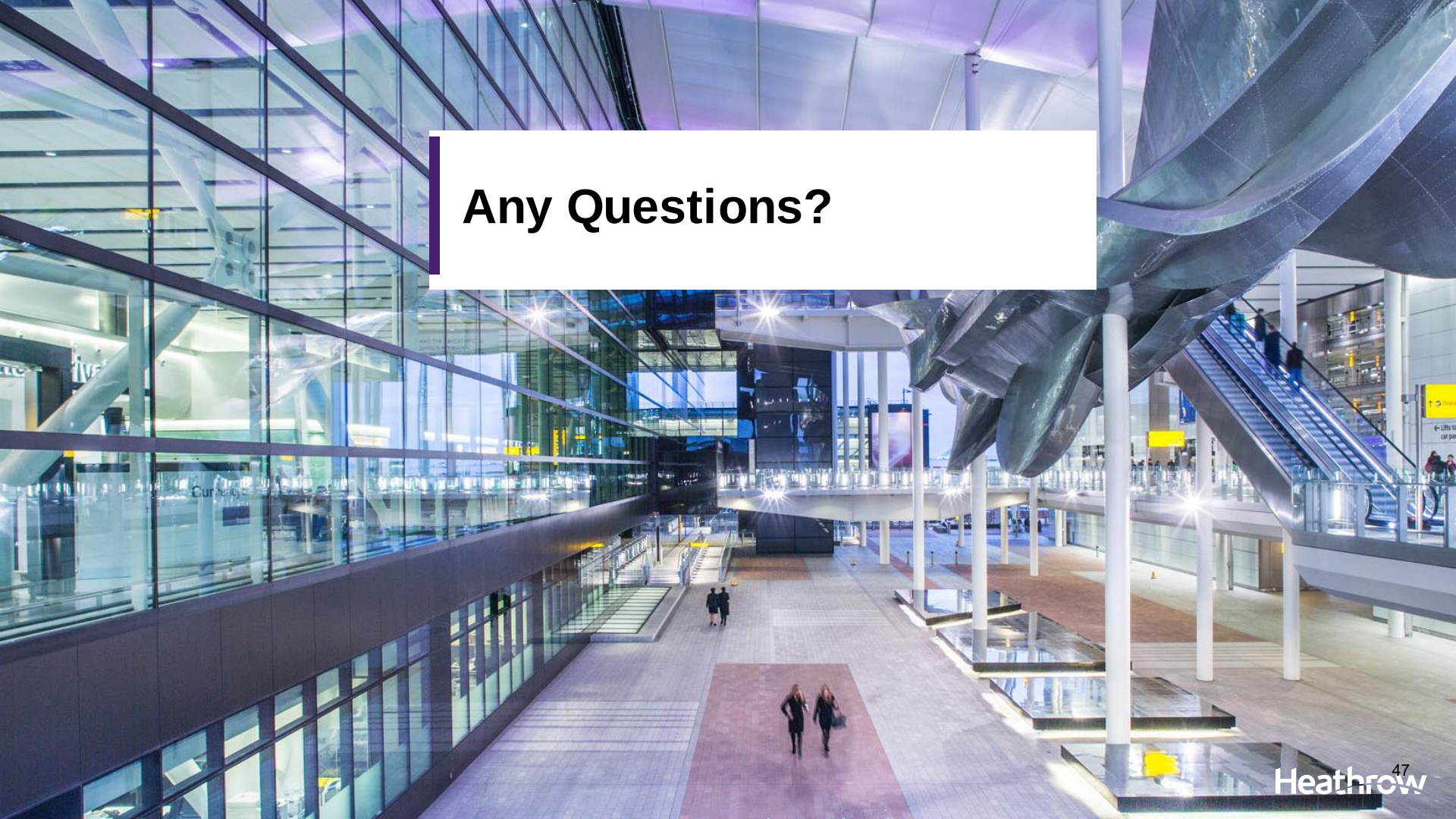
This image shows all the individual PBN arrival flight path options now being considered to each of Heathrow's four runway ends.

PBN flight paths all the way to final approach for arrivals will only be used during less busy times.

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

Options will also be refined as we understand more about the future airspace design of other airports and NATS, and as we consider a broader range of aircraft types and practices.

Heathrow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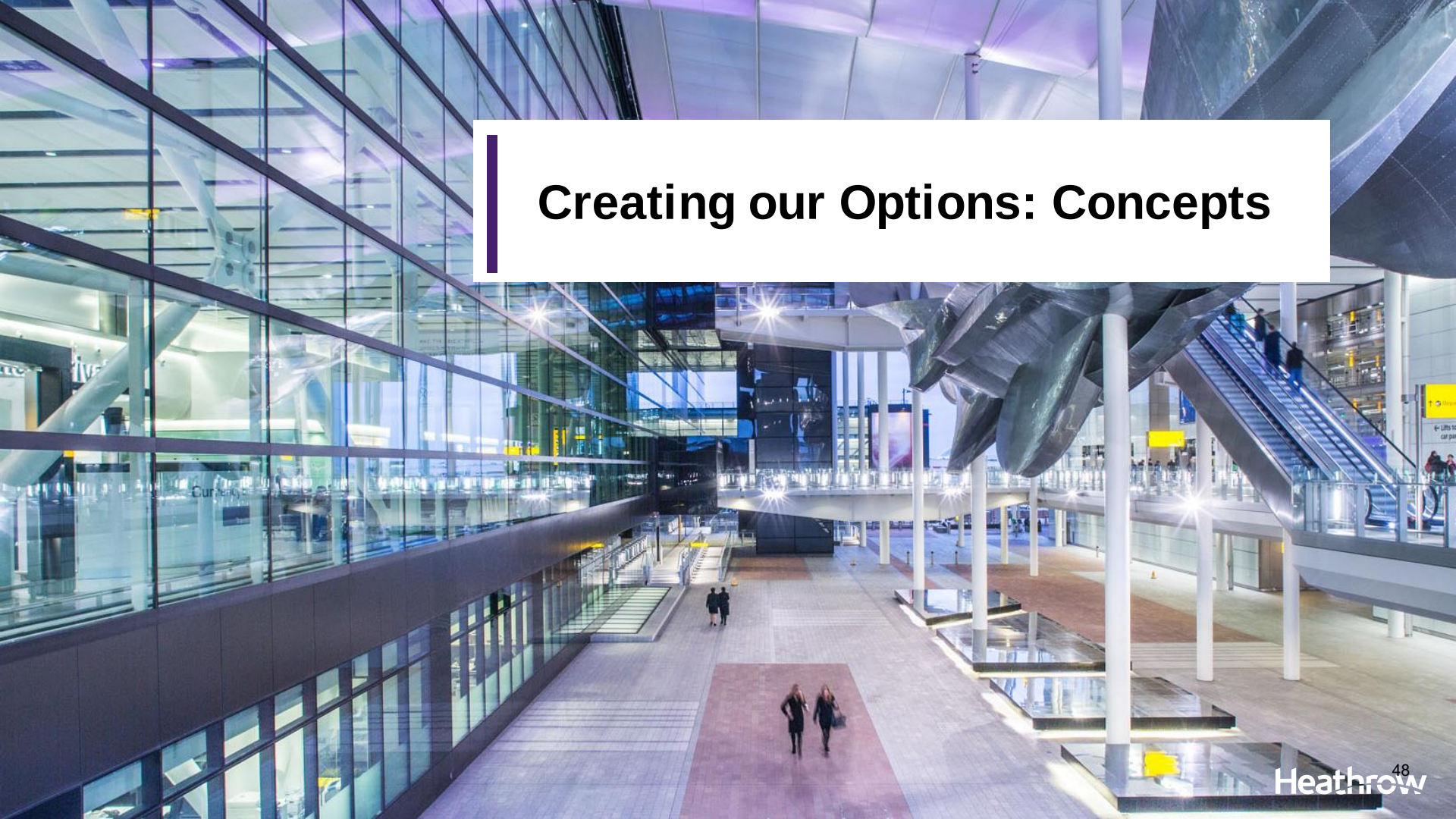


Creating our Options: Concepts

Some Design Principles were addressed through operational concepts that can be applied to each option

These concepts will be explored further throughout Stage 2 and Stage 3 to identify the combination of these concepts that should be applied to our comprehensive list of flight path options to best meet the Design Principles:

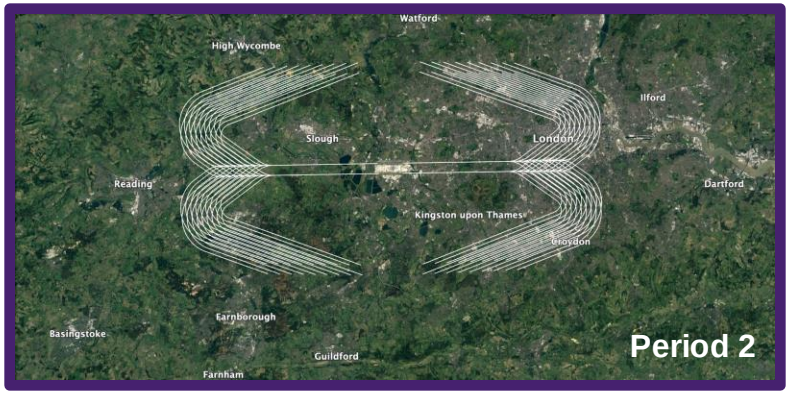
Design Principle	Our Design Principles for Airspace Modernisation	Our Consideration during options development
3	**Use noise efficient operational practices to limit and, where possible, reduce adverse impacts from aircraft noise**	Concepts developed: to be applied to any of the flight path options
6	Provide predictable and meaningful respite to those affected by noise from Heathrow's movements	Concepts developed: to be applied to any of the flight path options
7	Seek to avoid overflying the same communities with multiple routes including those to/from other airports	Initial consideration applied to all options: concepts to be refined as other airports share more information
8	Contribute to minimising the negative impacts of night flights	Concepts developed: to be applied to any of the flight path options
11	Enable the efficiency of other airspace users' operations	Initial consideration applied to all options: concepts to be refined as other airspace users share more information
12	Minimise the impact to all stakeholders from future changes to Heathrow's airspace	Initial consideration applied to all options: concepts to be refined as future industry and airport requirements become clearer

Arrival path options have also been created for aircraft being "vectored" by air traffic control

Aircraft currently join final approach between 8-18 nautical miles, with 10-16 nautical miles being most common.

These arrival options seek to deliver against **Design Principle 6: "Provide predictable and meaningful respite to those affected by noise from Heathrow's movements"** by varying the point at which aircraft join final approach.

The Initial Options Appraisal at Step 2B will use metrics to assess whether the introduction of set vector paths such as these would be beneficial in providing predictable and meaningful respite



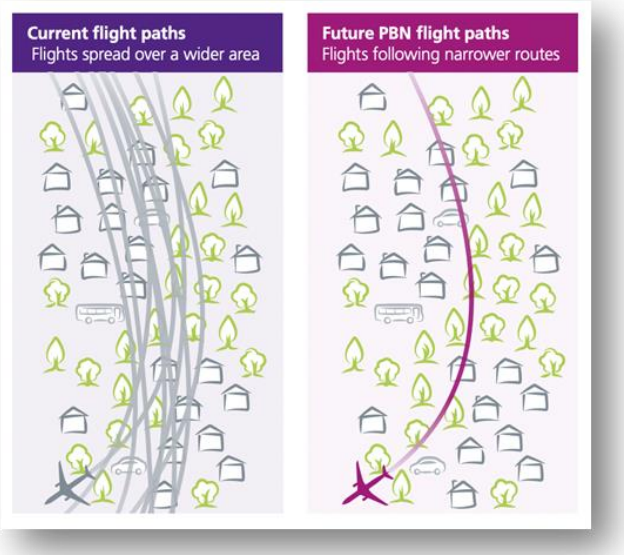
Examples of different arrival paths for use during different periods of day, or on different days

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

We have identified three potential concepts for delivering respite or relief from noise

Three concepts are being considered to deliver departure options that meet **Design Principle 6: "Provide predictable and meaningful respite to those affected by noise from Heathrow's movements"**

1 Relief via dispersion



The navigation of aircraft today is less precise than PBN, so leads to some dispersion of aircraft within today's routes: aircraft fly routes slightly differently so they tend to be spread over a wider area

Heathrow is looking at the feasibility of using techniques to enable dispersion within a PBN environment, in collaboration with other airports.

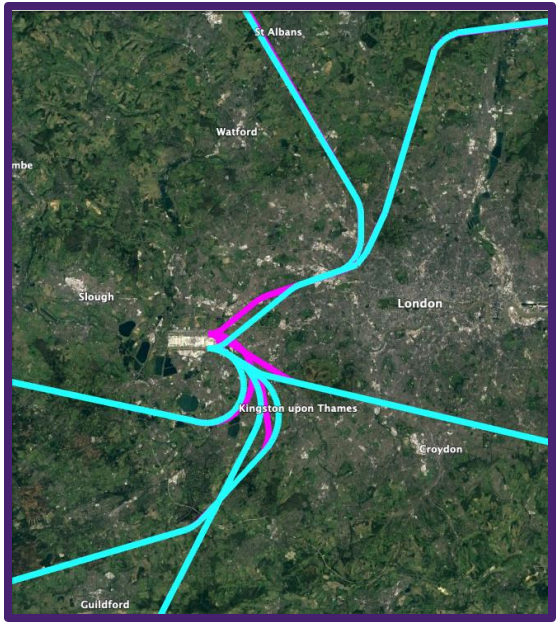
Dispersion of flight paths within an allocated route would not give the significant break in noise required for "respite", but it could offer "relief" from noise for overflown communities.

The study will involve:

- Analysing track data to identify how and where dispersion of aircraft along a route is provided today; and,
- Identifying potential designs and/or techniques for introducing dispersion within a route in future

Our departure options would also enable concepts for providing predictable and meaningful respite

2 Respite via runway alternation



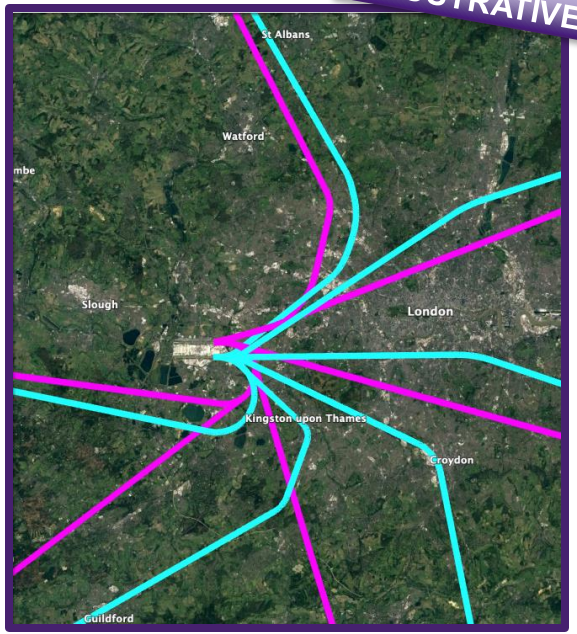
Today's easterly departure routes

Today's departure routes from adjacent runways merge shortly after departure. This means that communities underneath those departure routes don't benefit from runway alternation to the same extent communities under arrivals might.

We are investigating whether departure routes from adjacent runways can follow different tracks for longer to increase the number of people who benefit from runway alternation.

There are potential disbenefits too, since more people would be overflown.

ILLUSTRATIVE



Example of how we could design different flight paths to keep routes from the two runways separate

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

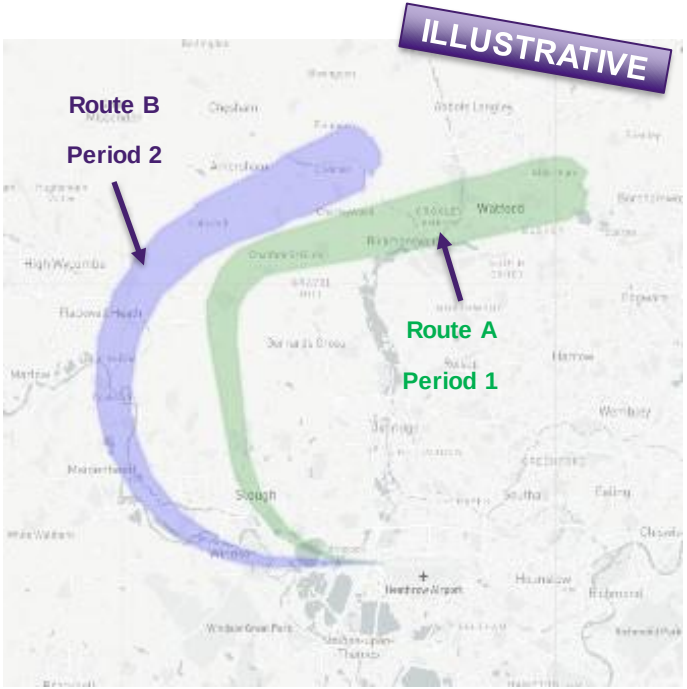
Proposed solutions to delivering predictable and meaningful respite will be shared at Stage 3

3 Respite via route alternation

Heathrow is exploring whether we could use different flight paths for a Departure or Arrival route at different times to offer respite to overflown communities.

The image on the right provides an example where we might have 2 potential departure flight paths towards the Clacton waypoint (CLN);

- Route A could be used during Period 1
- Route B could be used during Period 2

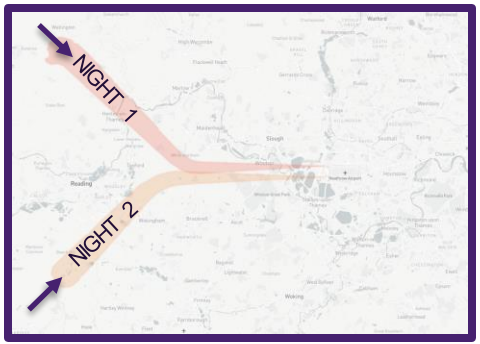


Our options enable different concepts to be applied to minimise the negative effects of night flights

Three concepts are being considered to deliver **Design Principle 8: "Contribute to minimising the negative impacts of night flights"**

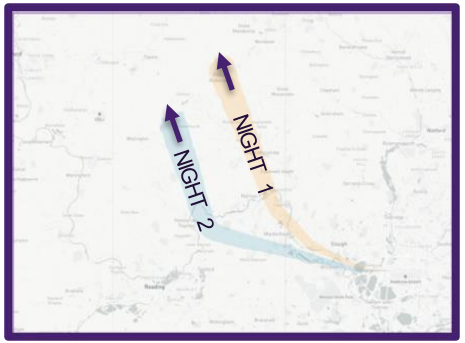
1

Use of PBN arrival flight paths for early morning (pre 6am) arrivals. Flight paths could be alternated to ensure the same communities are not overflown each morning.



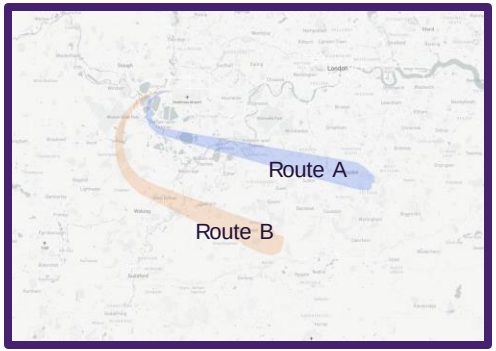
2

Use of bespoke departure routes for occasional late running departures at night. These routes could vary on a rotation pattern.



3

Use of 'extra' departure routes during or after periods of disruption (such as periods of bad weather) to minimise aircraft departing after 11pm.



The options will enable use of noise efficient operational practices

Design Principle 3 requires us to: "Use noise efficient operational practices to limit and, where possible, reduce adverse impacts from aircraft noise"

Noise efficient operational practices are considered to be:

- Continuous Climb Operations (CCO)
- Continuous Descent Operations (CDO)
- Noise Abatement Departure Procedures (NADPs)
- Steeper Approaches
- Steeper Climbs
- Landing Gear Deployment
- Low Power Low Drag

CCO and CDO will form the basis of all design options.

The rest are enhancements/requirements that can be added to every option: these will be investigated at Stage 3.

We are working with other airports to avoid overflying the same areas where possible

Design Principle 7 is to: "Seek to avoid overflying the same communities with multiple routes including those to/from other airports"

Illustration of areas of interaction between airports in south-east England today
Source – ACOG Masterplan Iteration 2

Flight paths from multiple airports often overfly the same areas today.

We will be working with other UK airports, via ACOG, to try to separate future flight paths, allowing aircraft to climb and descend continuously and avoiding overflying communities with multiple routes.

This should reduce the frequency of overflight for these communities to provide more noise respite and achieve noise benefits of getting higher sooner (on departures) and staying higher for longer (on arrivals).

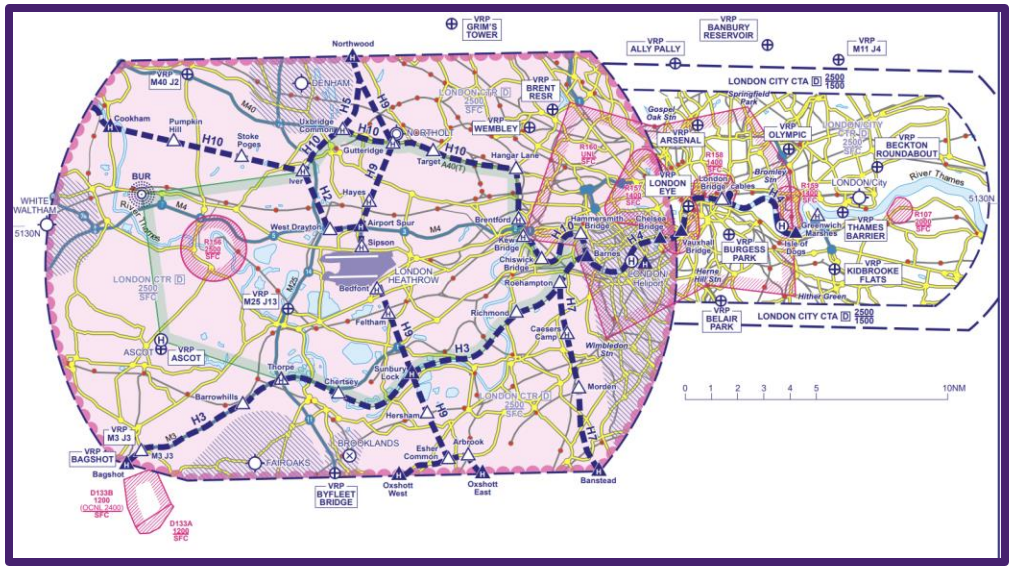
Develop Comprehensive List of Options (CLOO)

Our options aim to “future proof” our operation and to minimise impacts to other airspace users

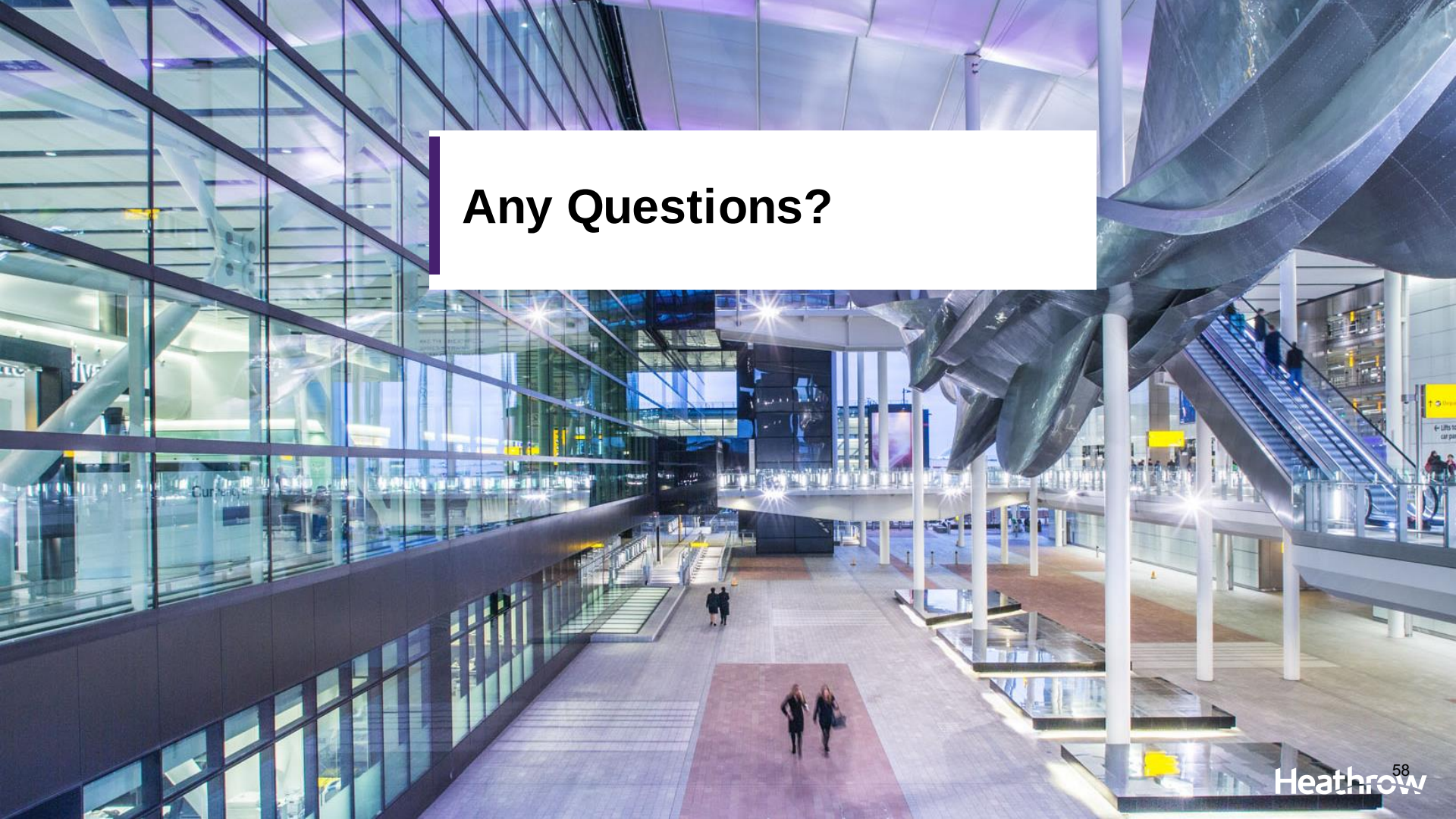
Design Principle 11 is to: “Enable the efficiency of other airspace users’ operations” and Design Principle 12 is to “Minimise the impact to all stakeholders from future changes to Heathrow’s airspace”

Our options aim to:

- Limit Controlled Airspace, with no more Controlled Airspace currently envisaged
- Enable Continuous Climb Operations and Continuous Descent Operations for other airports’ routes below 7,000ft
- Enable NATS to achieve their upper airspace design objectives
- Enable integration of future technologies such as Advanced Air Mobility (AAM) or "drones"
- Limit changes to helicopter routes



Heathrow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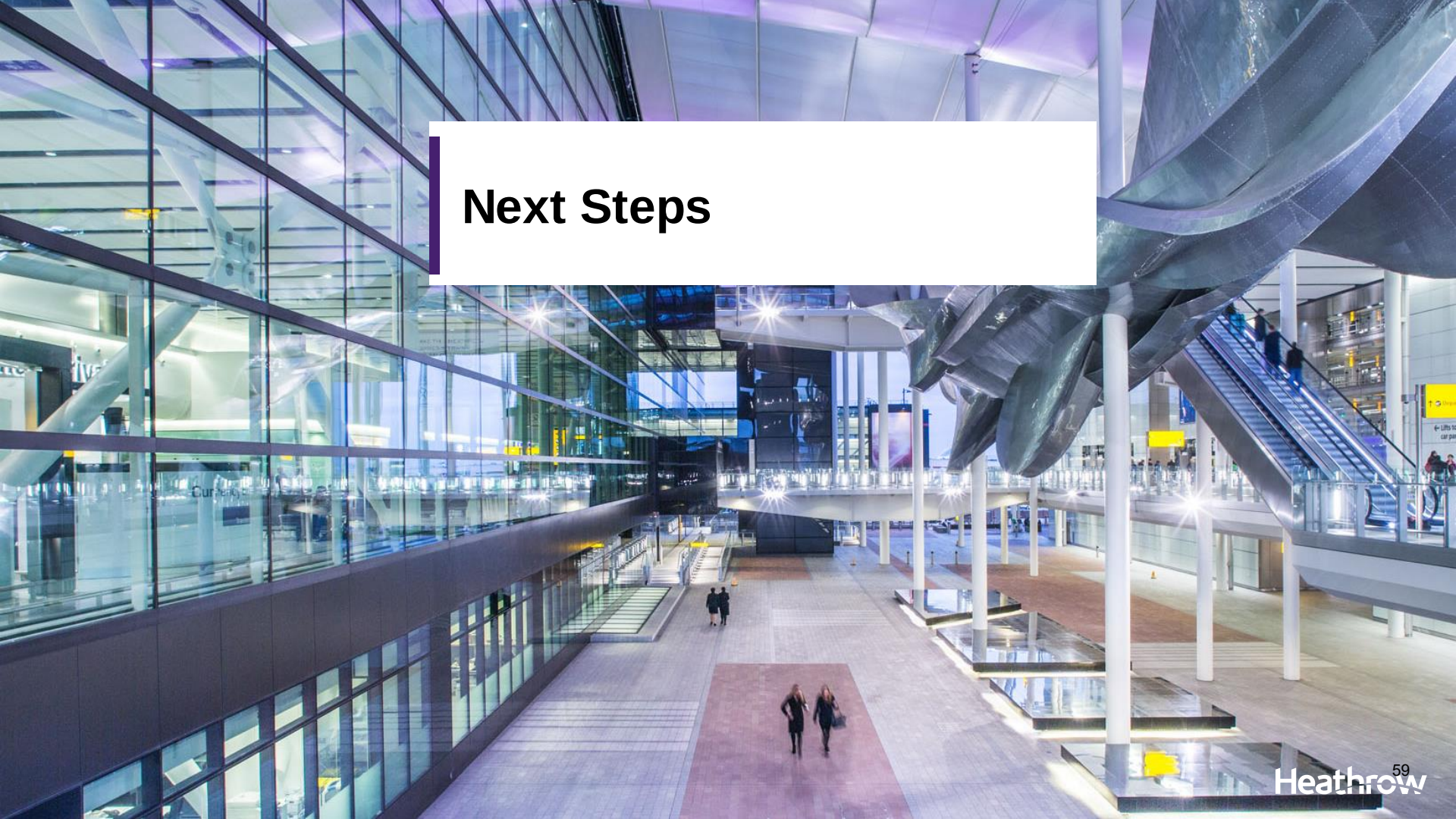


Next Steps

Have your say

We will provide you with:

1. A copy of this presentation;
2. A link to our Feedback Form (you can also use the QR code on this page); and
3. An Appendix with the full set of our Comprehensive List of Options by Design Principle.

The following pages include a Glossary of Terms and responses to some 'Frequently Asked Questions': these provide further information on the wider range of questions that you may have.

If you have any additional questions or require any clarification on the material presented today, please email us at **airspace@heathrow.com**

Please use the Feedback Form to provide your feedback on our Comprehensive List of Options and the information we have shared today.

Please submit your feedback by Friday 9 December 2022.

Please remember: we are seeking feedback on the approach at this stage, not the specific geographical areas or potential impacts of the flight path options. This discussion will take place at Stage 3

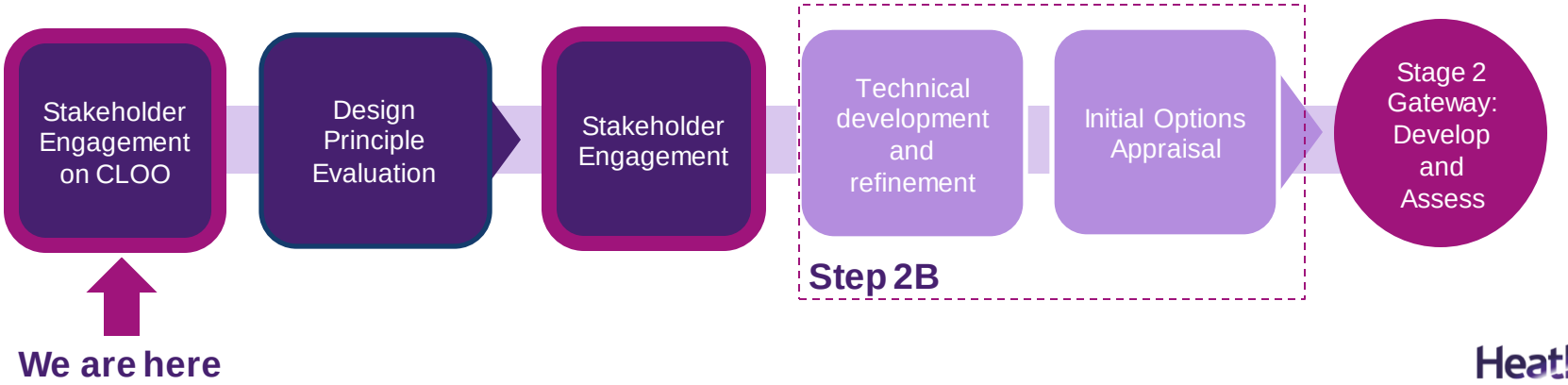
What happens next?

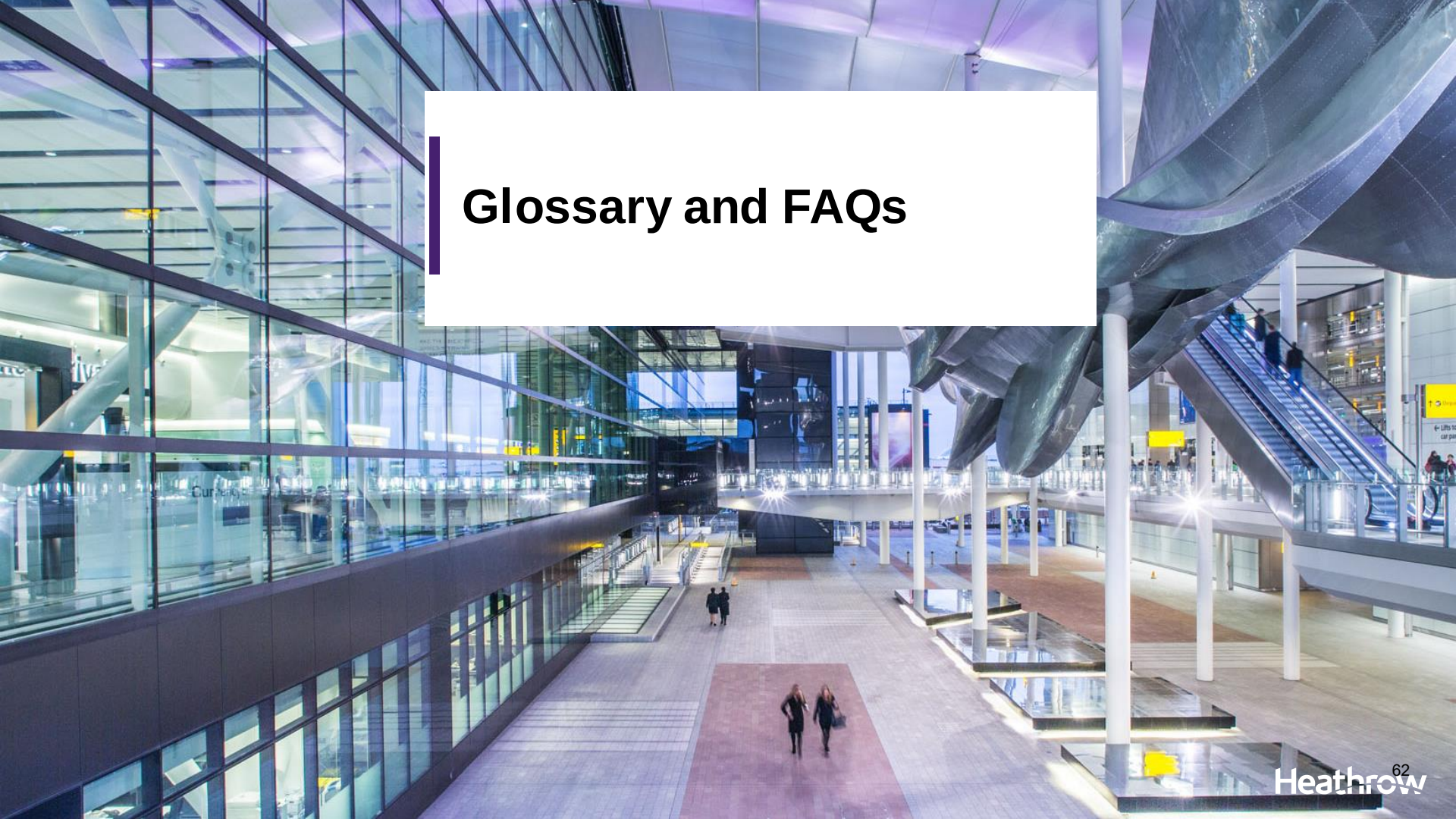
Stakeholder Engagement on CLOO

The Heathrow team will review all responses and will provide you with a summary of the feedback we receive prior to our Stage 2 submission.

Our Stage 2 submission to the CAA will include all feedback received and will be published on the CAA's Airspace Change Portal.

Once we have received your feedback, we will carry out a Design Principle Evaluation on the Comprehensive List of Options to assess how each flight path option performs against each and every Design Principle. This may enable us to create a shorter list of options which perform well against our full set of Design Principles. The shortlisted options will be carried through to our Initial Options Appraisal.





Glossary and FAQs

Glossary

Term	Description
Above Ground Level (AGL)	Above Ground Level, or AGL, is the distance that an object is above the ground below it. Heathrow is responsible for the airspace design (flight paths) up to 7,000ft above the surface of the ground. AGL takes account of the natural height of the land (e.g. hills, mountains).
ACP Sponsor	An organisation that proposes, or sponsors, a change to the airspace design in accordance with the CAA's airspace change process. Heathrow is the sponsor of this airspace change.
Advanced Air Mobility (AAM)	Advanced Air Mobility is an air transport system concept that integrates new, transformational aircraft designs and flight technologies into existing and modified airspace operations. This includes electric aircraft (e.g. air taxis), and small unmanned aircraft systems (drones).
Airspace Change Organising Group (ACOG)	ACOG was established in 2019 at the request of the DfT and CAA to coordinate the delivery of key elements of the UK's Airspace Modernisation Strategy. ACOG is a fully independent organisation and is responsible for coordinating airport's individual airspace changes via an Airspace Masterplan.
Airspace Change Portal	The CAA's Airspace Change Portal is a publicly-accessible website where all ACP Sponsors are required to upload information on their ACPs.
Airspace Change Process	The CAA's airspace change process is known as 'CAP1616'. The process is designed to ensure that the CAA meets modern standards for regulatory decision-making, and is fair, transparent, consistent and proportionate. The process ensures that when the CAA decides whether or not to approve a proposal to change UK airspace, it does so in an impartial and evidence-based way that takes proper account of the needs and interests of all affected stakeholders.
Airspace Change Proposal (ACP)	Airspace change proposals (ACPs) are requests from a 'change sponsor', usually an airport or a provider of air navigation services (including air traffic control), to change the notified airspace design. ACPs must follow the CAA's CAP1616 airspace change process.
Airspace Modernisation Strategy (AMS)	The Airspace Modernisation Strategy, or AMS, is co-sponsored by the CAA and DfT. It sets out the 'ends', 'ways', and 'means' of modernising the design, technology, and operations of airspace. A nationwide airspace modernisation programme is underway across UK airports in support of the AMS.
Air Traffic Control (ATC)	Air Traffic Control, or ATC, is a service provided by ground-based air traffic controllers who direct aircraft on the ground and through a given section of controlled airspace, and can provide advisory services to aircraft in non-controlled airspace.

Glossary

Term	Description
CAP1616	CAP1616 is the CAA's airspace change process guidance, introduced in December 2017. CAP1616 establishedadditional CAA scrutiny and validation of sponsors' work and evidence as they develop proposals; increased requirements relating to transparency and engagement; and introduced new opportunities for those impacted by proposals to have their voices heard.
Civil Aviation Authority (CAA)	The CAA is the UK's aviation regulator, overseeing and regulating all aspects of civil aviation in the UK. The Secretary of State for Transport placed a statutory duty upon the CAA to have a strategy and plan for modernising airspace.
Climb Gradient	The climb gradient is how steeply the aircraft climbs on departure. It is the ratio between distance travelled over the ground and altitude gained and is usually expressed as a percentage.
Controlled Airspace	A defined area of airspace in which Air Traffic Control (ATC) services are provided. Controlled airspace usually exists in the immediate vicinity of busier airports and at higher levels where air transport flights would tend to cruise.
Comprehensive List of Options (CLOO)	Airspace change sponsors are required to develop a Comprehensive List of Options at Stage 2 of the CAP1616 process. The CLOO should include a comprehensive set of airspace design options that address the Statement of Need and align with the Design Principles set at Stage 1.
Continuous Climb Operations (CCO)	CCO is a departure procedure whereby the aircraft climbs continuously to its cruising level without levelling off. Heathrow's Comprehensive List of Options assumes that aircraft will perform a CCO to at least 7,000ft.
Continuous Descent Operations (CDO)	CDO is an arrival procedure whereby the aircraft descends continuously from its cruising level without levelling off. Heathrow's Comprehensive List of Options assumes that aircraft will perform a CDO from at least 7,000ft.
Cumulative Impacts	Consideration of the combined impacts of multiple airports' ACPs, where proposed flight paths overfly the same geographical areas.
Department for Transport (DfT)	The Department for Transport (DfT) is the United Kingdom government department responsible for the English transport network (and a limited number of transport matters in Scotland, Wales and Northern Ireland that have not been devolved).
Descent Gradient	The descent gradient is the rate at which an aircraft decreases altitude on the approach to the runway for landing. It is the ratio between distance travelled over the ground and altitude lost and is usually expressed n degrees.

Glossary

Term	Description
Design Principle (DP)	Design Principles encompass the objectives that the airport seeks to achieve through the airspace change, including safety, policy, environmental, and operational factors. Design Principles are set through engagement with stakeholders at Stage 1, and they guide the airspace designers to create suitable flight path options at Stage 2.
Design Principle Evaluation (DPE)	The Design Principle Evaluation is a requirement of the CAP1616 airspace change process at Stage 2. It involves assessing the Comprehensive List of Options against each Design Principle.
FASI	Heathrow is part of the 'Future Airspace Strategy Implementation-South' programme to re-design airspace in the south of the UK. There is also a 'FASI-N' programme for the north of the UK.
Flight Path Options	Flight path options are operationally viable (flyable) flight paths developed by Heathrow's technical team.
Heathrow Expansion	A Heathrow project to build a third runway to the north-west of the existing two runways and re-design the airspace to accommodate it. Heathrow was previously progressing airspace modernisation via its Airspace Change Proposal (ACP) for airport expansion and we consulted widely on these plans in 2018 and 2019. This project has remained on pause since 2020.
Holding Stack	Holding stacks are areas of airspace used as a waiting room which allow air traffic controllers to organise the planes before they land. Heathrow has four holding stacks located over navigation beacons that lend them their names. The locations of Heathrow's stacks have been the same since the 1960s.
Initial Options Appraisal (IOA)	The IOA is required at Step 2B of the CAP1616 process. It involves an assessment of the impacts (costs and benefits) of each of the viable options. The appraisal must use WebTAG, the DfT's appraisal guidance, which includes consideration of environmental impacts, economic impacts and health impacts associated with noise.
NATS En-Route Limited (NERL)	NATS is the air navigation service provider responsible for the UK's airspace above 7,000ft, and at many airports (including at Heathrow). NATS is the parent company of NERL who provide ATC services to aircraft flying in airspace over the UK and the eastern part of the North Atlantic.
Nautical Miles (nm)	A nautical mile is a unit of length used in air, marine, and space navigation.

Glossary

Term	Description
Night Flights	There is no formal ban on night flights at Heathrow, but the Government has placed restrictions on them since the 1960s. Night-time (23:30 - 06:00) operations at Heathrow are heavily restricted by the Government, which sets a limit of 5,800 night-time take-offs and landings a year. A night quota limit is also in place, which caps the amount of noise the airport can make at night. Around 80% of the night flights at Heathrow are between 04:30 - 06:00 with an average of 16 aircraft arriving each day between these hours. Heathrow has a voluntary ban in place that prevents flights scheduled between 04:30 - 06:00 from landing before 04:30. We also do not schedule any departures between 23:00 - 06:00.
Noise Abatement Departure Procedures (NADP1 / NADP2)	A noise abatement departure procedure defines the height at which the flight crew will reduce engine power after take-off and the height at which acceleration from the take-off speed commences. The balance between how much energy is put into gaining altitude and speed, and at what altitudes power reduction and acceleration are initiated. and in what order, impacts the noise footprint of the aircraft. ICAO guidance provides two examples: NADP1 and NADP2.
Notional Tracks	Notional tracks are lines drawn to/from a runway end to/from a point in the airspace network. They are based on basic principles of airspace design, but they cannot be considered 'flyable' flight paths. They are used to collect data on the areas that would be "overflown" by them.
Overflight	CAA's CAP1498 document sets out a definition of overflight for use in ACPs. "Overflown" is defined as "an aircraft in flight passing an observer at an elevation angle of 48.5° from the ground at an altitude below 7000ft" (CAA). The overflight metric enables the number of overflights experienced at locations on the ground to be calculated according to the agreed definition.
Overflight Cones	The CAA's CAP1498 document states that overflight above a given location should be measured using a cone. The cone identifies the airspace above a given location within which an aircraft might be perceived as "overflying" that location. This is because an aircraft does not need to be directly overhead to have an impact (noise and/or visual) on the local population.
Performance Based Navigation (PBN)	PBN improves the accuracy of where aircraft fly by using modern satellite navigation and moving away from outdated and conventional navigation techniques using ground-based beacons (it is similar to GPS "sat nav" devices that most people use in their cars today). PBN is being adopted worldwide through International, Regional and State level initiatives and regulations.

Glossary

Term	Description
Potentially Affected Area	The area around Heathrow airport where aircraft might be at or below 7,000ft under the future airspace design. The CAA requires all airport sponsors to identify the potentially affected area on their Airspace Change Portal.
Relief	A break from, or a reduction in, aircraft noise.
Respite	Scheduled relief from aircraft noise for a set period of time.
Runway Alternation	Heathrow has two runways, with one used for arrivals and one used for departures at most times. During the day, when planes are landing and taking off to the west (westerly operations), we alternate the use of our two runways to provide local communities with respite. The alternation pattern means that for part of the day we use one runway for landings and the other for take-offs, then halfway through our operational day (at 15:00) we switch over.
Sound Exposure Level (SEL)	Occasional loud noise is measured in the UK by Sound Exposure Level (SEL). An SEL footprint can be created to show the geographical area over which a particular SEL is reached from a single noise event (e.g. the area in which the sound of a plane taking off reaches 70 decibels).
Statement of Need (SoN)	At the first stage of the airspace change process, airport sponsors are required to outline the objectives of the ACP, by setting out the airspace issue or opportunity it is seeking to address and what outcome it wishes to achieve.
Vectoring	Vectoring is the provision of navigational guidance to aircraft by air traffic controllers (ATC). Vectoring helps to maximise use of available airspace.

FAQs

	Question	Heathrow Response
1.	Why is Heathrow carrying out this airspace change proposal?	Heathrow was previously progressing airspace modernisation via its Airspace Change Proposal (ACP) for airport expansion and we consulted widely on these plans in 2018 and 2019. Whilst our Expansion ACP remains paused, Heathrow continues to be committed to the Government's Airspace Modernisation Strategy and to working with other UK airports to redesign our flight paths to modernise the design, technology, and operations of our airspace. Accordingly, we are developing this new ACP to progress the necessary changes, based on our existing two runways.
2.	Are you looking to increase the number of movements at Heathrow?	Heathrow currently has a 'cap' set by the Government on arrivals and departures of 480,000 movements (Air Traffic Movements or ATMs) per year. To increase this number, Heathrow would need to make a separate planning application. This ACP involves development of a new airspace design to accommodate the current cap.
3.	Why are you introducing Performance-Based Navigation (PBN)?	The introduction of PBN is fundamental to achieving the UK Government's Airspace Modernisation Strategy. PBN is being implemented all over the world.
4.	What percentage of aircraft using Heathrow are equipped for PBN?	All aircraft operating at Heathrow can use PBN but there are a range of different levels of PBN functionality. For example, arrival routes that join final approach close to the runway require a much higher level of PBN functionality than many aircraft have. Airlines also require additional approvals for pilots to fly more advanced PBN procedures and we don't yet know how many of our airlines will choose to seek this certification.
5.	Will you use PBN for arrivals?	We expect to use PBN for arrivals at times when the operation is less complex. This might be during quieter times or during the early morning period when Air Traffic Controllers (ATC) have very few departures to consider. It would be difficult to achieve the required throughput during all hours using PBN arrival routes. During core hours, aircraft can be spaced more closely together by ATC vectoring than on systemised PBN routes because controllers can take account of the various sizes and speeds of aircraft, and of changing weather conditions.
6.	Why have you based the Comprehensive List of Options on an A320 aircraft type?	The A320 Airbus aircraft is the most commonly used aircraft at Heathrow. At this early stage of airspace design, we have used the A320's noise footprint when assessing the noise impact of the many notional tracks. However, this is only a measure used to compare different notional tracks with each other, and more detailed assumptions on future aircraft types will be considered at later stages of the design process.

FAQs

	Question	Heathrow Response
7.	Why are you using a measure of "20 flights per day" to identify population newly overflown?	Using the CAA's definition of overflight, most people living within a 10-15 mile radius of the airport are overflown by at least one aircraft each day. However, the sporadic nature of today's aircraft movements means that many people will not notice these aircraft. A measure of "20 flights per day on average" is therefore used to identify the local population most likely to perceive themselves as routinely "overflown" today.
8.	What do the darker shaded areas of the flight path options on the maps indicate?	The flight path options are shown by Design Principle on pages 25-32 and on pages 39-44. The overflight cone appears as a darker colour where two flight path options overlap.
9.	Are you assuming the westerly preference will remain?	The direction planes arrive and depart from Heathrow depends on the direction of the wind. For safety and performance reasons, aircraft typically take off and land into the wind. This is because an aircraft's wing relies on the speed of the air moving over it (airspeed) to lift it off the ground. Prevailing winds in the UK typically come from the south-west, so aircraft arrive and depart on "westerly operations". When winds are light (below 5 knots – about 6 miles per hour) aircraft can potentially take off or land in either direction. When this occurs, Heathrow must follow a "westerly preference" rule set by the Government to reduce the number of aircraft taking off in an easterly direction over London, the most heavily populated side of the airport. An amendment to this rule in 2001 now allows for this preference to be removed (if winds allow) during night-time hours so operations can be rotated between east and west, providing a fairer distribution of traffic. 70% of the time we are on westerly operations and 30% of the time we are on easterly operations. We are assuming the same split for our future airspace design.
10.	What is happening with the introduction of Easterly Alternation at Heathrow?	Respite for easterly operations remains a key commitment at Heathrow. However, airfield works are required to enable full easterly alternation and previous planning permission granted in February 2017 for these works has now expired. The timescales to deliver easterly alternation will therefore be subject to both the airspace change process and the process for seeking permission for revised planning requirements and associated groundworks. Heathrow has committed to introducing easterly alternation in Heathrow 2.0 and is aiming for 2028.

FAQs

	Question	Heathrow Response
11.	Will there still be night flights at Heathrow?	Night flights are an important part of operations at airports around the world. The time differences in an inter-connected global transport system mean that it is difficult to avoid flights at night and early in the morning. We are assuming that night flights will still be required within the new airspace design, but we are looking at ways to minimise and mitigate the effects of them as far as possible.
12.	What is happening with Heathrow's Expansion (third runway) plans?	Our Expansion airspace change proposal is currently paused. We are reviewing the expansion project internally and we will ensure our local communities and other stakeholders are informed if our plans change.
13.	What is happening with Heathrow's IPA project?	Heathrow previously consulted on a proposed short-term change to the way some aircraft arrive at Heathrow. This project was known as Independent Parallel Approaches (IPA) and involved some new arrival routes into Heathrow from the holding stacks. Some of these flight paths could have overflown areas that are not affected by Heathrow arrivals today. The ACP for this project was paused in 2020 and has now been discontinued. We anticipate a requirement for simultaneous approach routes to our two runways within our new airspace design. However, our Airspace Modernisation ACP involves a full airspace re-design, so these arrival routes are likely to be different to those developed under the IPA project.
14.	Are you going to be displacing thresholds as part of this ACP?	Heathrow was considering the introduction of "displaced thresholds" on the runways as part of the infrastructure changes proposed for the Expansion project. A displaced threshold reduces the length of runway available for landing aircraft which increases the height the aircraft would be at a point on the arrival path. This ACP only includes ground infrastructure changes necessary to implement the airspace changes for modernisation. The introduction of further displaced thresholds is therefore not included in this ACP.

FAQs

	Question	Heathrow Response
15.	Can I share these slides with my Local Authority colleagues or Community Group members?	These slides are marked as "Private" because they rely on the context and explanations provided in the workshops and are not therefore considered suitable for meaningful engagement with the wider public. You are welcome to share these with relevant colleagues, and to share the Feedback Form with them so that they can reply individually if they wish to, but please do not share these more widely. We will undertake a public consultation at Stage 3. At this stage we will advertise to, and consult with, the wider public. The material we share at Stage 3 will be tailored to different audiences so that those without any previous understanding of airspace change or Heathrow's operations can meaningfully engage and respond.

November 2022

Airspace Modernisation: Airspace Change Proposal

Comprehensive List of Options – Options Appendix

DISCLAIMER:

The information contained within this document does not constitute a formal company position and does not necessarily reflect a final view.
It is provided to you to facilitate discussions with Heathrow Airport and feedback on our developing proposals. The incomplete and preliminary nature of the information should be recognised when reviewing this material.

Heathrow Airport Limited will not accept or assume any responsibility or liability for the accuracy or correctness of the information or of any figures provided, or any assumptions that may be drawn from them. All route options shown are for discussion only. All options will be available on the CAA Airspace Change Portal by the end of 2023.

This information is intended for your sole purpose, is confidential and should not be shared outside your organisation or with any third party without the express consent of Heathrow Airport Limited.

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

This Options Appendix should be used in conjunction with the main Engagement pack.

Some Design Principles have 2 versions. This is because there was more than one way of applying the Design Principle.

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Contents

PBN Departures
- Runway 27L
- Runway 27R
- Runway 09L
- Runway 09R

PBN Arrivals
- Runway 27L
- Runway 27R
- Runway 09L
- Runway 09R

Vectored Arrivals
- Westerly
- Easterly

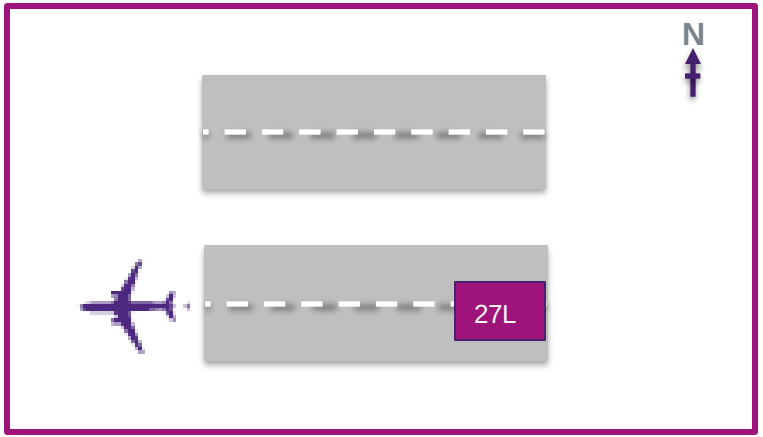
November 2022

Airspace Modernisation: Airspace Change Proposal

Comprehensive List of Options – PBN Departures

Heathrow

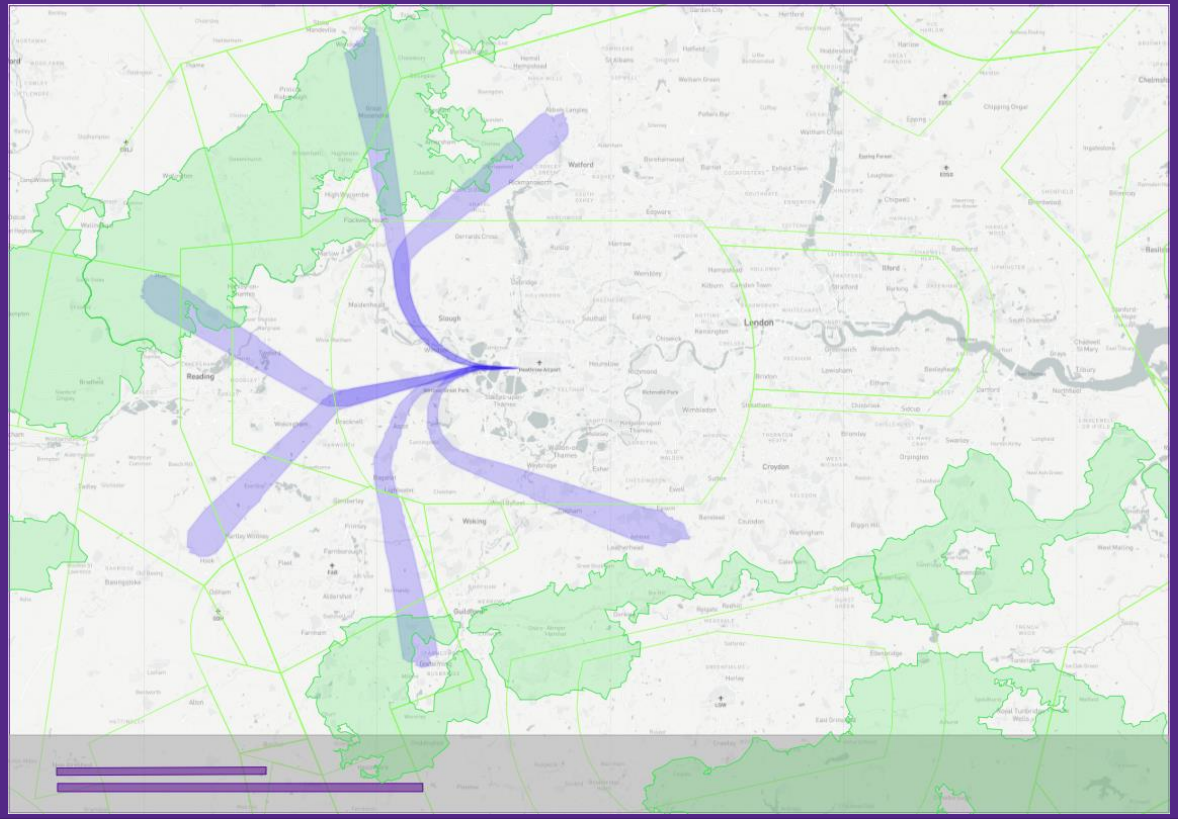
Runway 27L Departures



27L = Aircraft departing the Southern runway to the West

When the wind blows from the West Heathrow need to operate on their Westerly runways. This is approximately 70% of the time.

Runway 27L Design Principle 2



These options were designed to minimise the number of people exposed to noise up to 7,000ft whilst also considering CO_2 and AONBs

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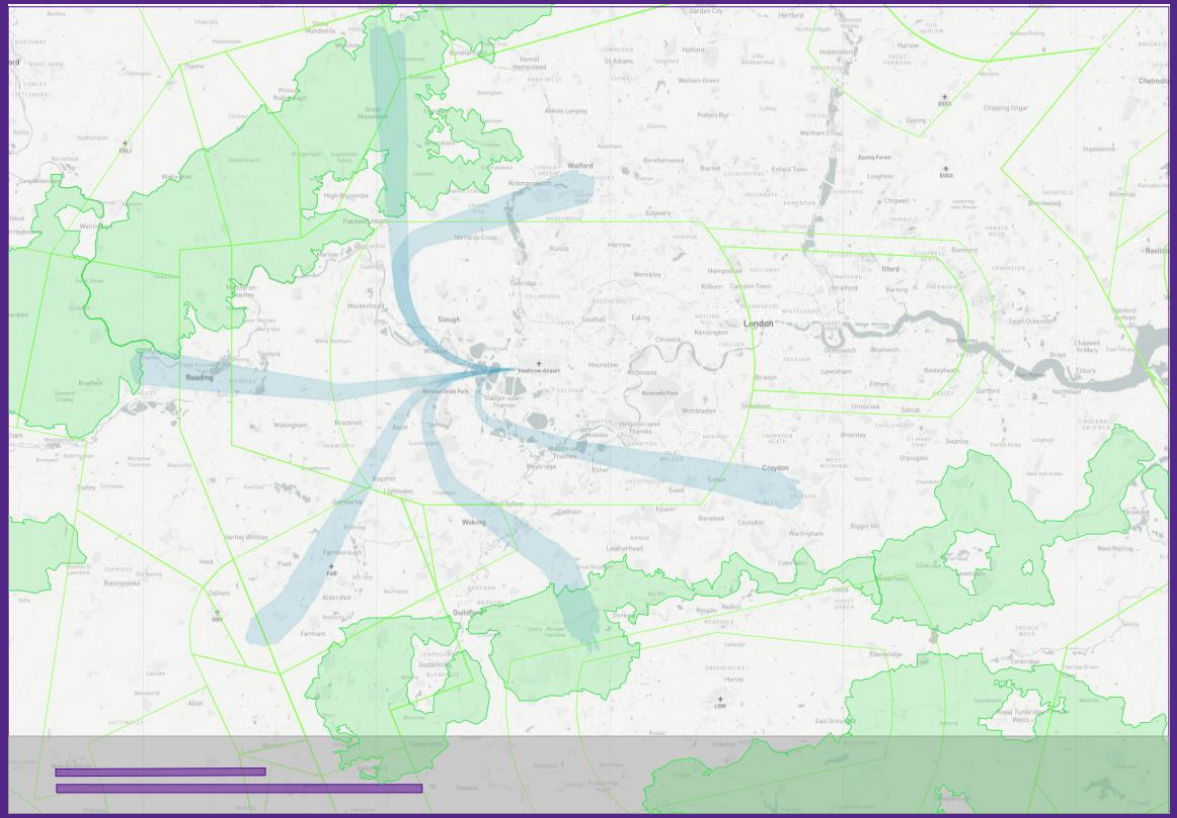
Runway 27L Design Principle 2 (a)



These options were designed to minimise the number of people exposed to noise up to 4,000ft and then minimise track miles from 4,000ft

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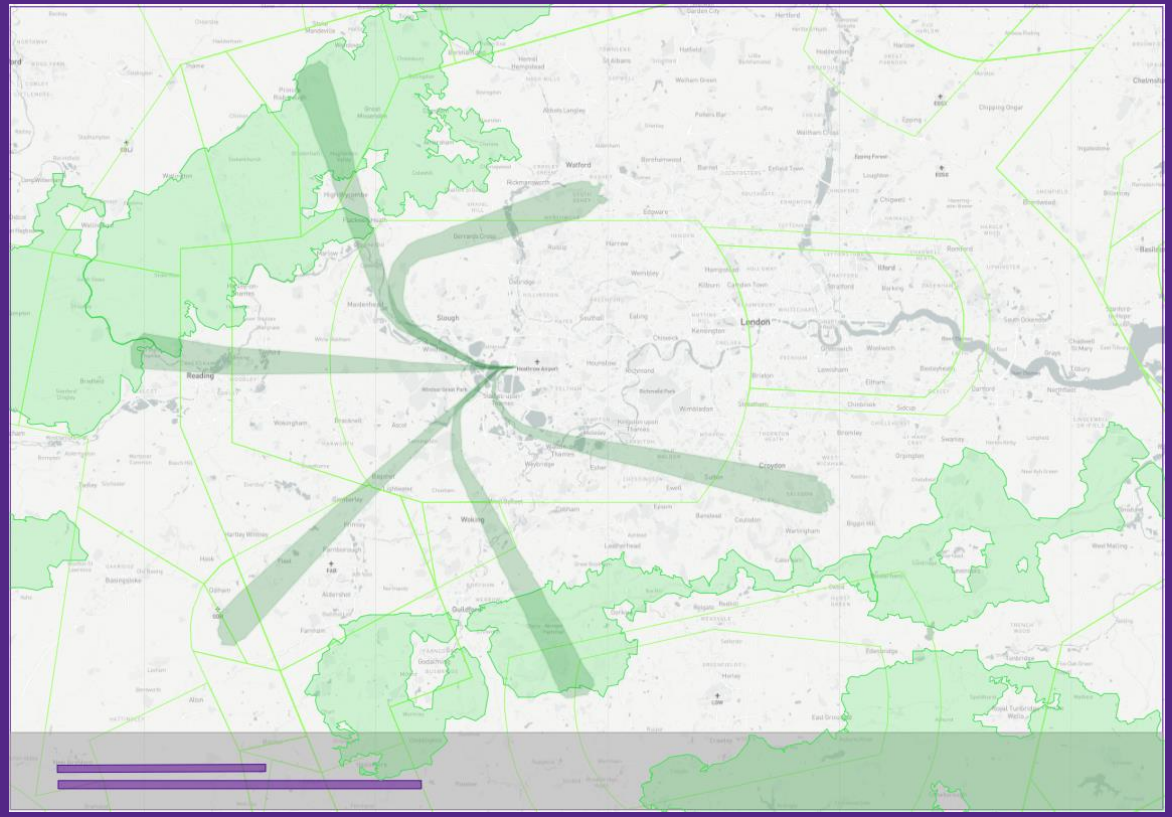
Runway 27L Design Principle 4



These options were designed to minimise the number of track miles flown

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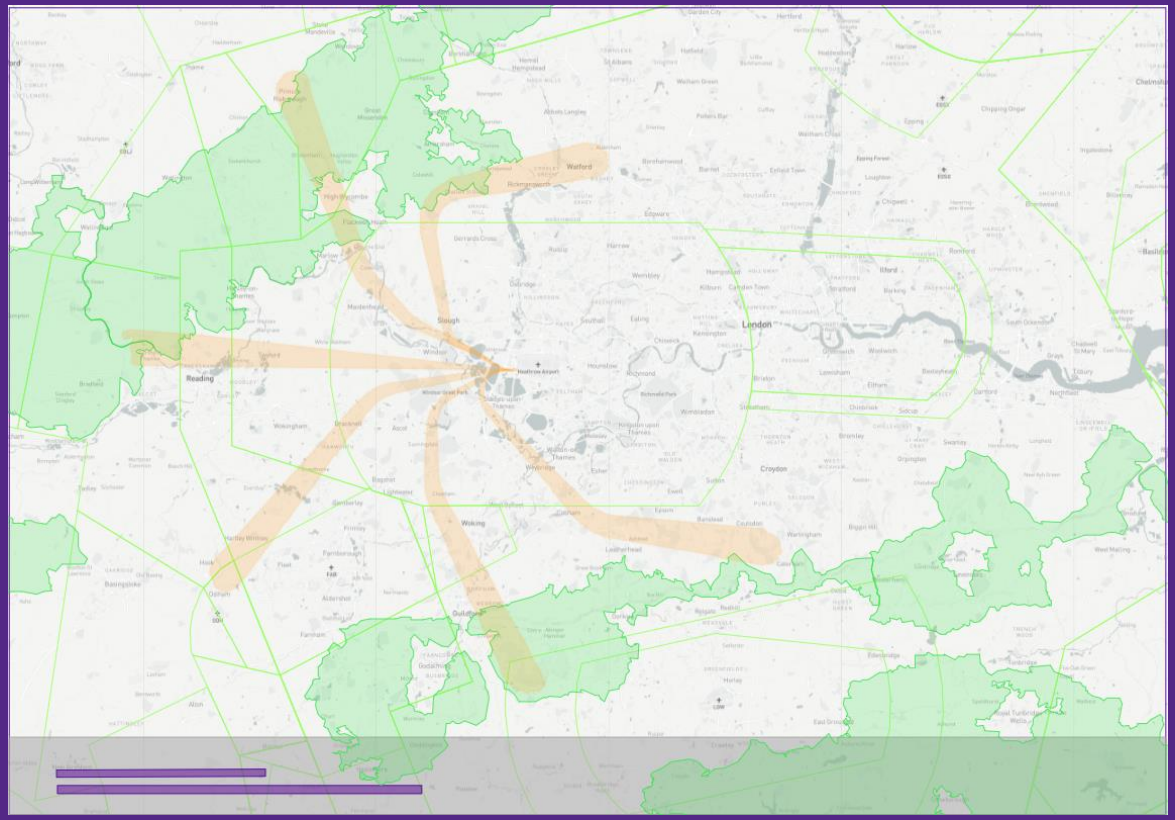
Runway 27L Design Principle 5



These options were designed to maximise departure efficiency

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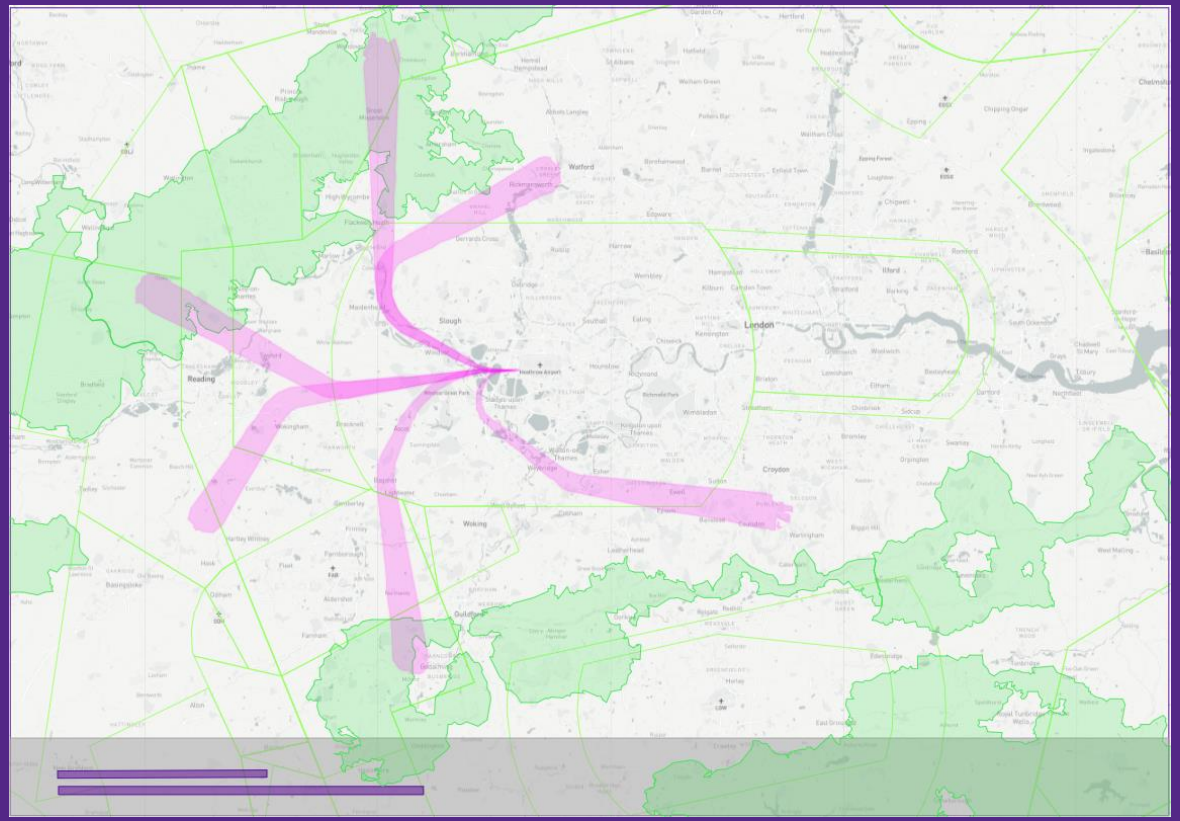
Runway 27L Design Principle 9



These options were designed to minimise the number of people newly overflown

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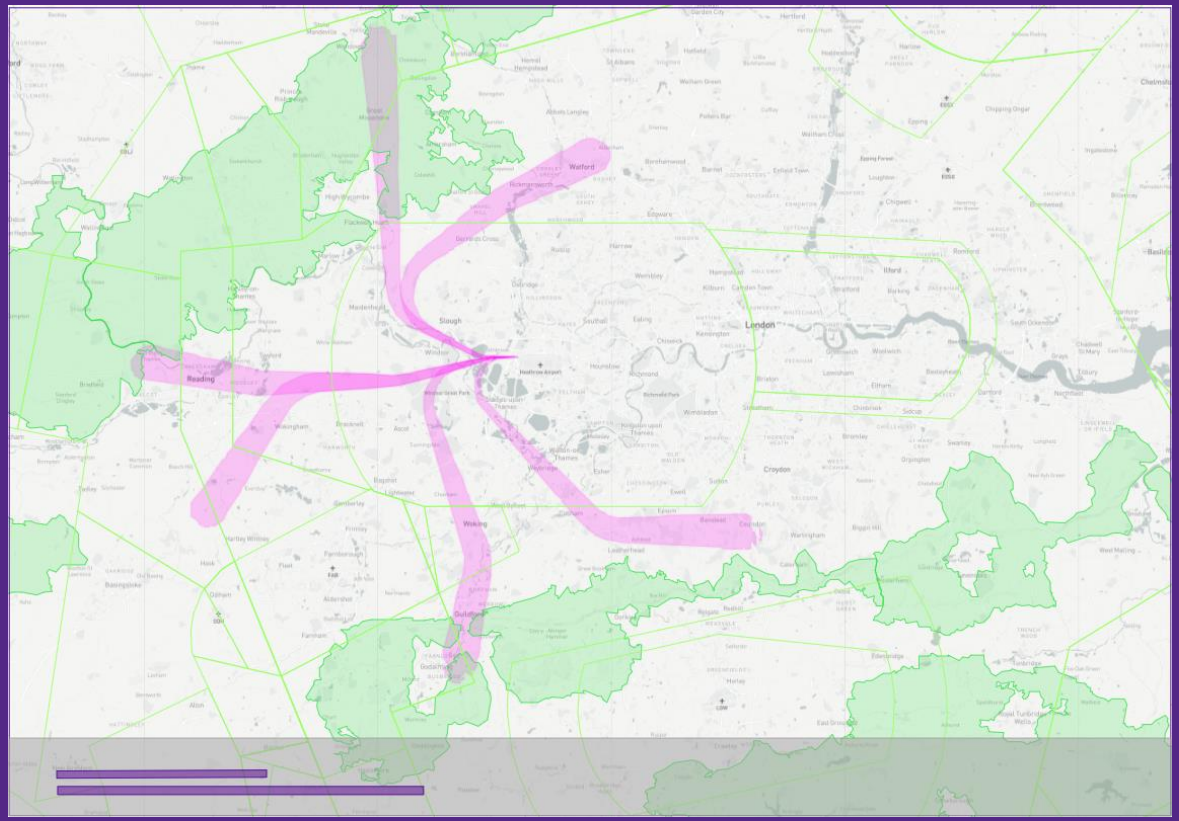
Runway 27L Design Principle 9 (a)



These options are the existing SID centrelines to minimise people newly overflown

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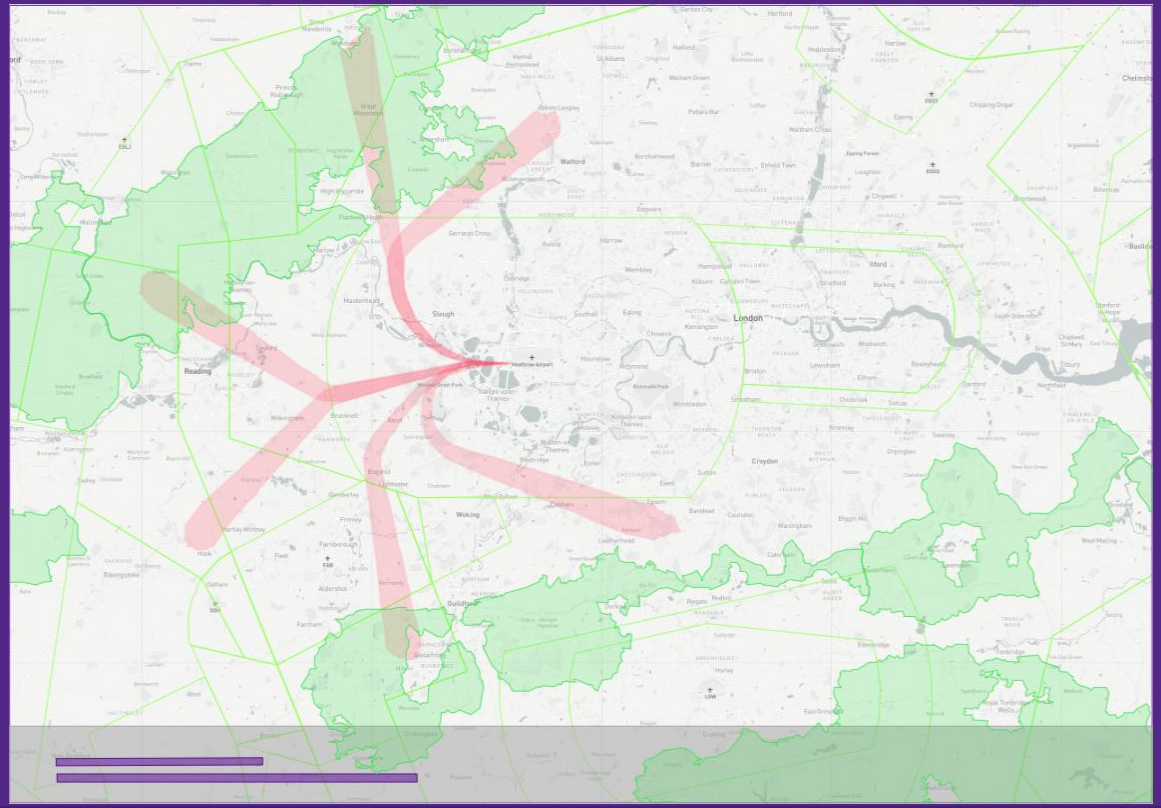
Runway 27L Design Principle 10



These options were designed to minimise the number of people exposed to noise up to 7,000ft.

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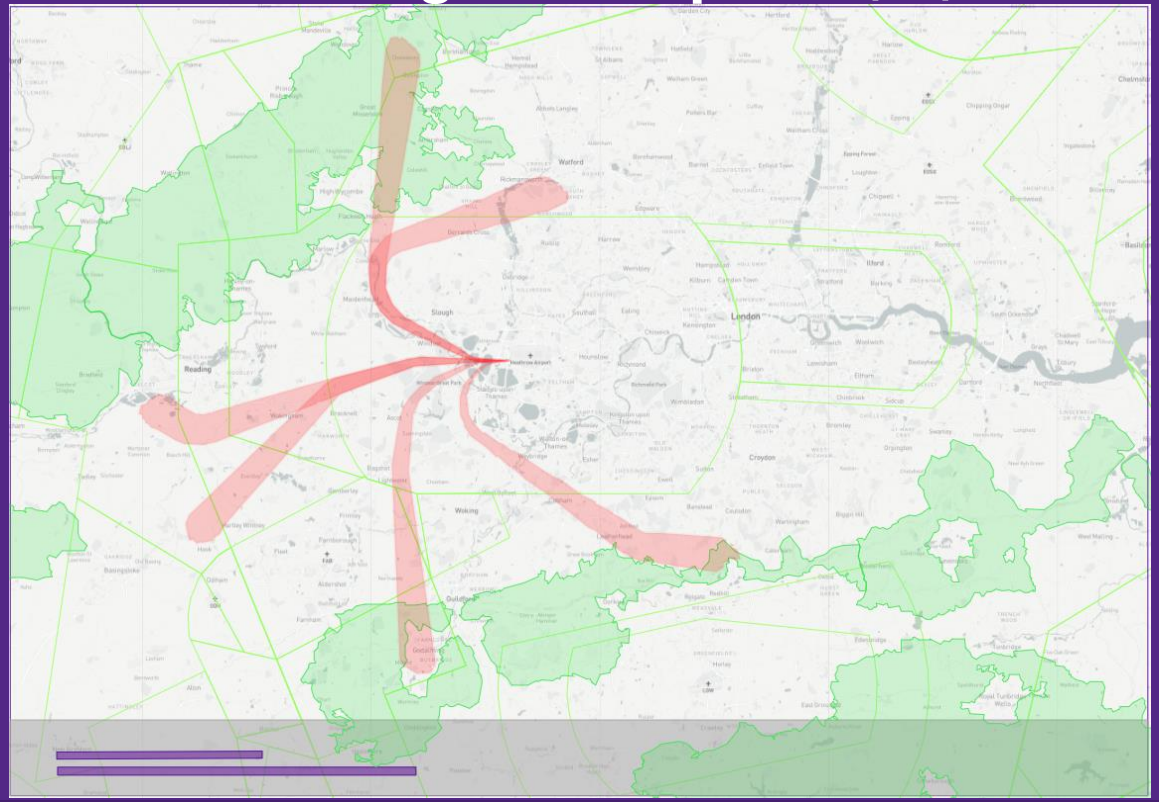
Runway 27L
Blend of Design Principles 2, 4, 9 and 10



These options were designed to balance population numbers, newly overflown, CO_2 and AONBs

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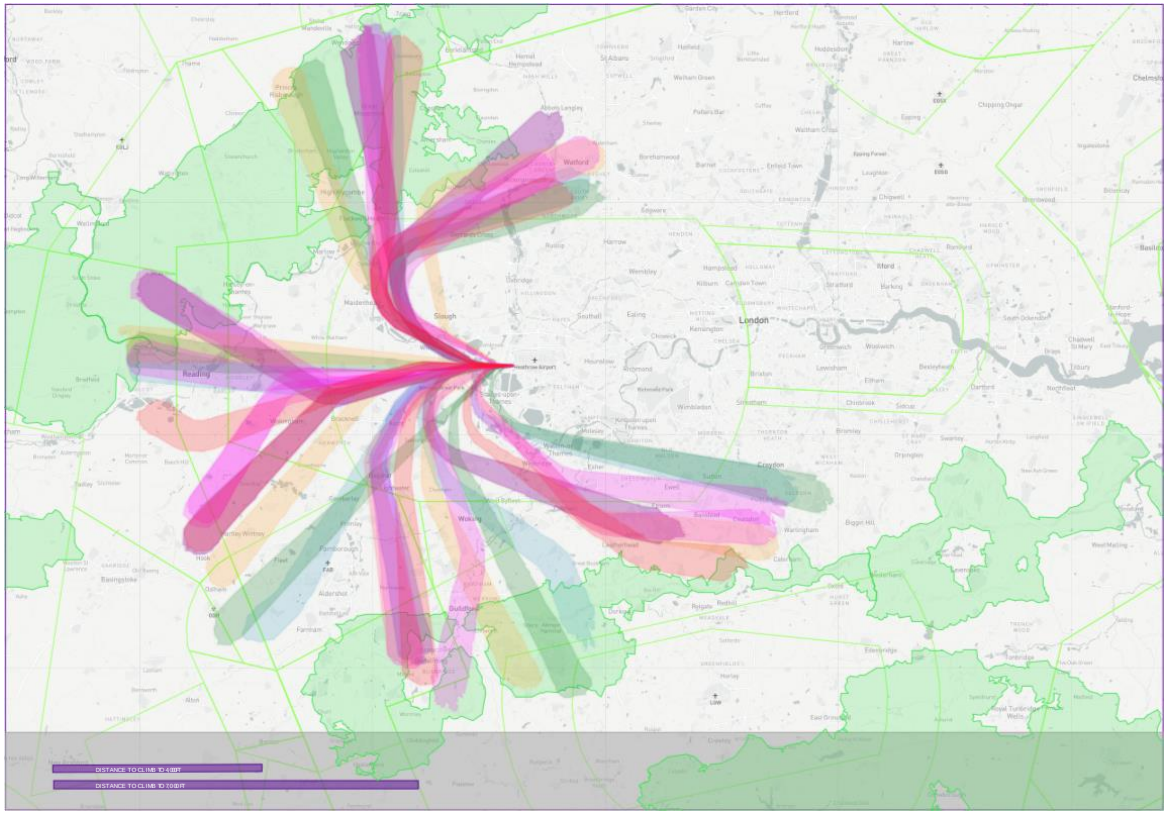
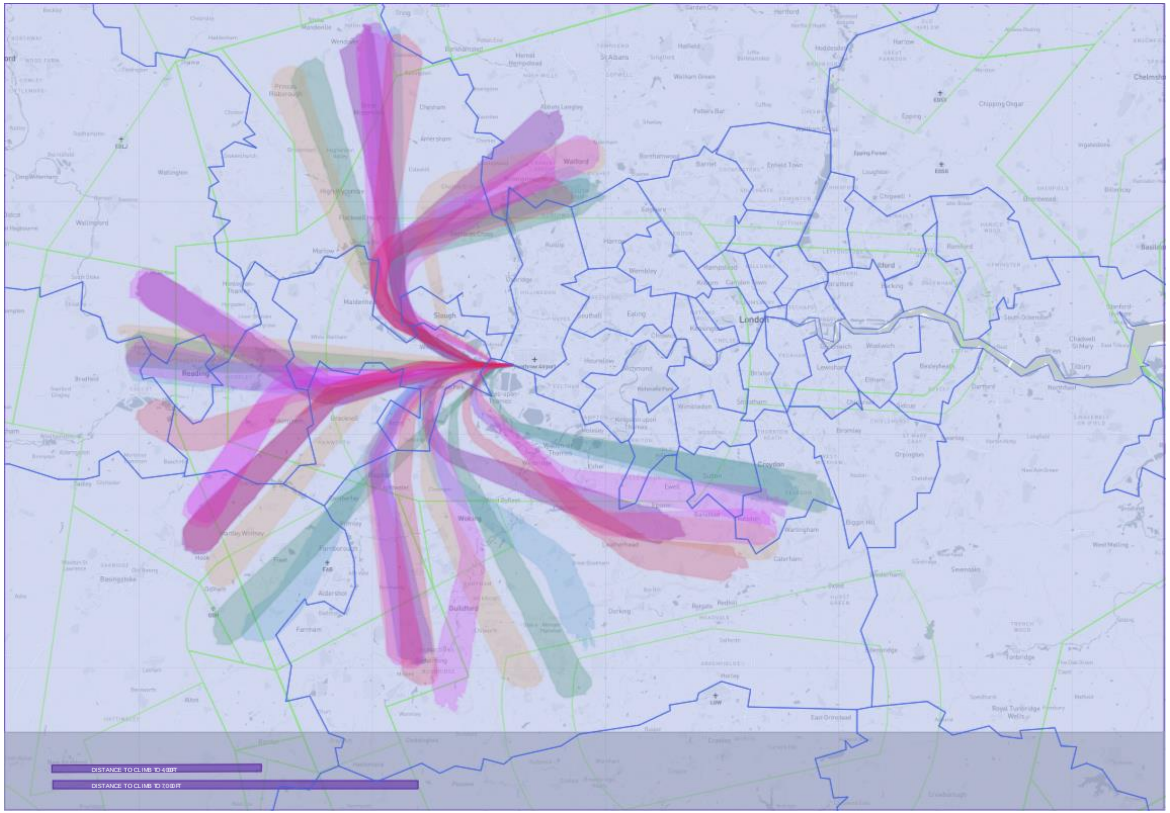
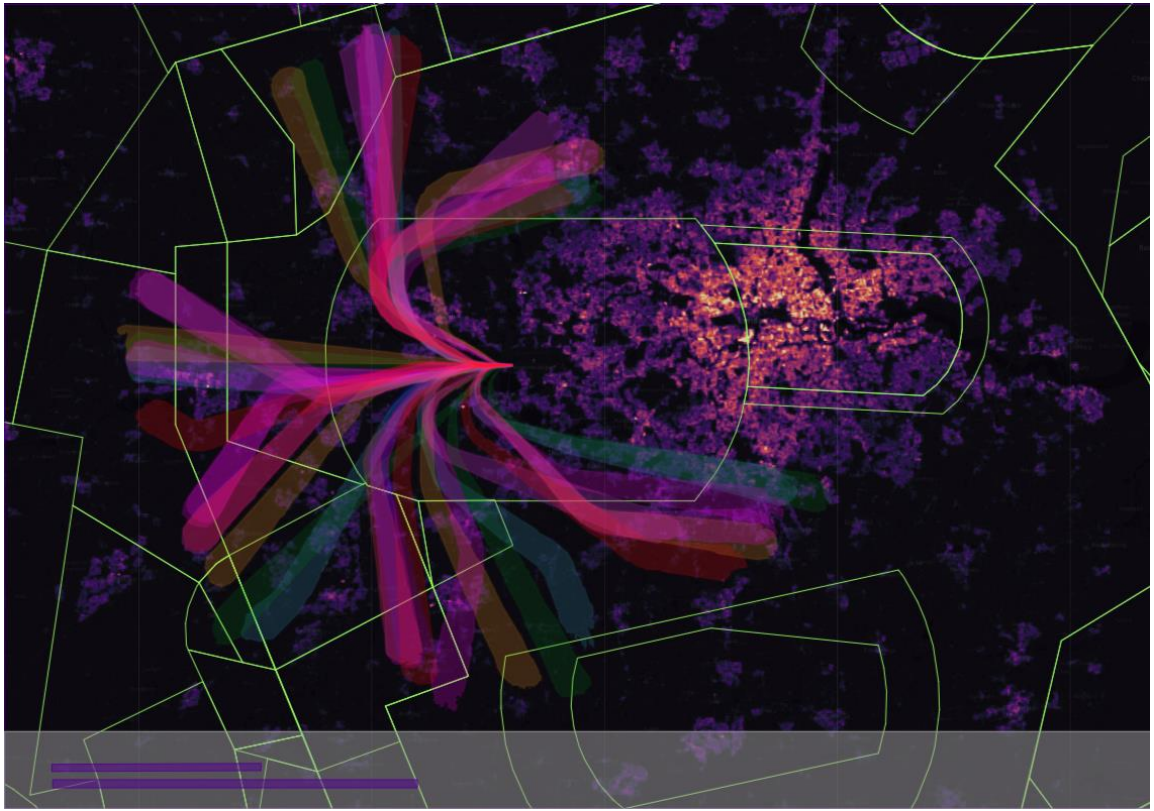
Runway 27L All Departure Options



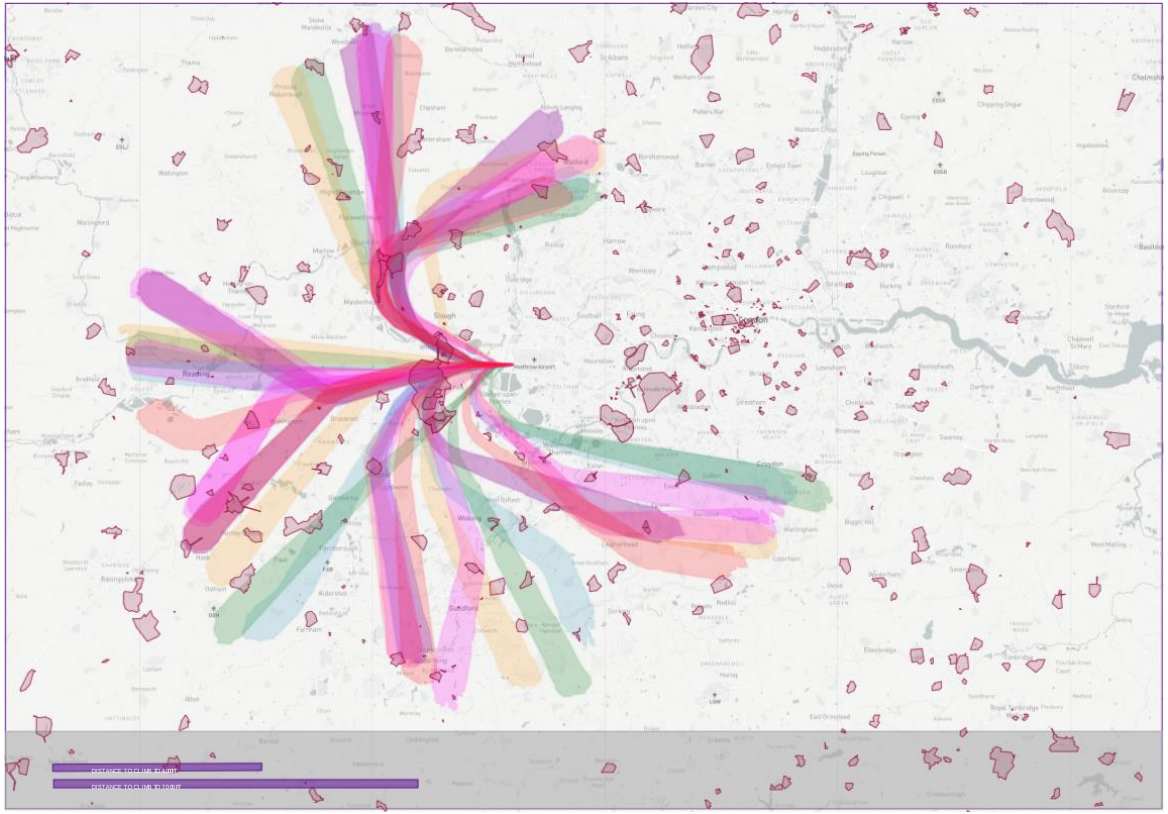
Runway 27L All Departure Options (LA boundaries)



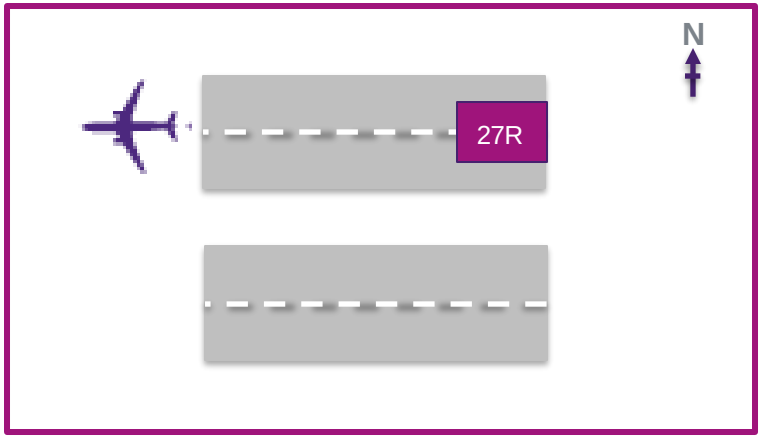
Runway 27L All Departure Options (Population)



Runway 27L All Departure Options (Parks and Gardens)



Runway 27R Departures



27R = Aircraft departing the Northern runway to the West

When the wind blows from the West Heathrow need to operate on their Westerly runways. This is approximately 70% of the time.

Runway 27R Design Principle 2

These options were designed to minimise the number of people exposed to noise up to 7,000ft whilst also considering CO_2 and AONBs

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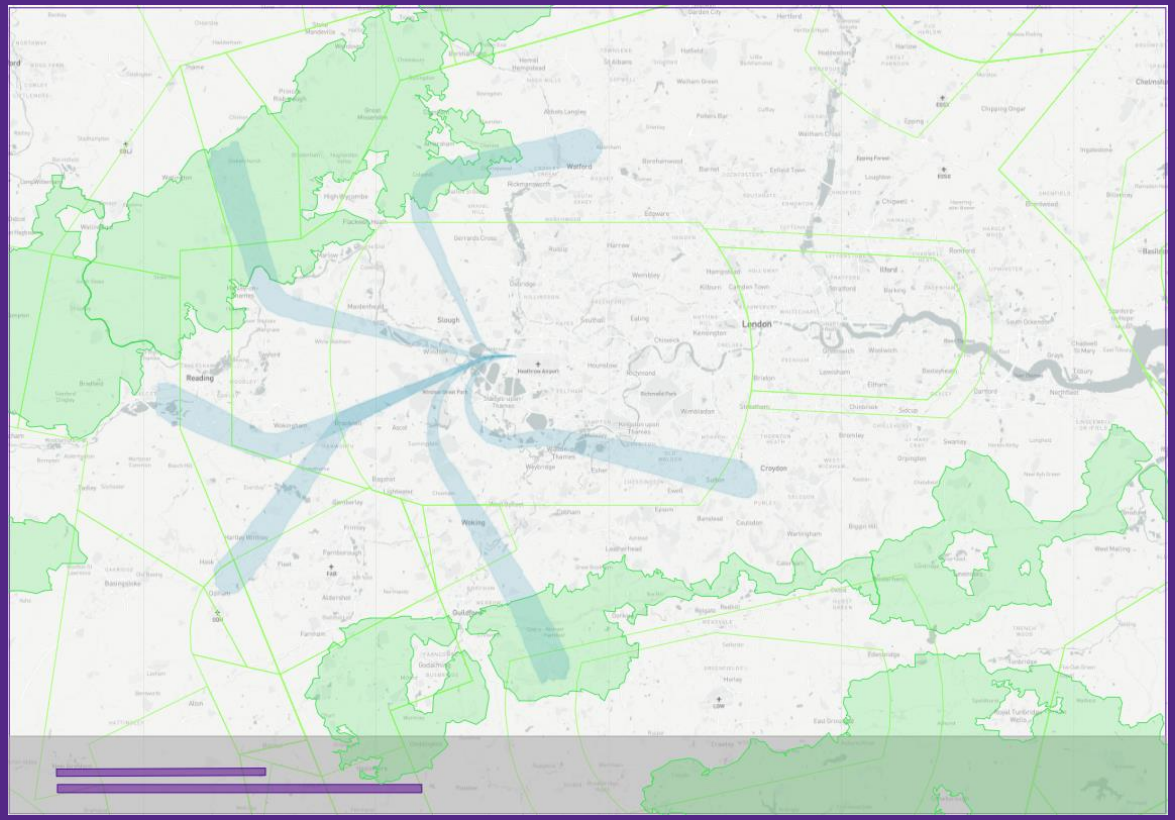
Runway 27R Design Principle 2 (a)



These options were designed to minimise the number of people exposed to noise up to 4,000ft and then minimise track miles from 4,000ft

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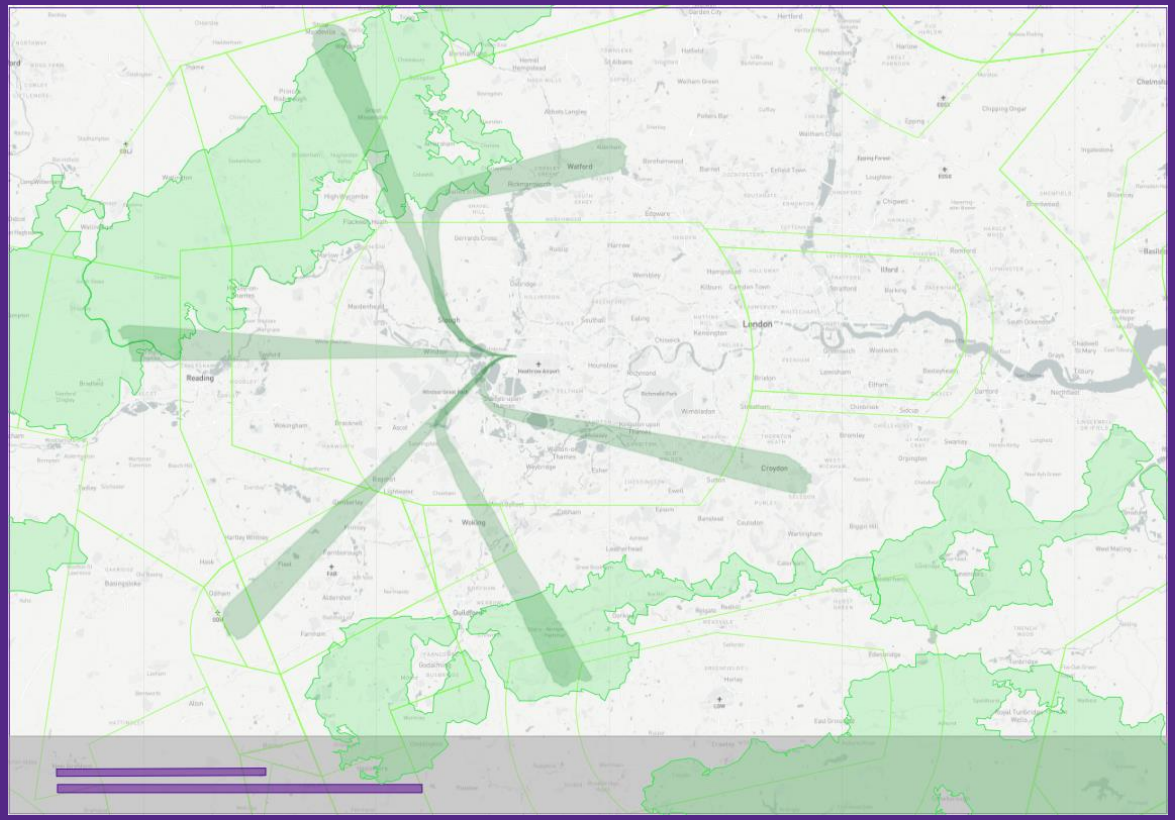
Runway 27R Design Principle 4



These options were designed to minimise the number of track miles flown

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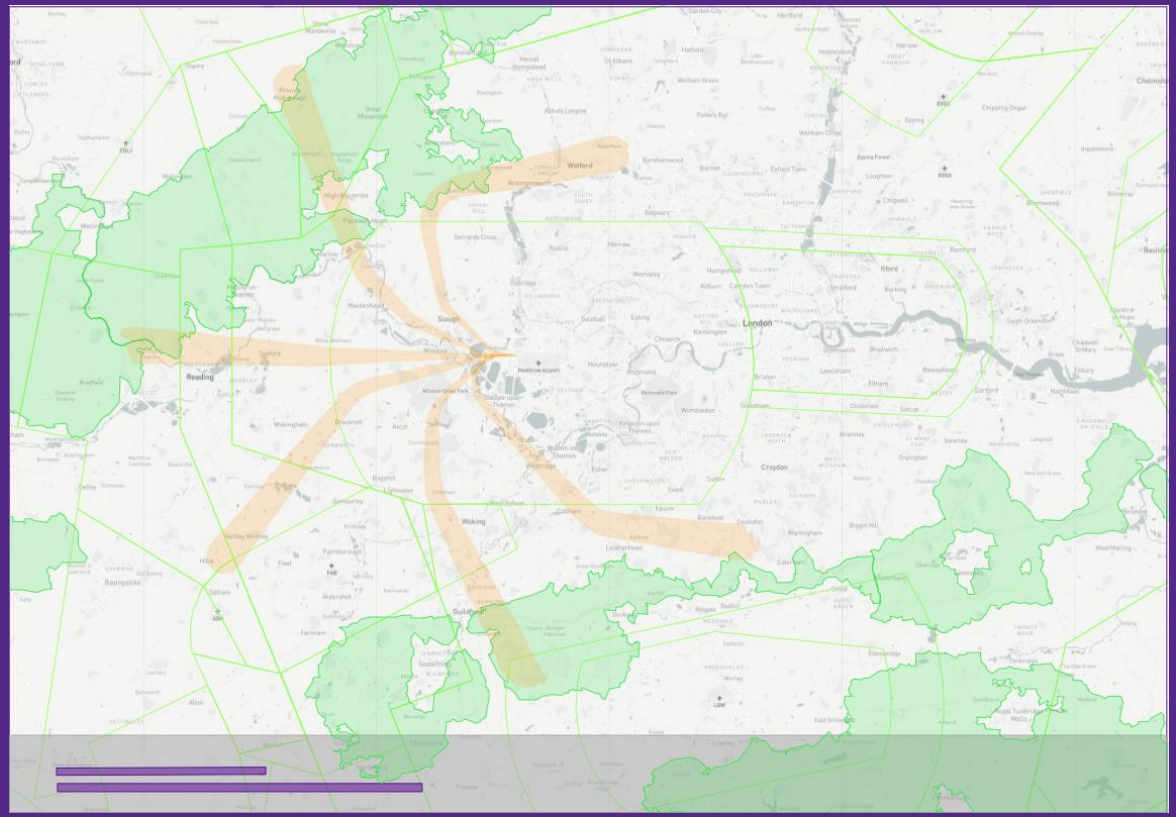
Runway 27R Design Principle 5



These options were designed to maximise departure efficiency

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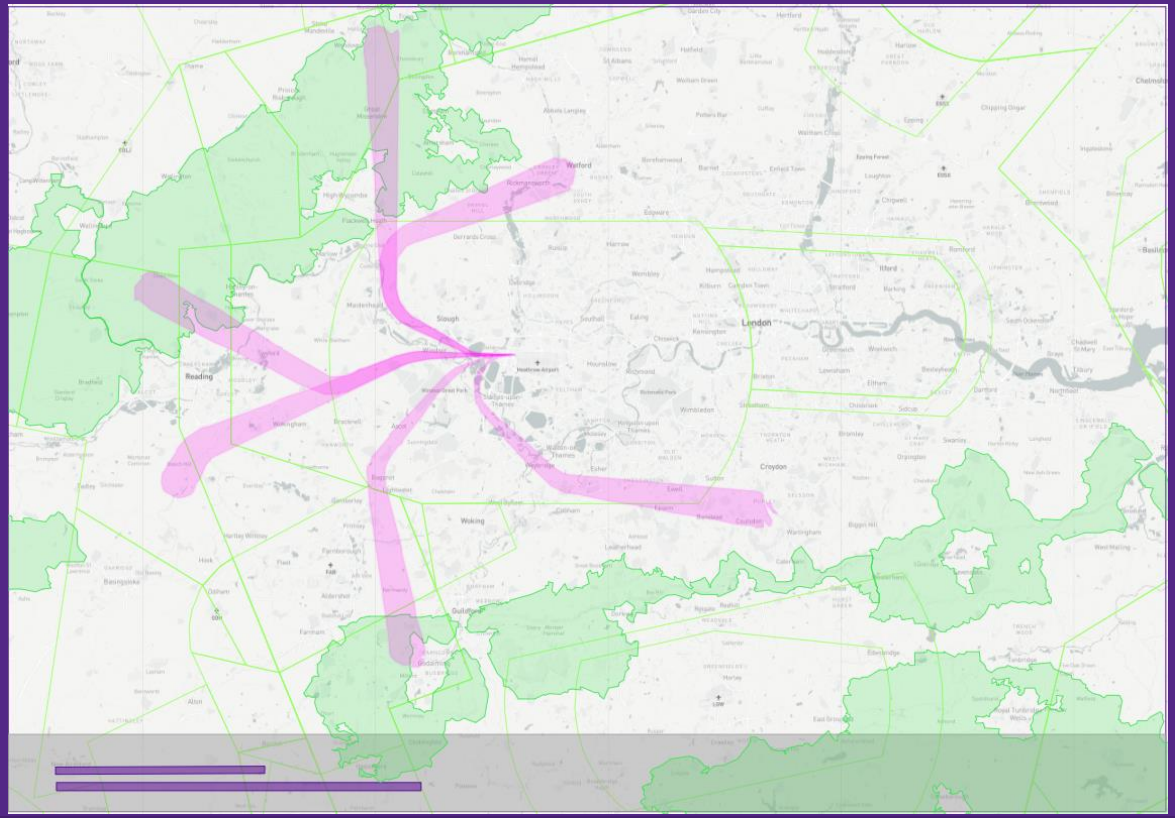
Runway 27R Design Principle 9



These options were designed to minimise the number of people newly overflown

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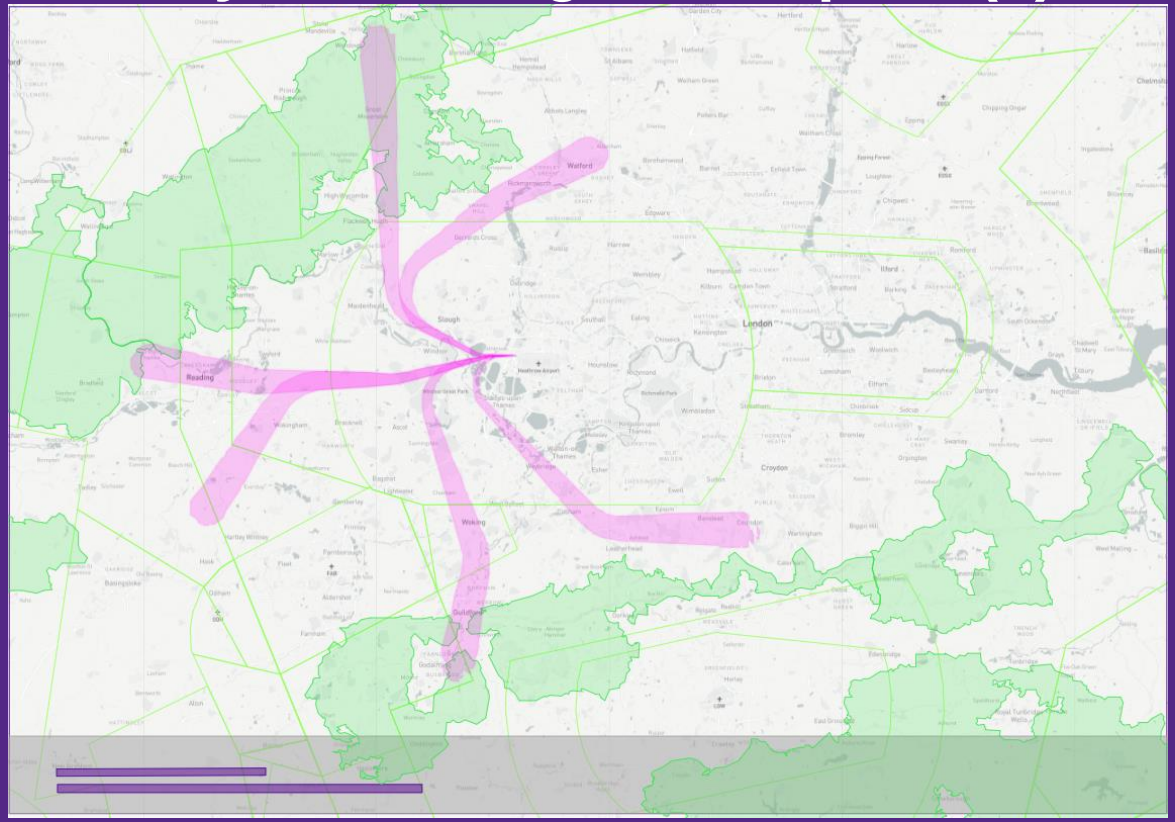
Runway 27R Design Principle 9 (a)



These options are the existing SID centrelines to minimise people newly overflown

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Runway 27R Design Principle 10

These options were designed to minimise the number of people exposed to noise up to 7,000ft.

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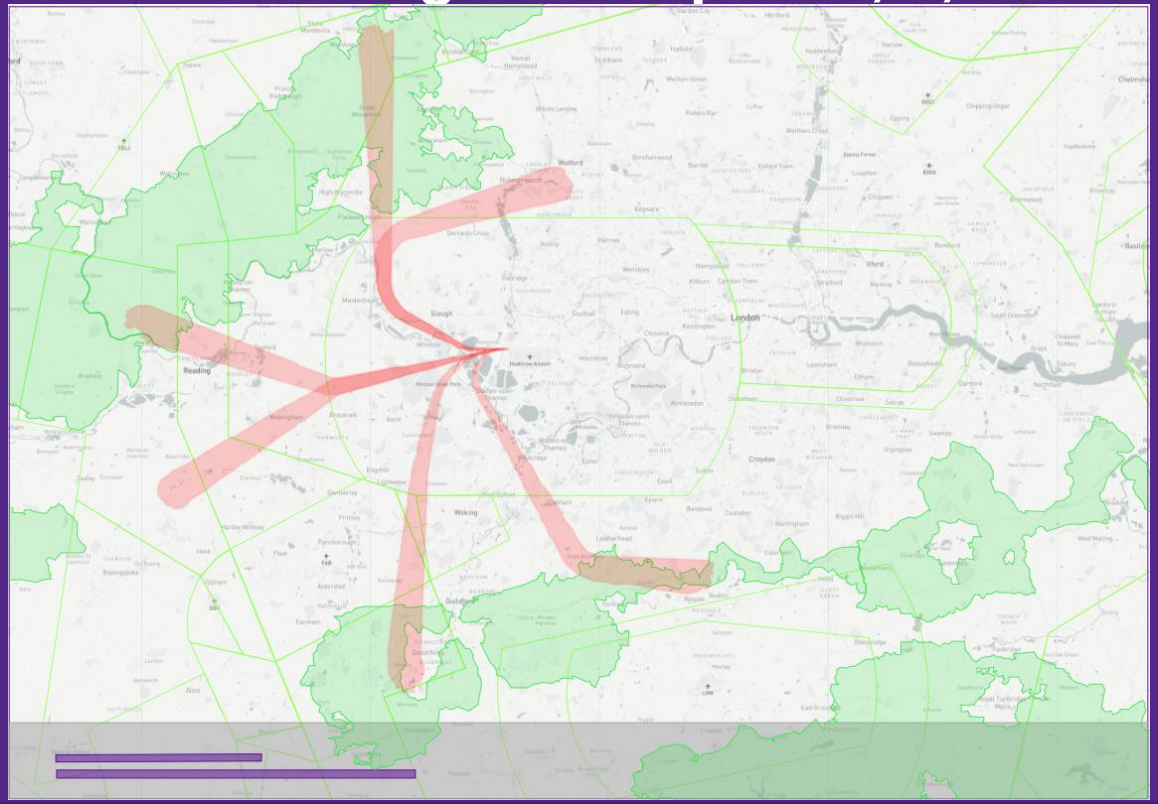
Runway 27R
Blend of Design Principles 2, 4, 9 and 10



These options were designed to balance population numbers, newly overflown, CO_2 and AONBs

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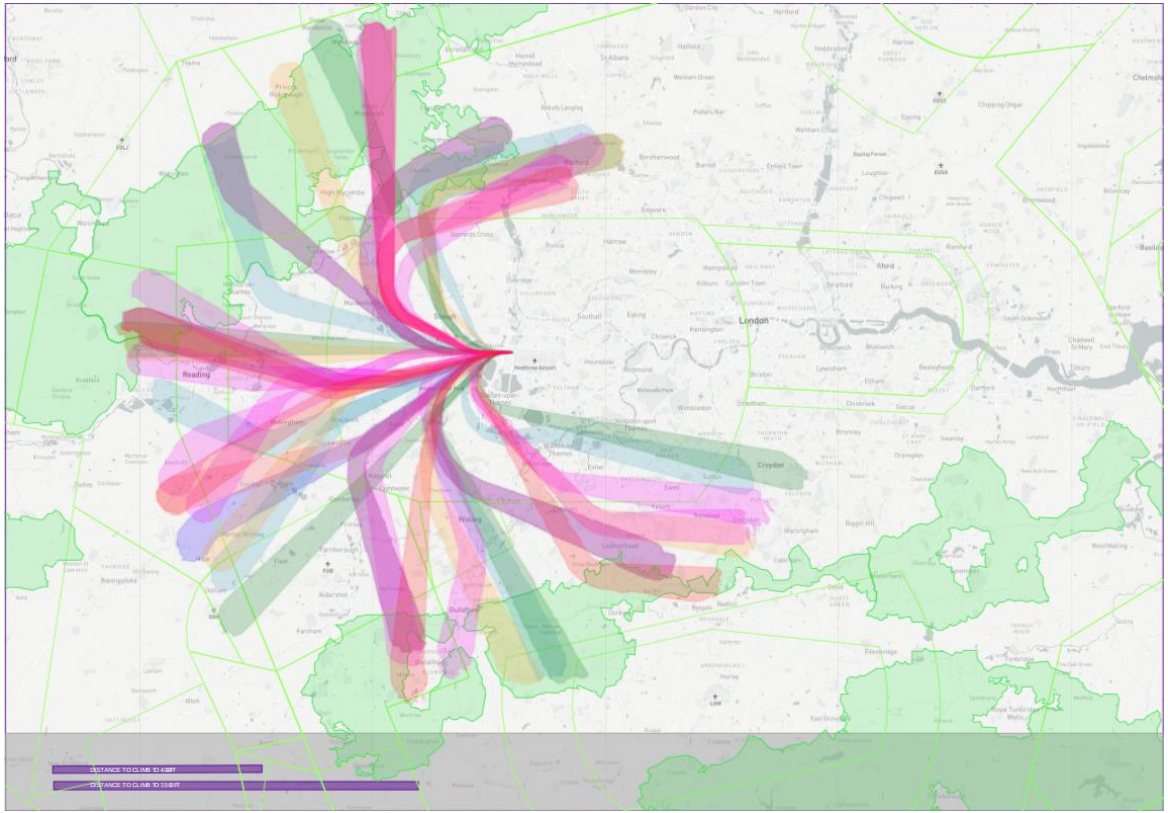
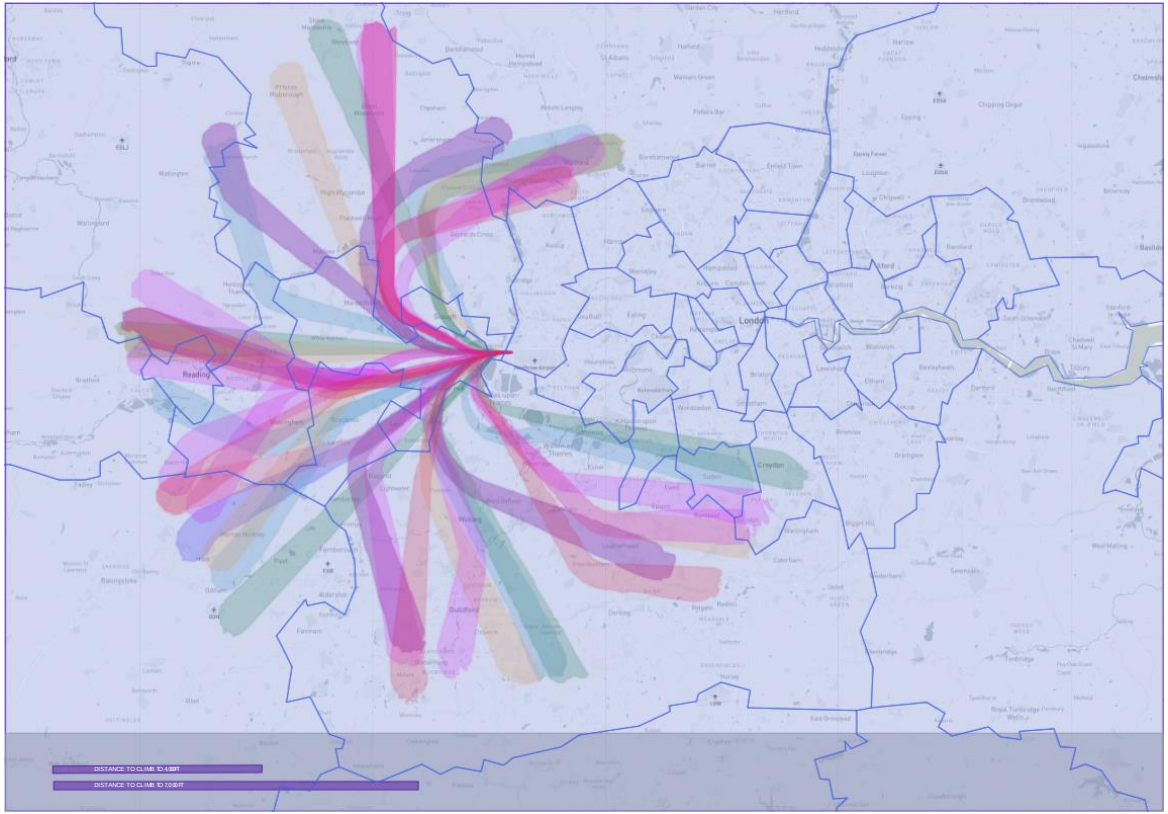
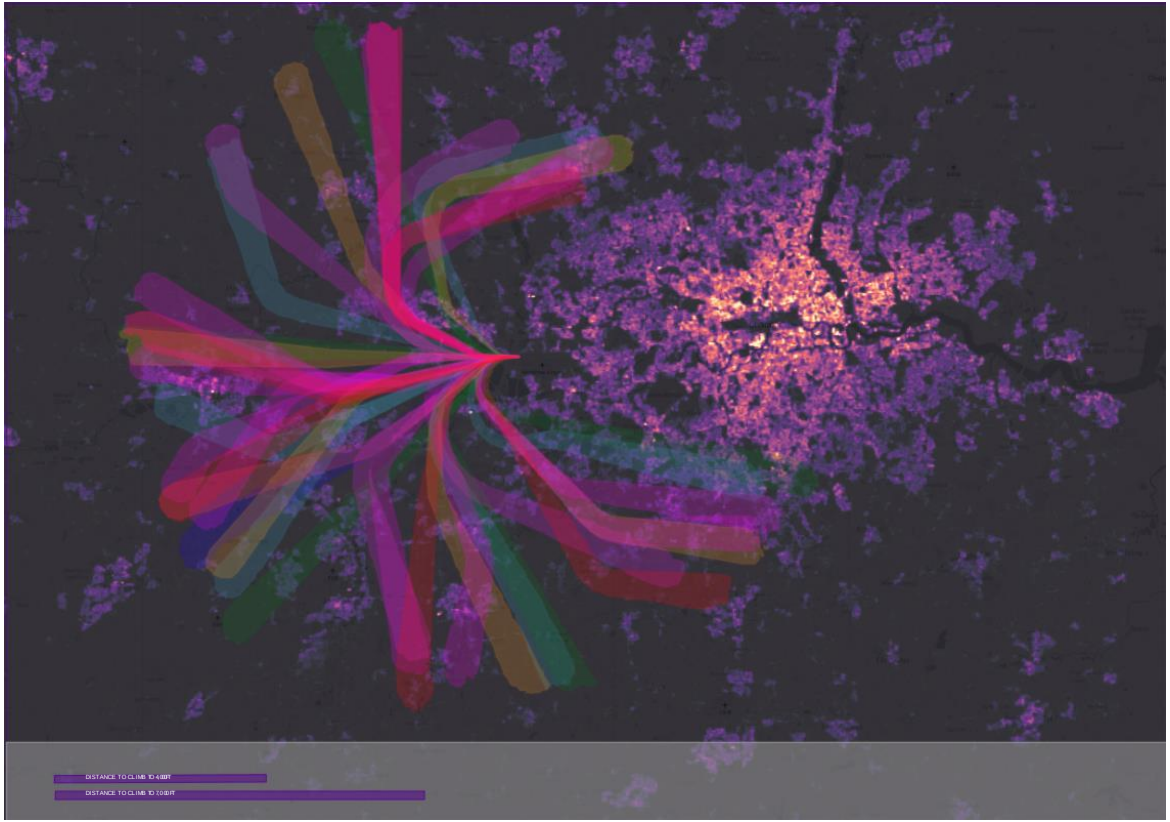
Runway 27R All Departure Options



Runway 27R All Departure Options (LA boundaries)

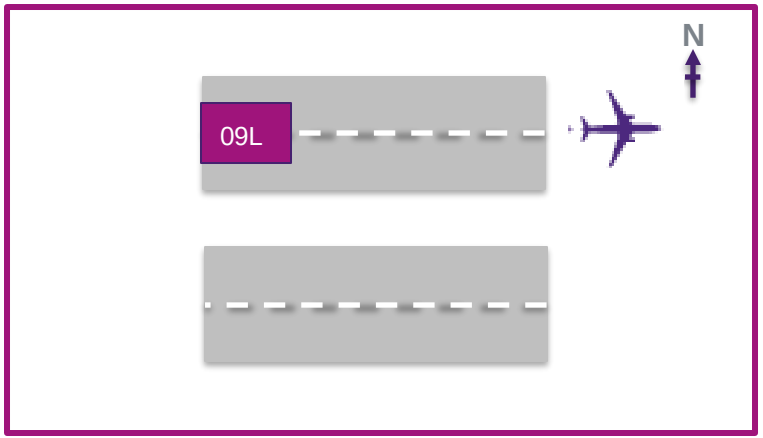


Runway 27R All Departure Options (Population)



Runway 27R All Departure Options (Parks and Gardens)

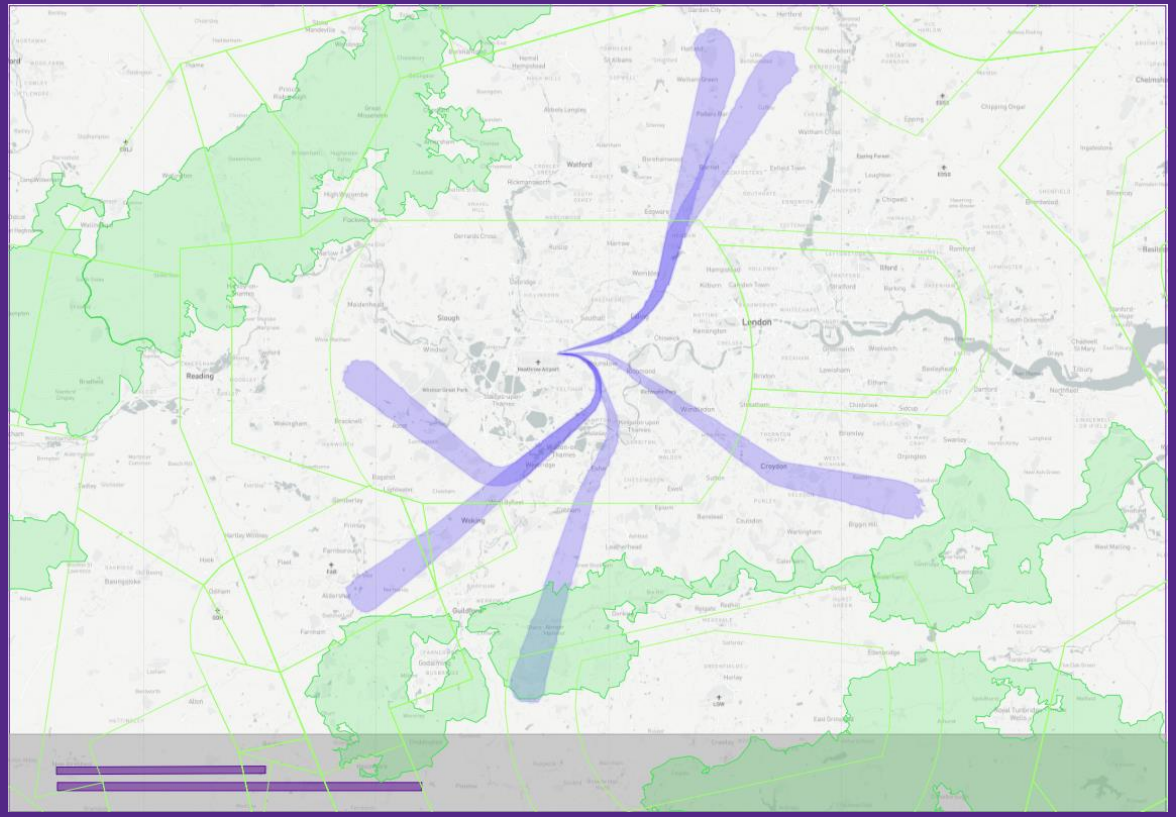
Runway 09L Departures



09L = Aircraft departing the Northern runway to the East

When the wind blows from the East Heathrow need to operate on their Easterly runways. This is approximately 30% of the time.

Runway 09L Design Principle 2



These options were designed to minimise the number of people exposed to noise up to 7,000ft whilst also considering CO_2 and AONBs

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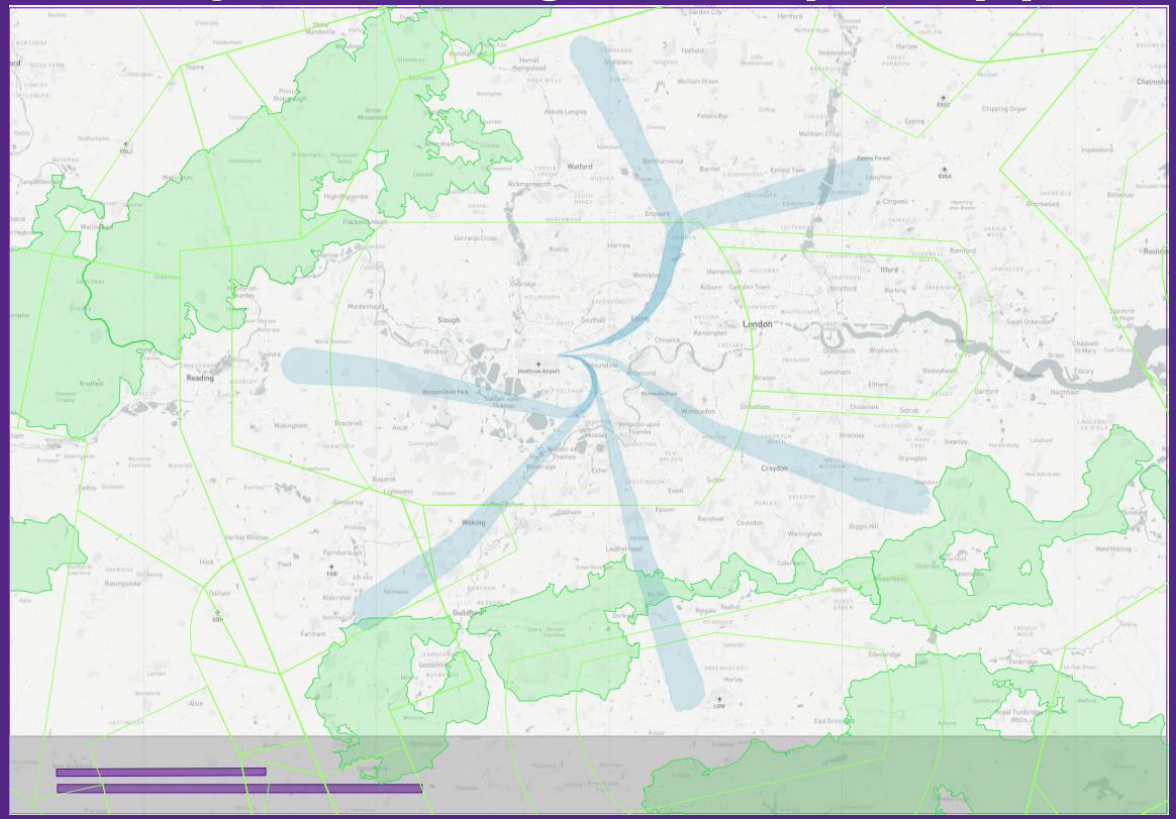
Runway 09L Design Principle 2 (a)



These options were designed to minimise the number of people exposed to noise up to 4,000ft and then minimise track miles from 4,000ft

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

Runway 09L Design Principle 4

These options were designed to minimise the number of track miles flown

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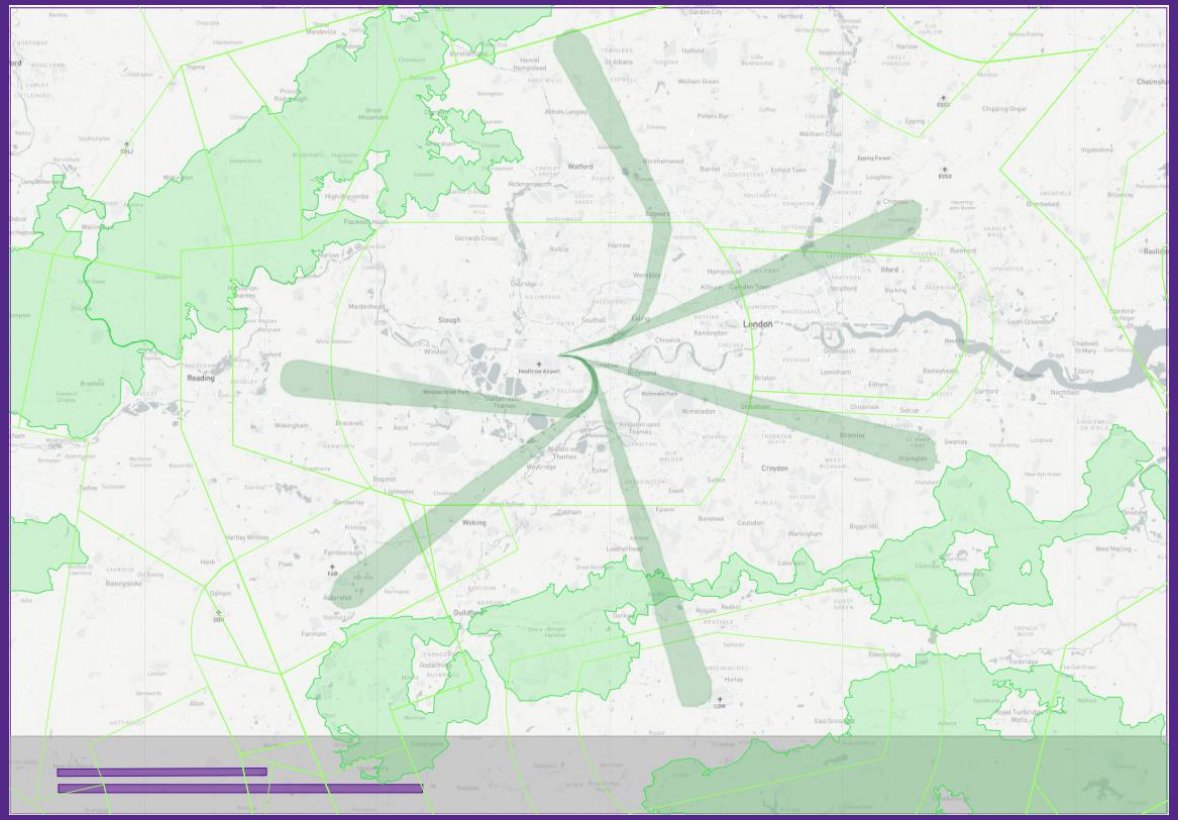
Runway 09L Design Principle 4 (a)



These options were designed to minimise the number of track miles flown

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Runway 09L Design Principle 5

This option was designed to maximise departure efficiency

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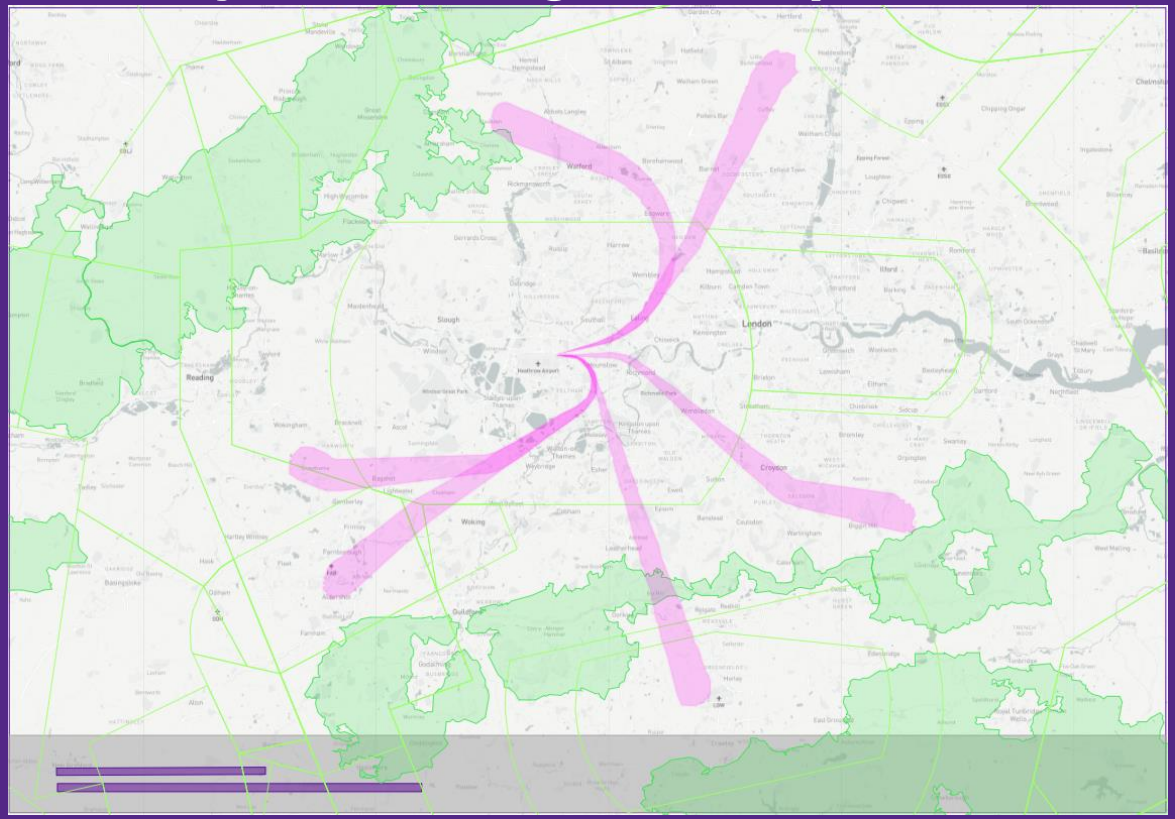
Runway 09L Design Principle 9



These options were designed to minimise the number of people newly overflown

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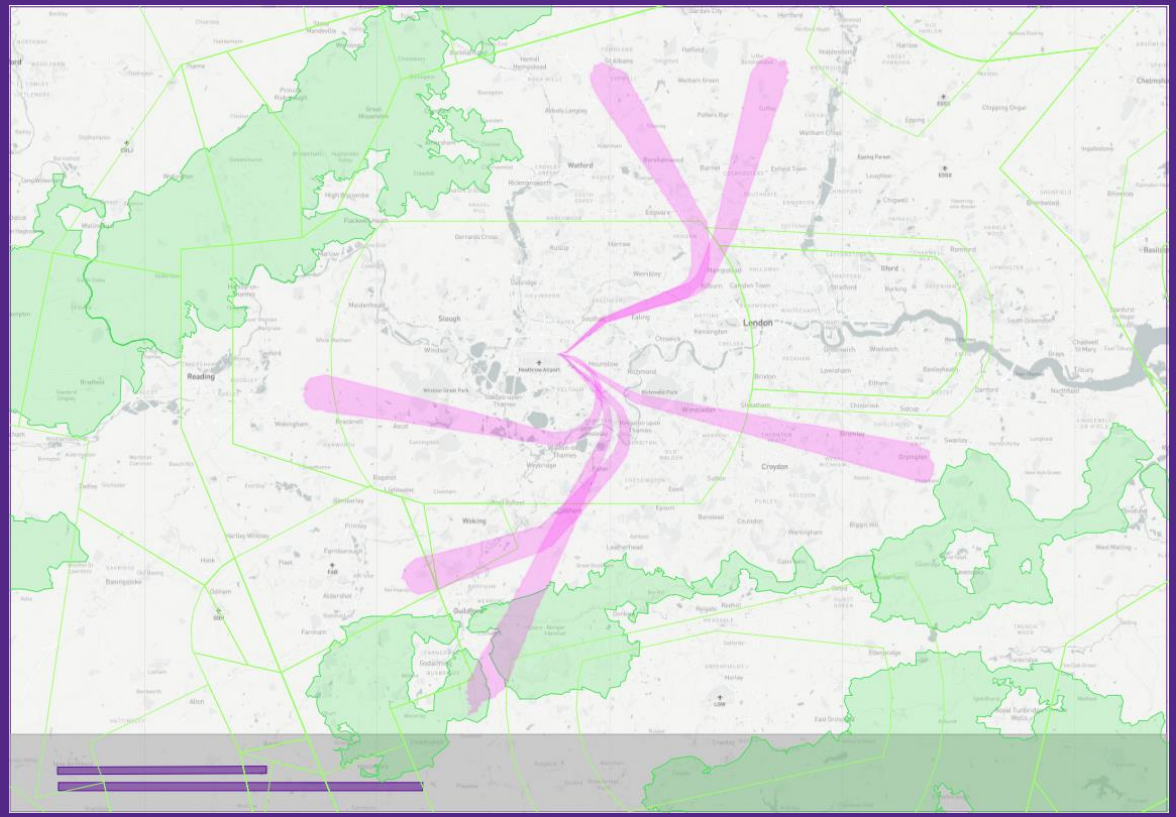
Runway 09L Design Principle 9 (a)



These options are the existing SID centrelines to minimise people newly overflown

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Runway 09L Design Principle 10

These options were designed to minimise the number of people exposed to noise up to 7,000ft.

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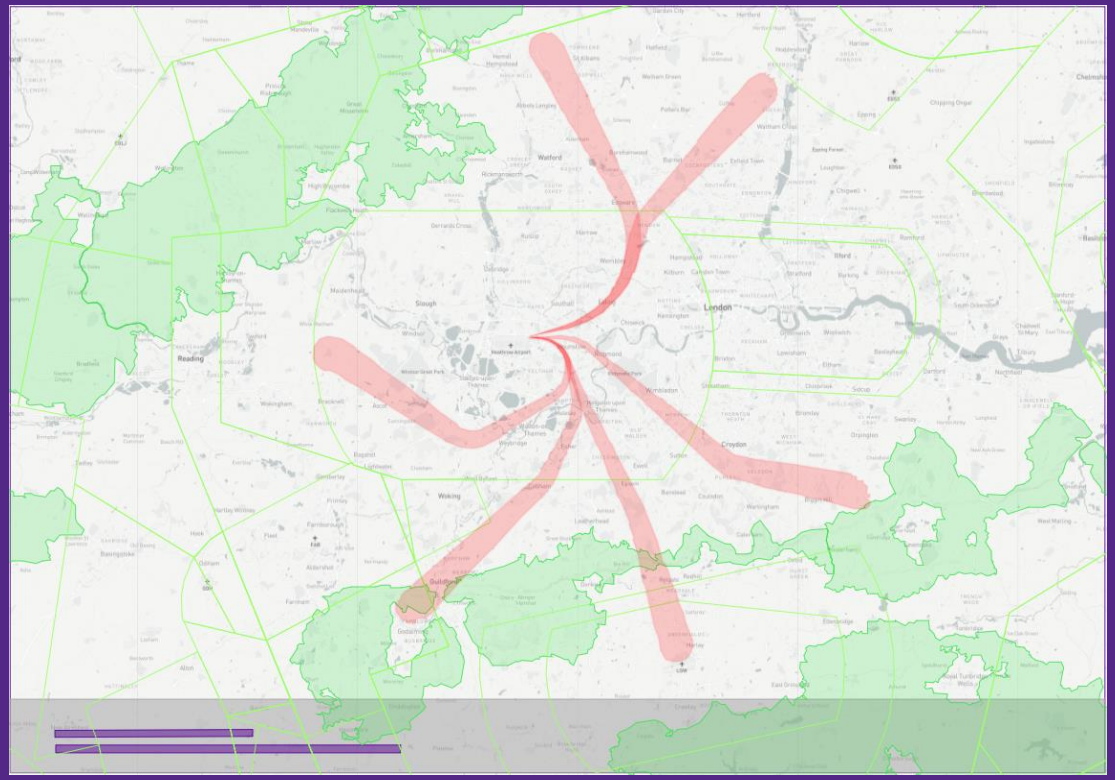
Runway 09L
Blend of Design Principles 2, 4, 9 and 10



These options were designed to balance population numbers, newly overflown, CO_2 and AONBs

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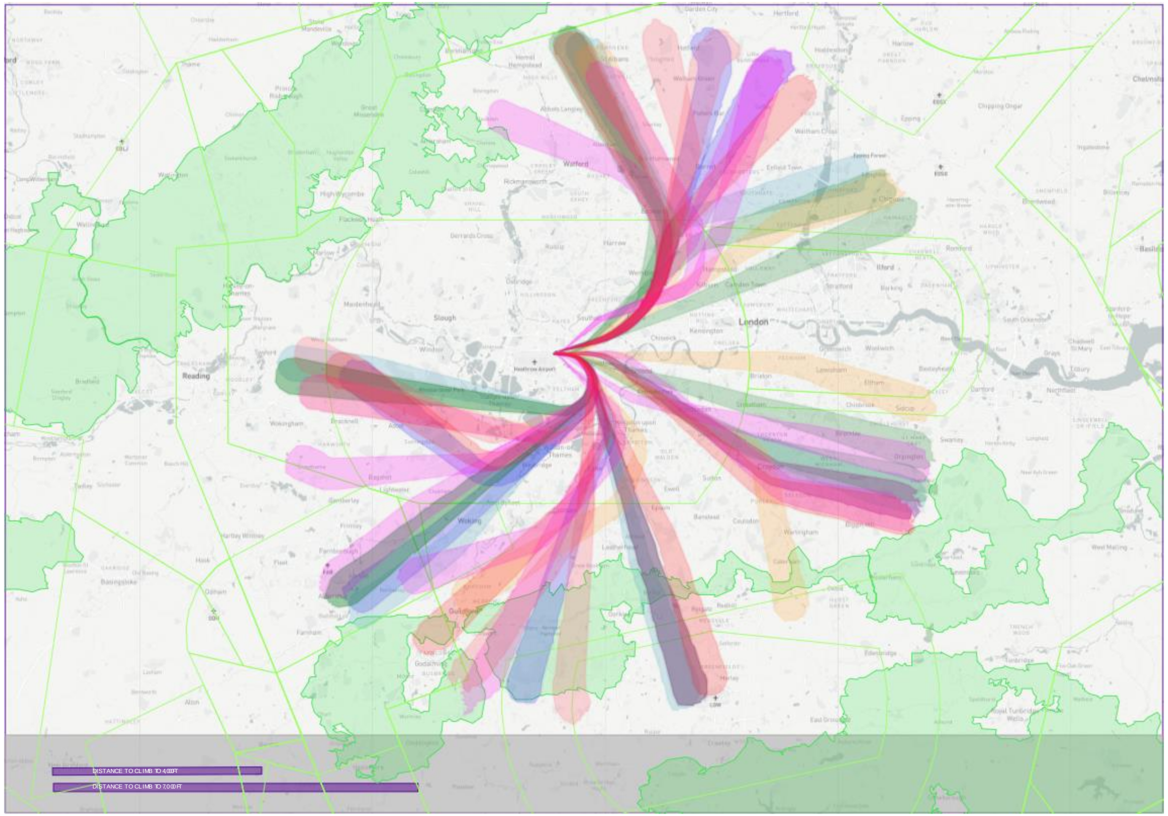
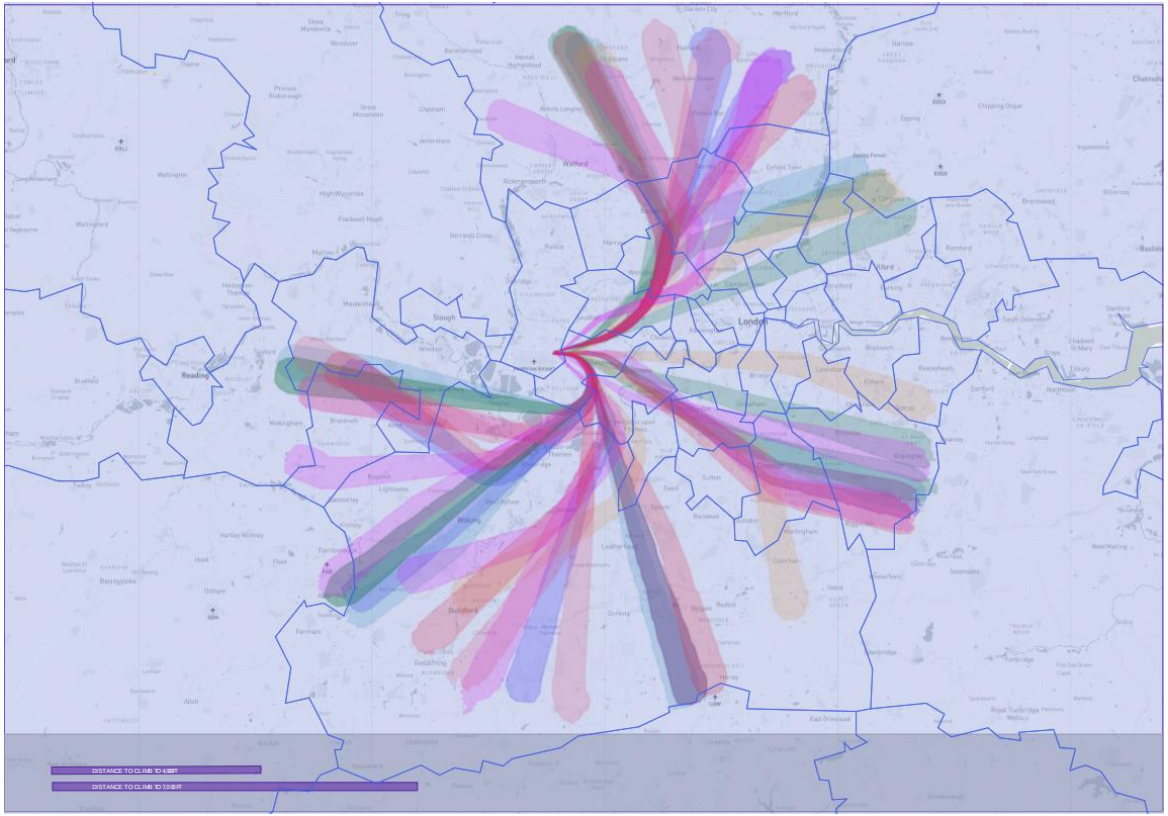
Runway 09L All Departure Options

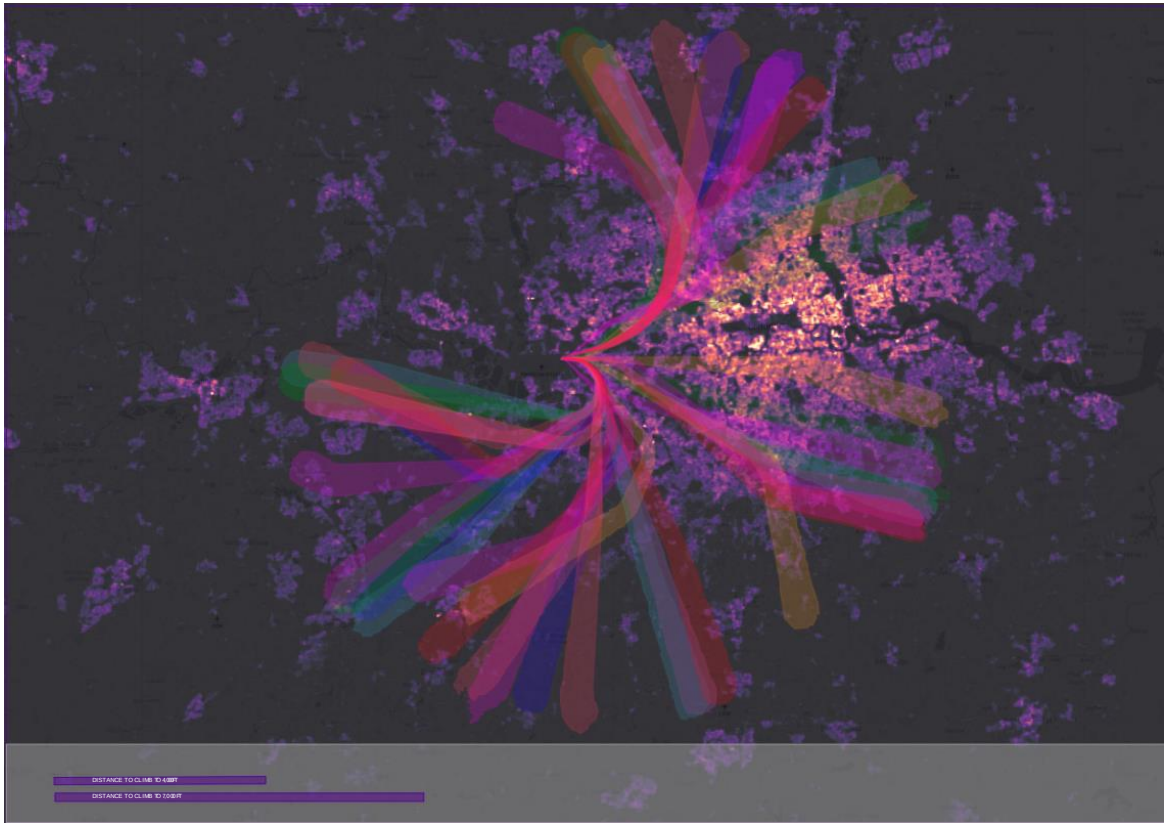


Heathrow

Runway 09L All Departure Options (LA boundaries)

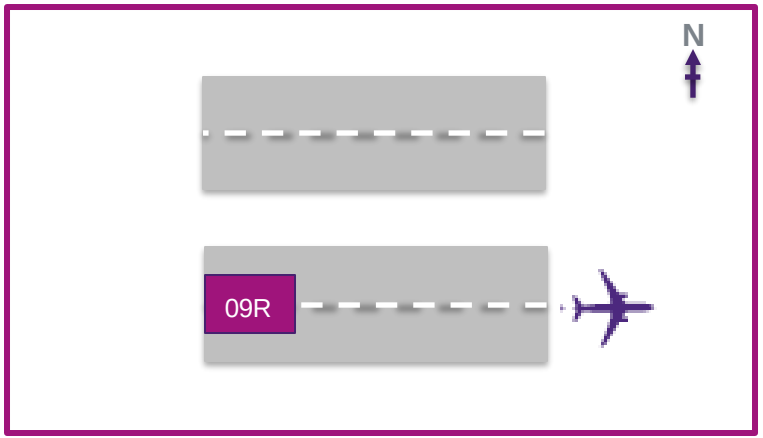


Runway 09L All Departure Options (Population)



Runway 09L All Departure Options (Parks and Gardens)

Runway 09R Departures



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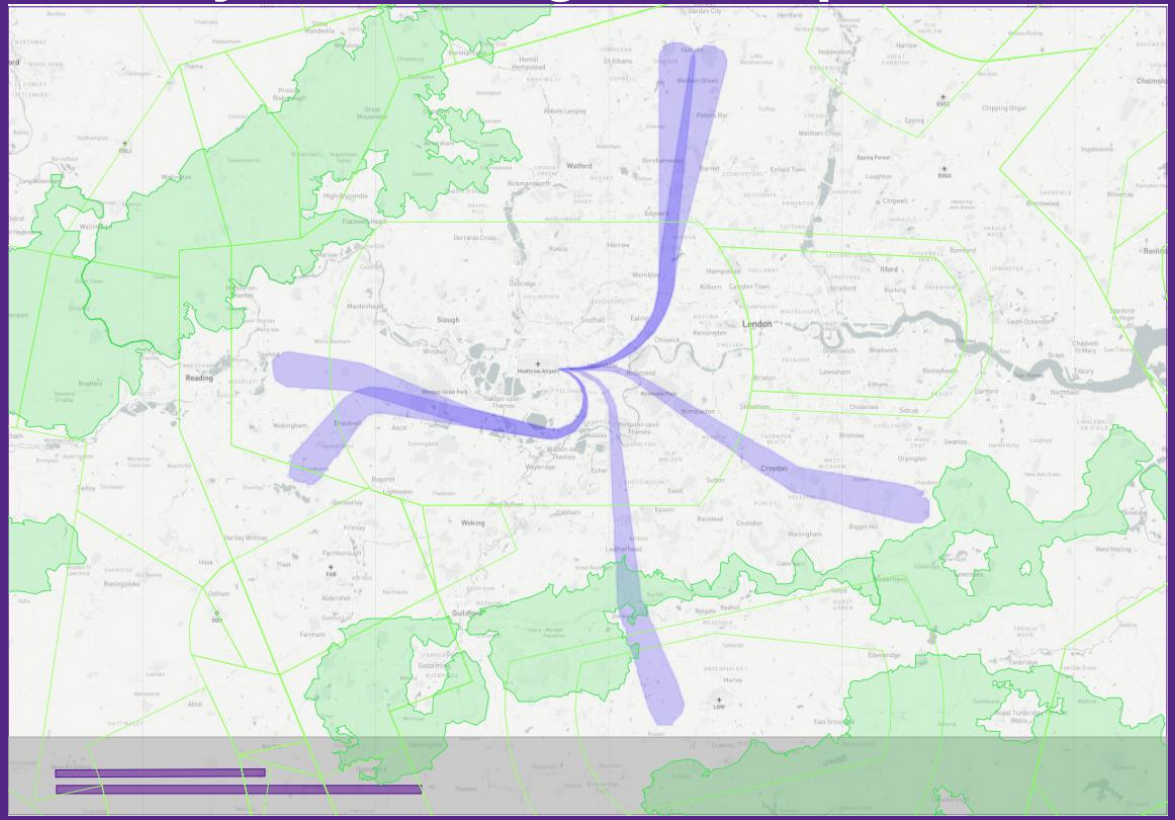
Runway 09R Design Principle 2



These options were designed to minimise the number of people exposed to noise up to 7,000ft whilst also considering CO_2 and AONBs

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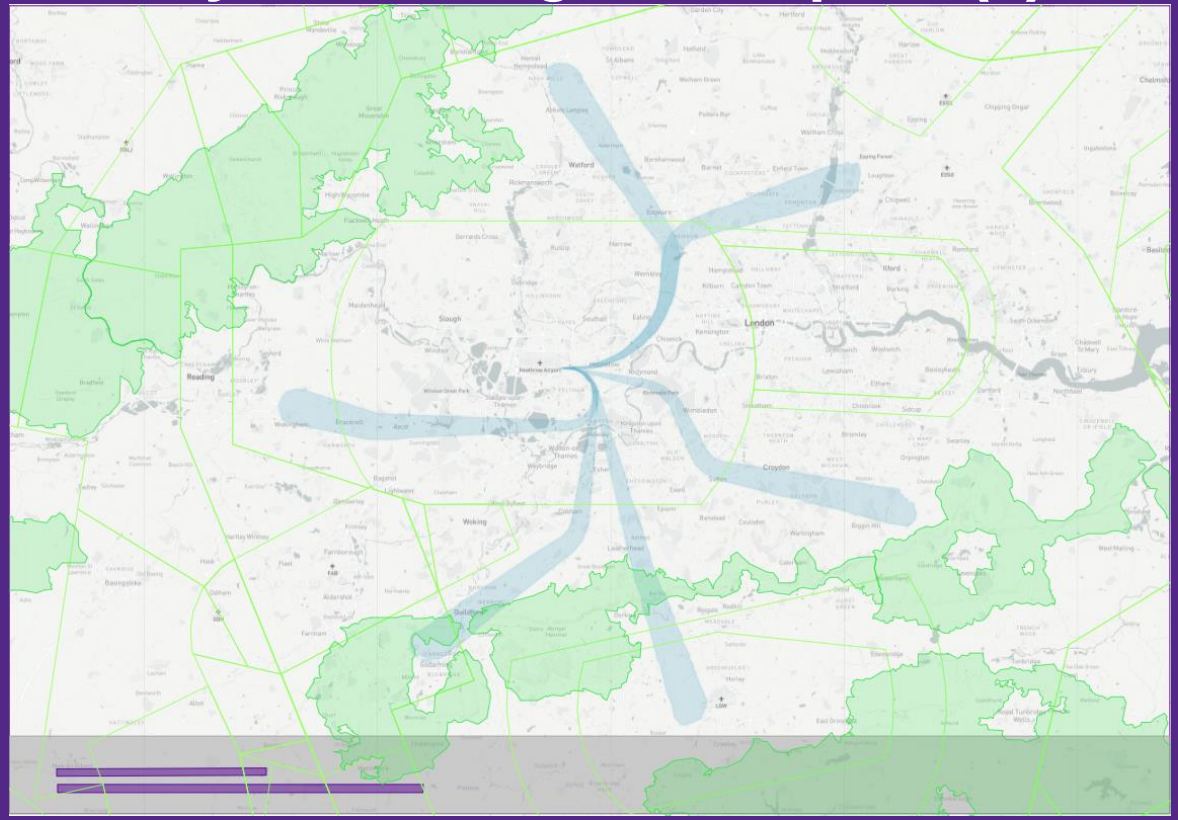
Runway 09R Design Principle 2 (a)



These options were designed to minimise the number of people exposed to noise up to 4,000ft and then minimise track miles from 4,000ft

All options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our Design Principles, our appraisals and stakeholder engagement and consultation.

Runway 09R Design Principle 4

These options were designed to minimise the number of track miles flown

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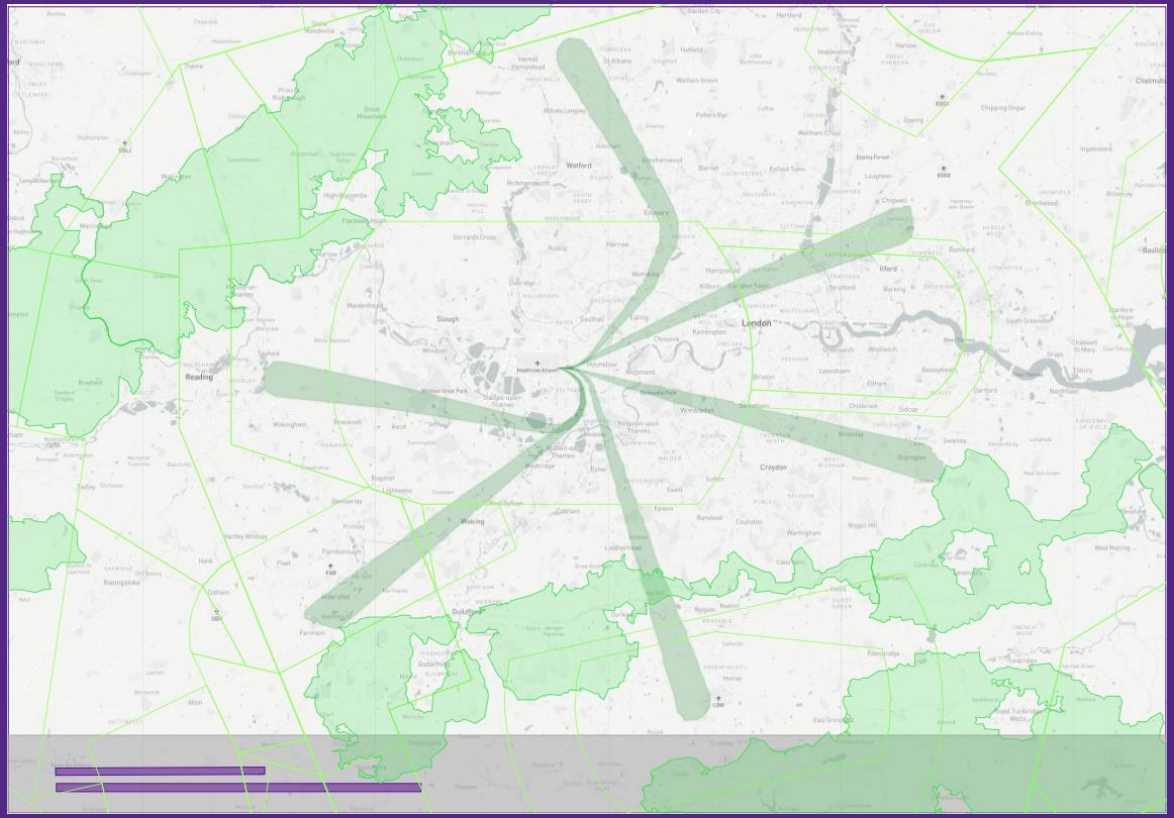
Runway 09R Design Principle 4 (a)



These options were designed to minimise the number of track miles flown

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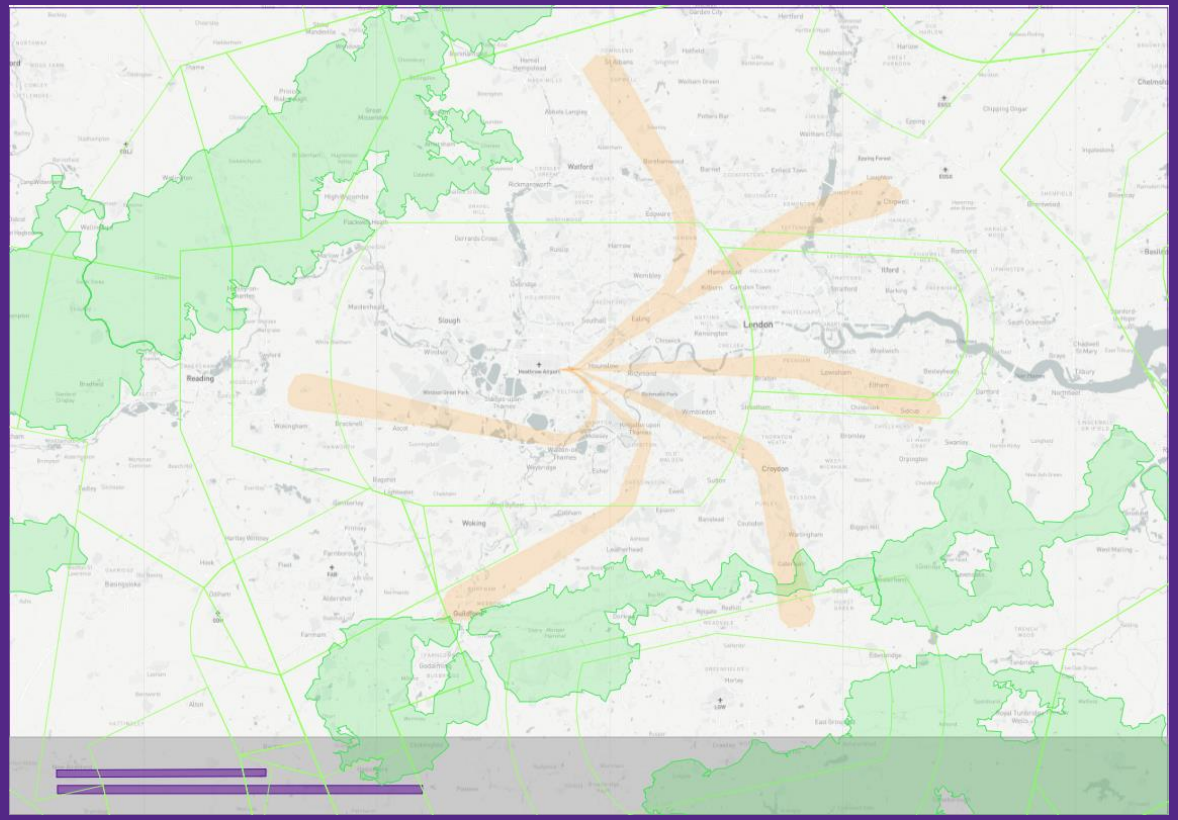
Runway 09R Design Principle 5



These options were designed to maximise departure efficiency

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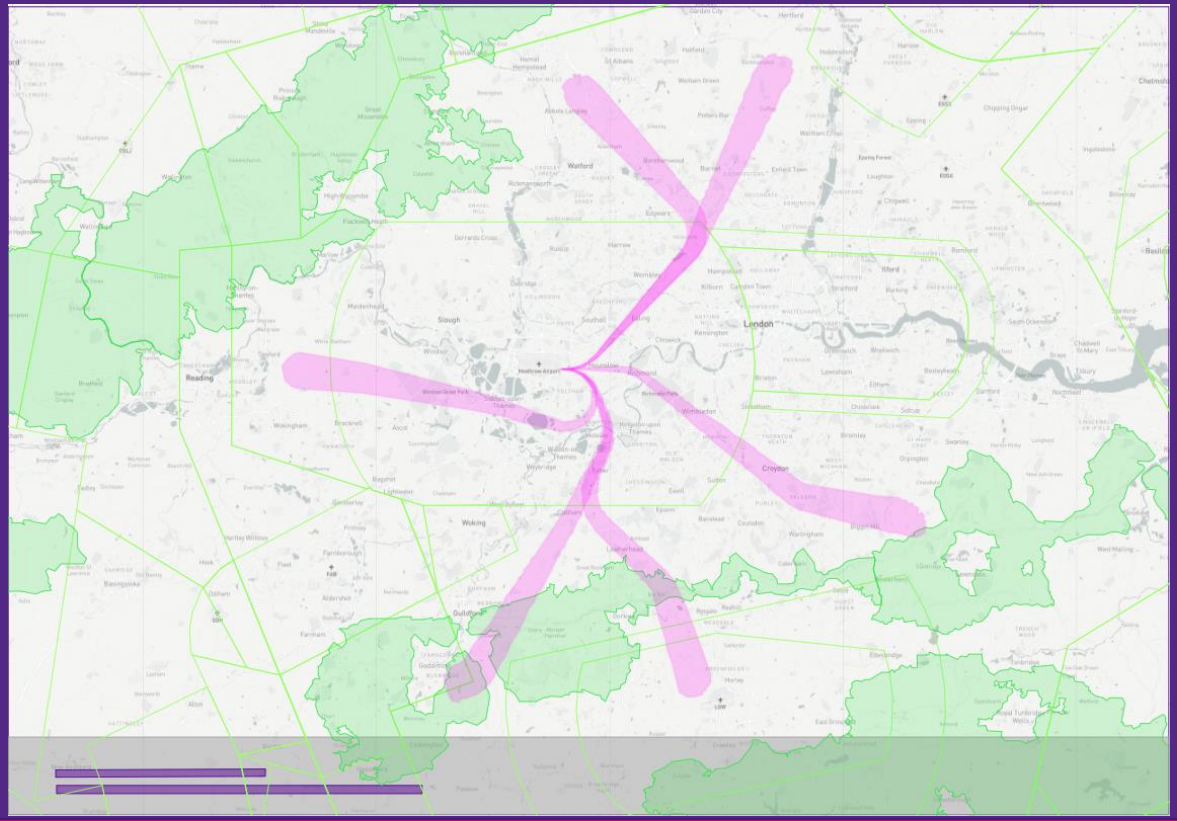
Runway 09R Design Principle 9



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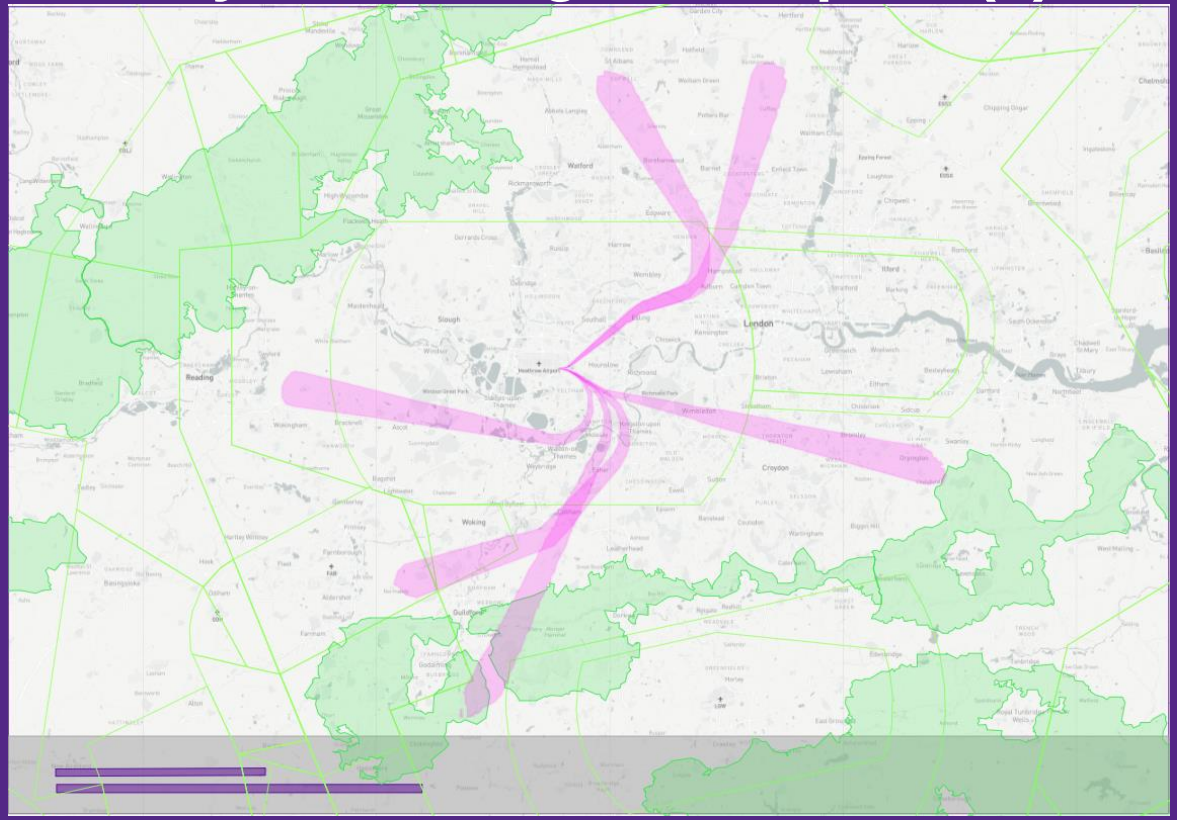
Runway 09R Design Principle 9 (a)



Thiese options are the existing SID centrelines to minimise people newly overflown

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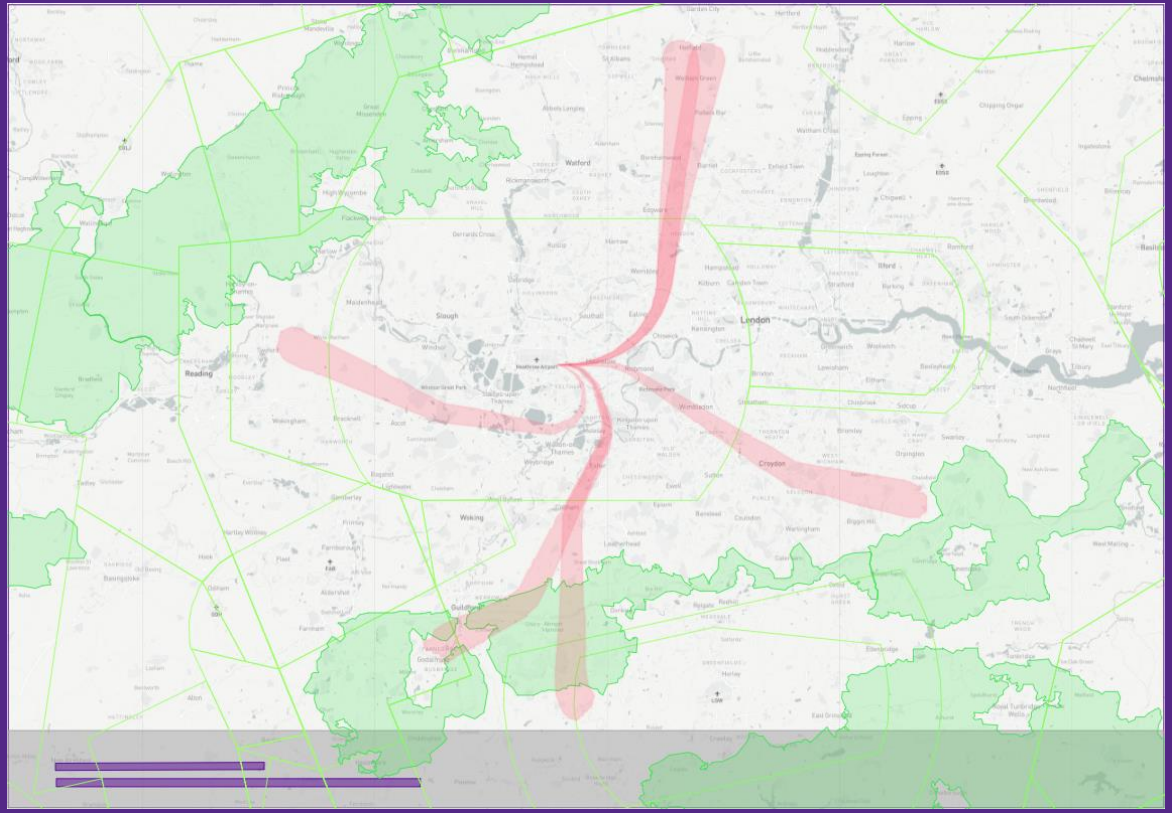
Runway 09R Design Principle 10



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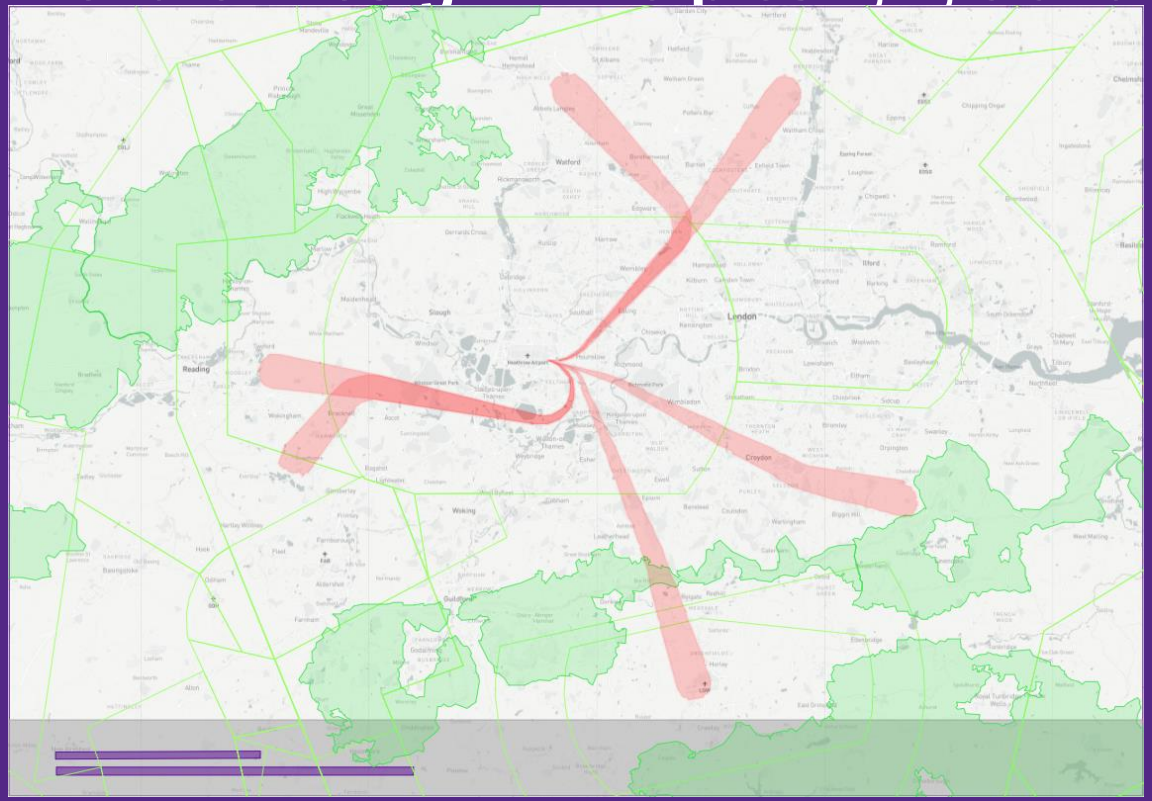
Runway 09R
Blend of Design Principles 2, 4, 9 and 10



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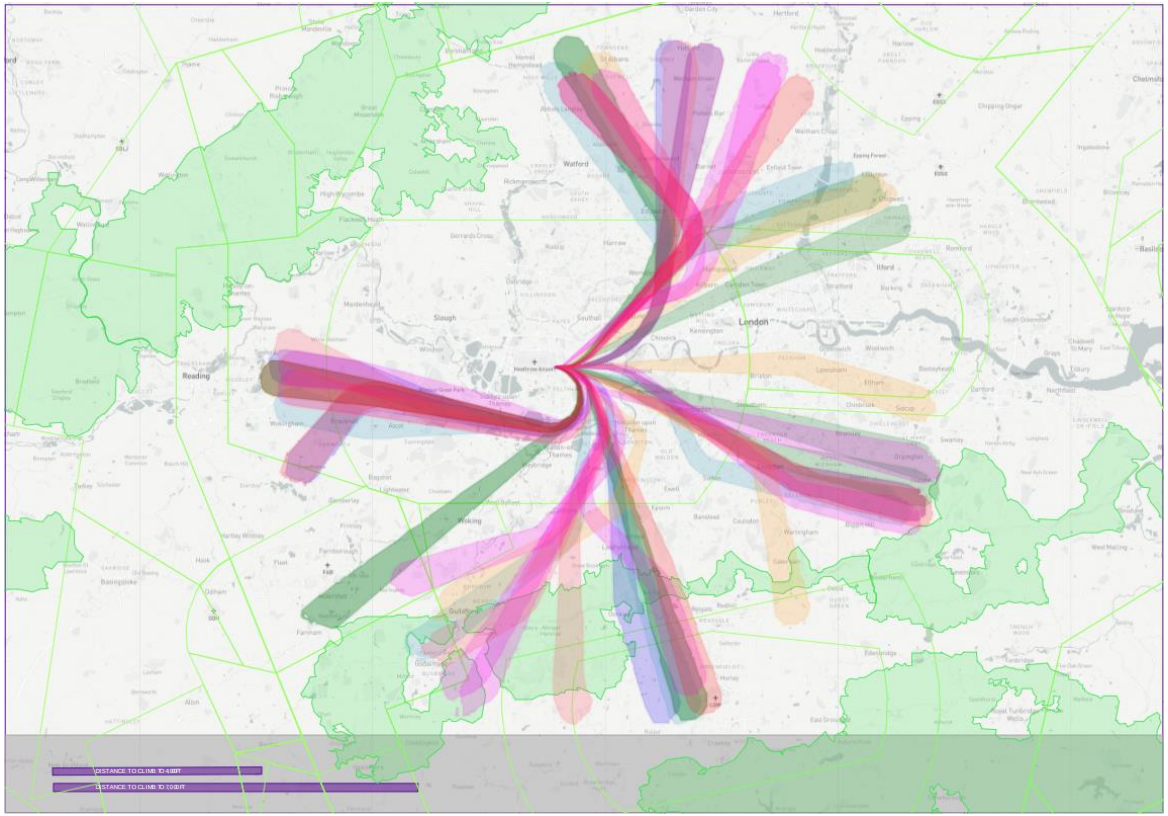
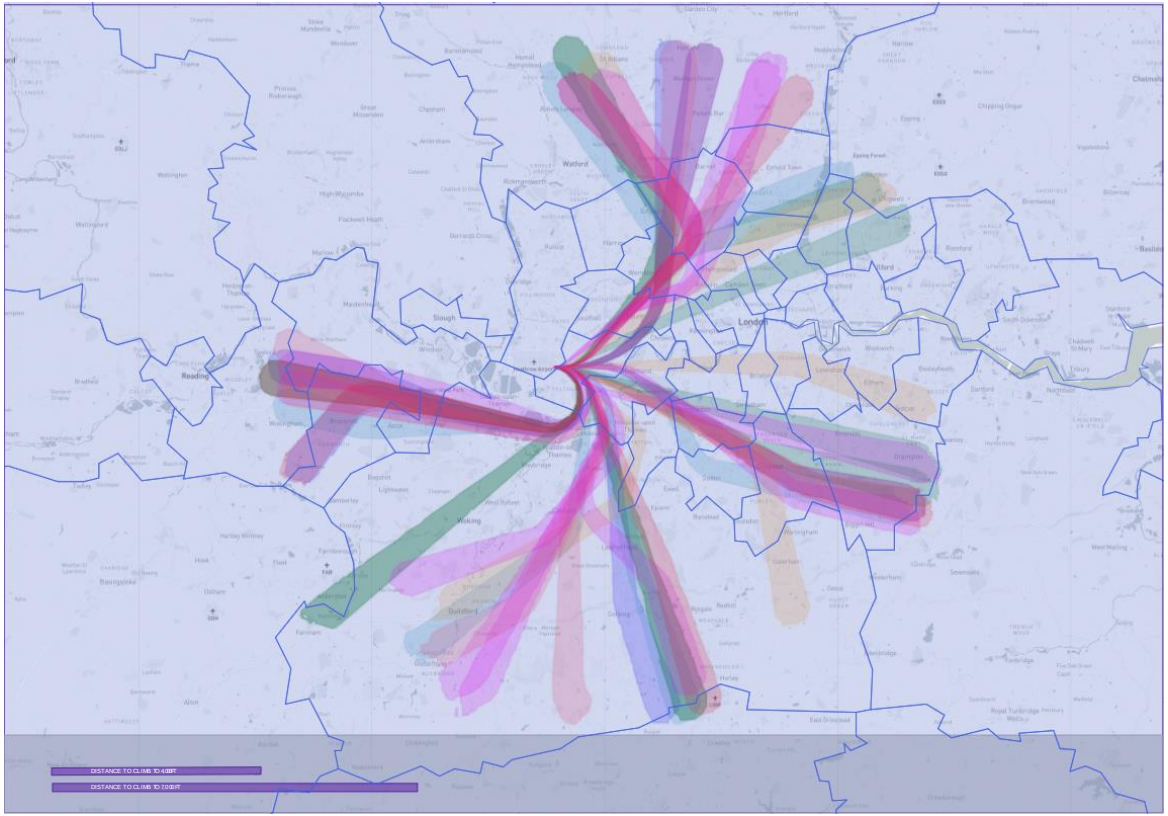
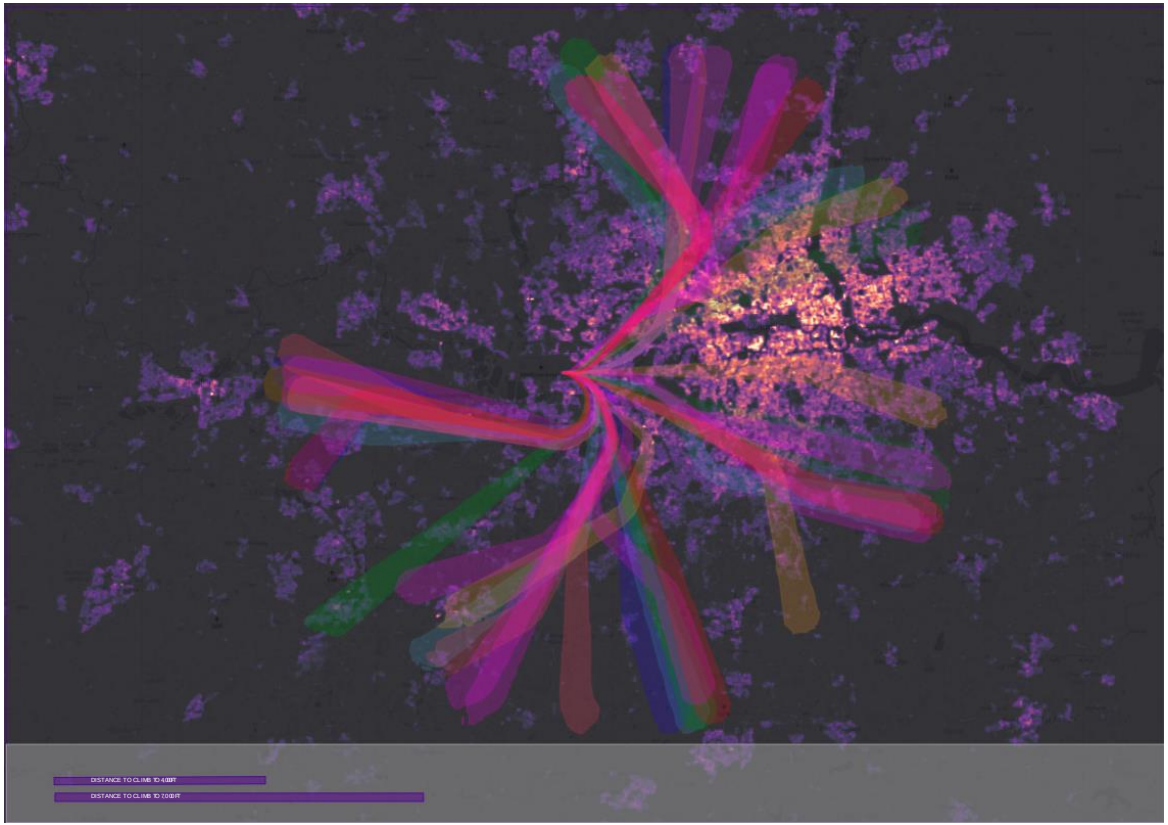
Runway 09R All Departure Options



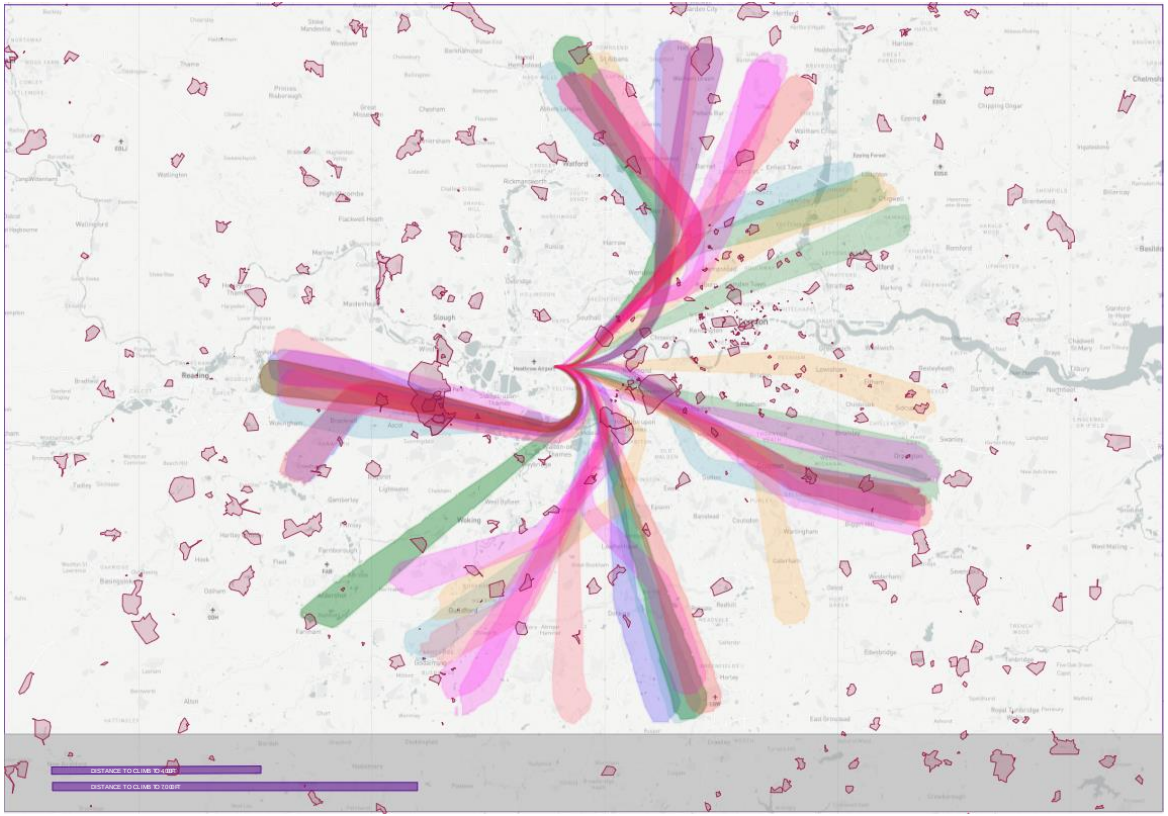
Runway 09R All Departure Options (LA boundaries)



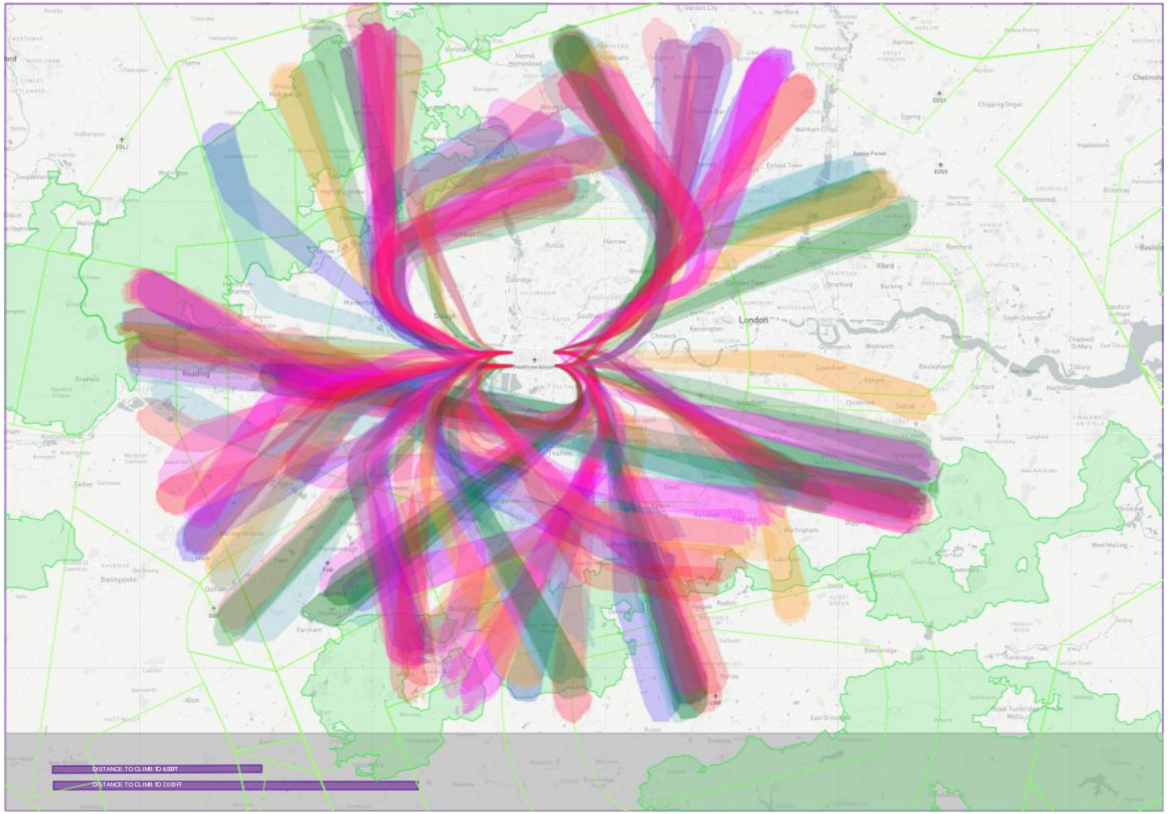
Runway 09R All Departure Options (Population)



Runway 09R All Departure Options (Parks and Gardens)



All Departure Options

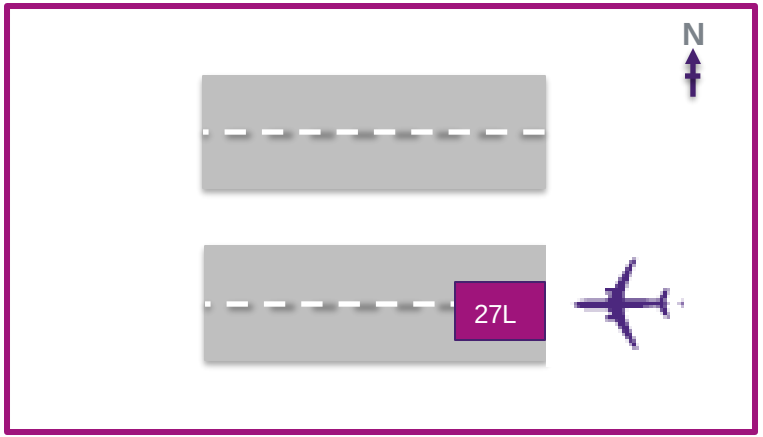


November 2022

Airspace Modernisation: Airspace Change Proposal

Comprehensive List of Options – PBN Arrivals

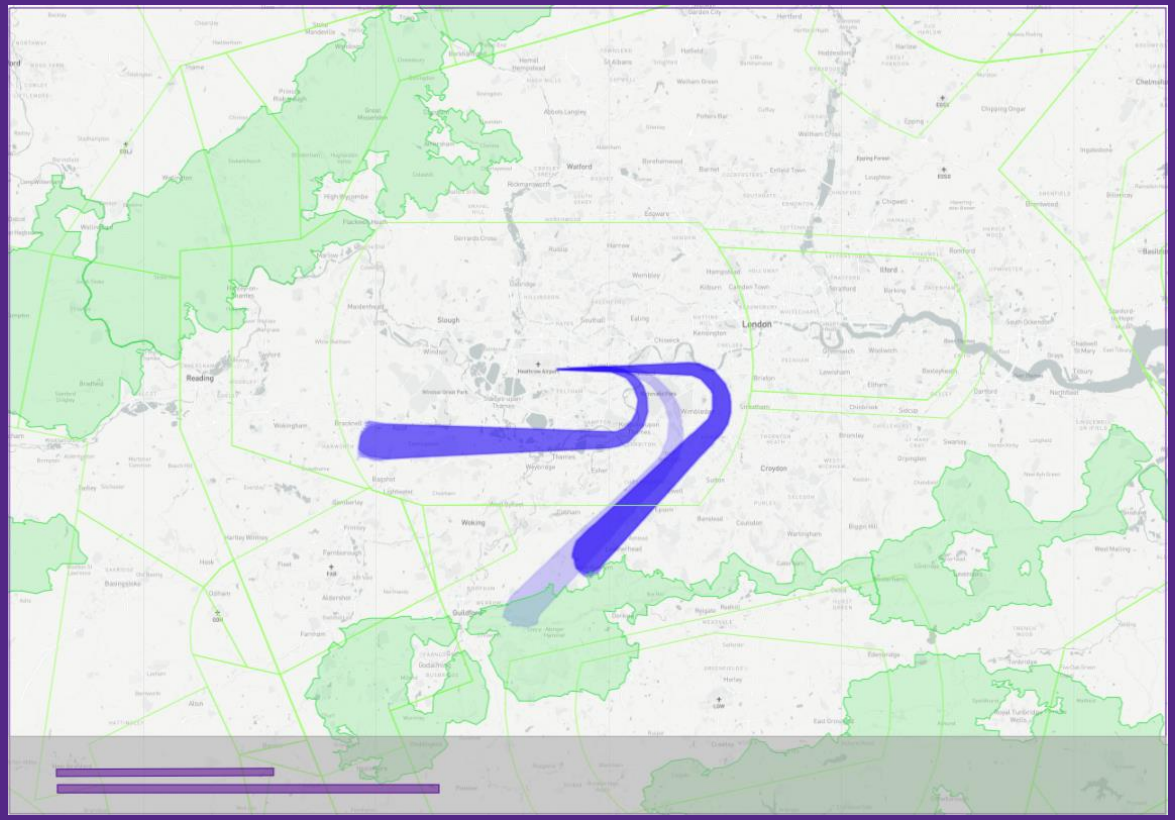
Runway 27L PBN Arrivals



27L = Aircraft departing the Southern runway to the West

When the wind blows from the West Heathrow need to operate on their Westerly runways. This is approximately 70% of the time.

Runway 27L Design Principle 2



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Runway 27L Design Principle 4

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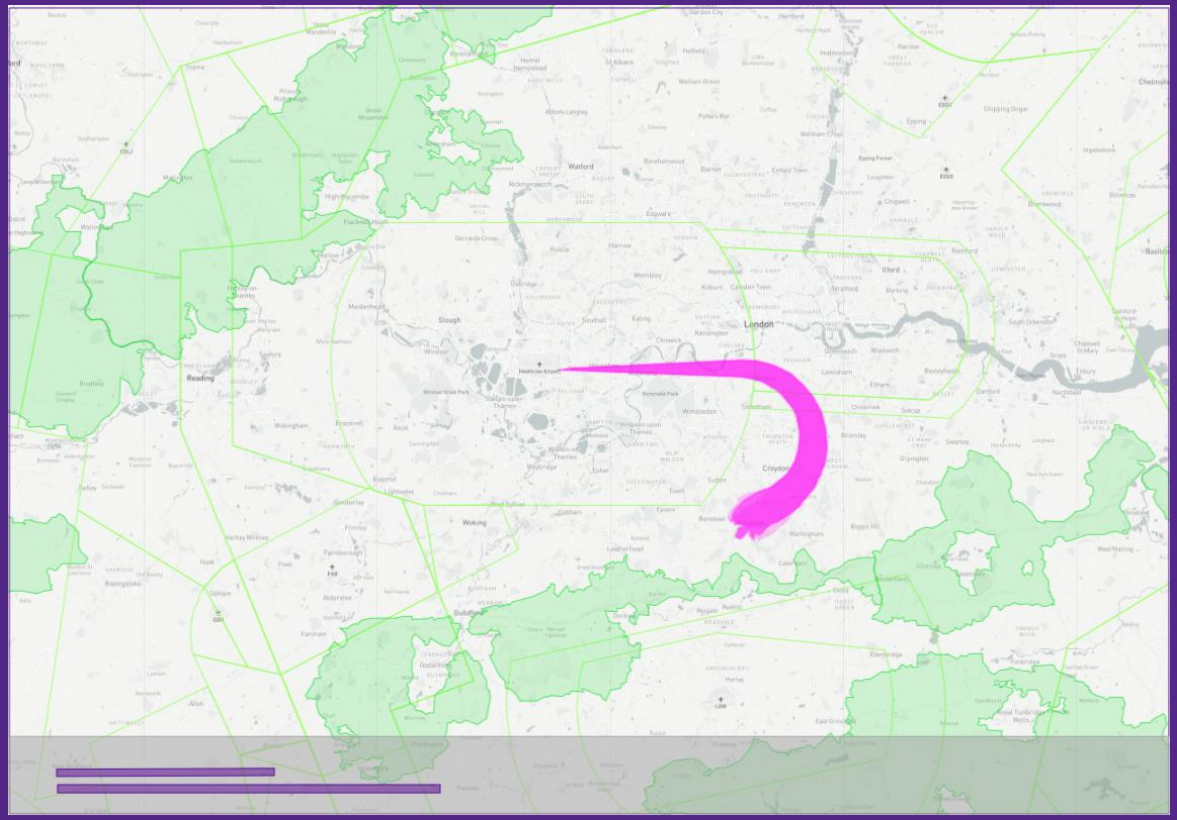
Runway 27L Design Principle 9



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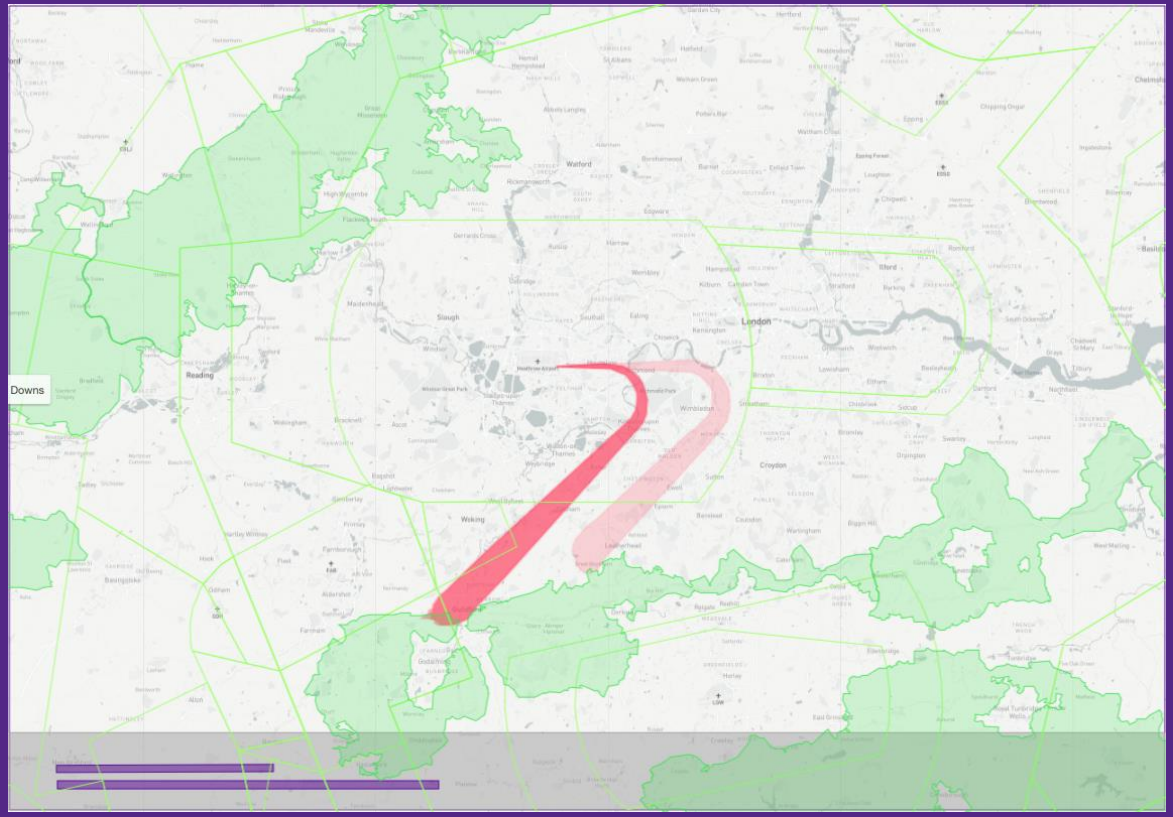
Runway 27L Design Principle 10



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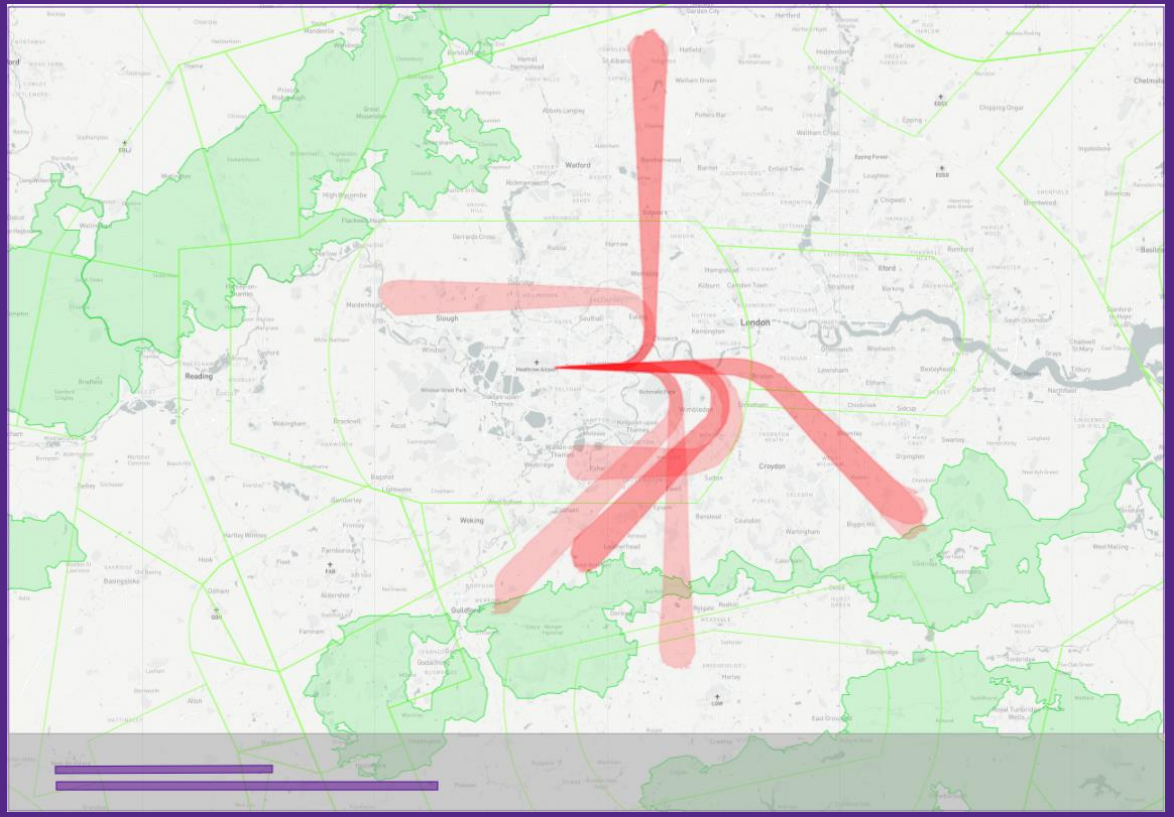
Runway 27L Blend of Design Principles 2, 4, 9 and 10



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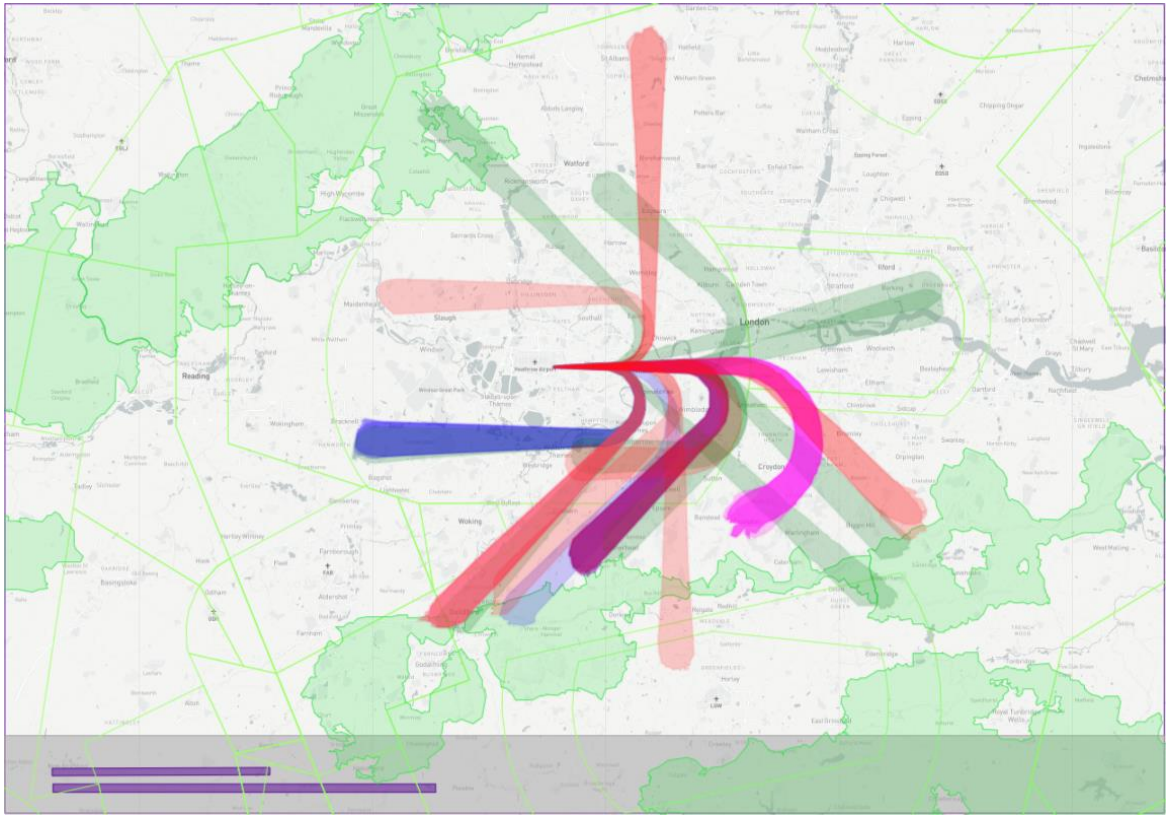
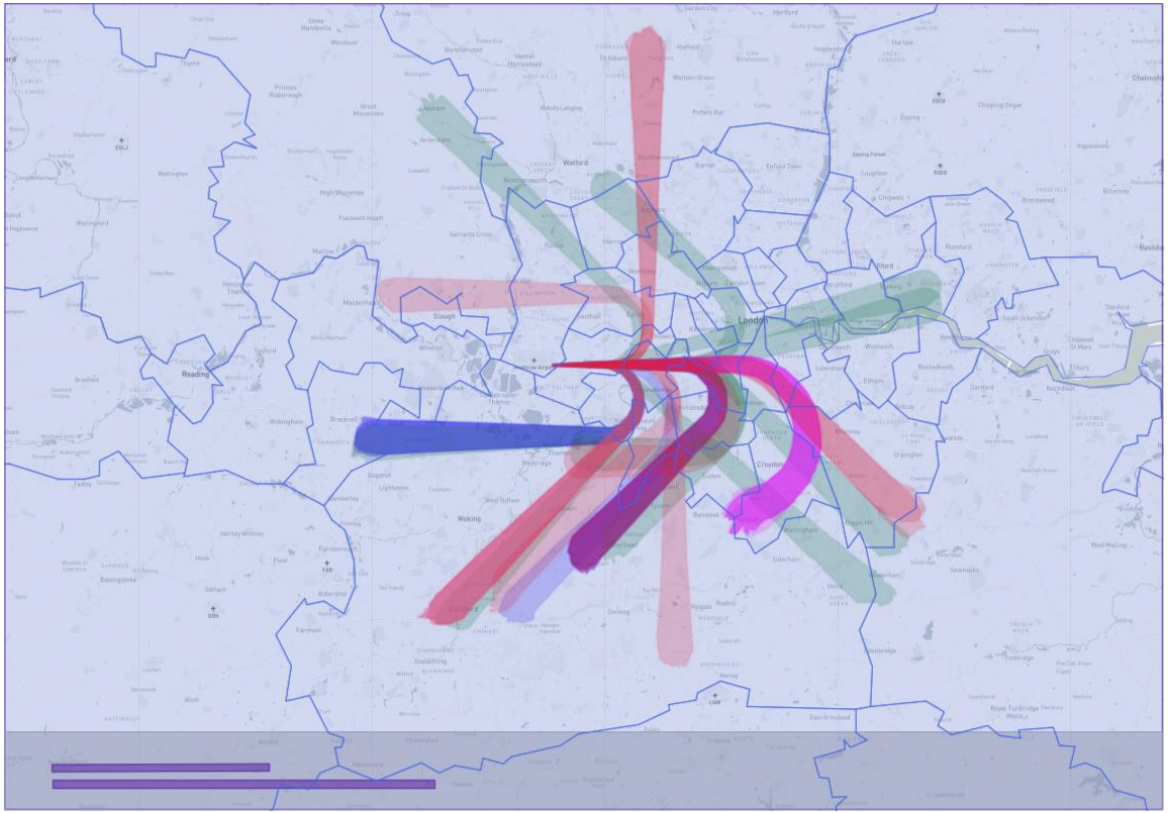
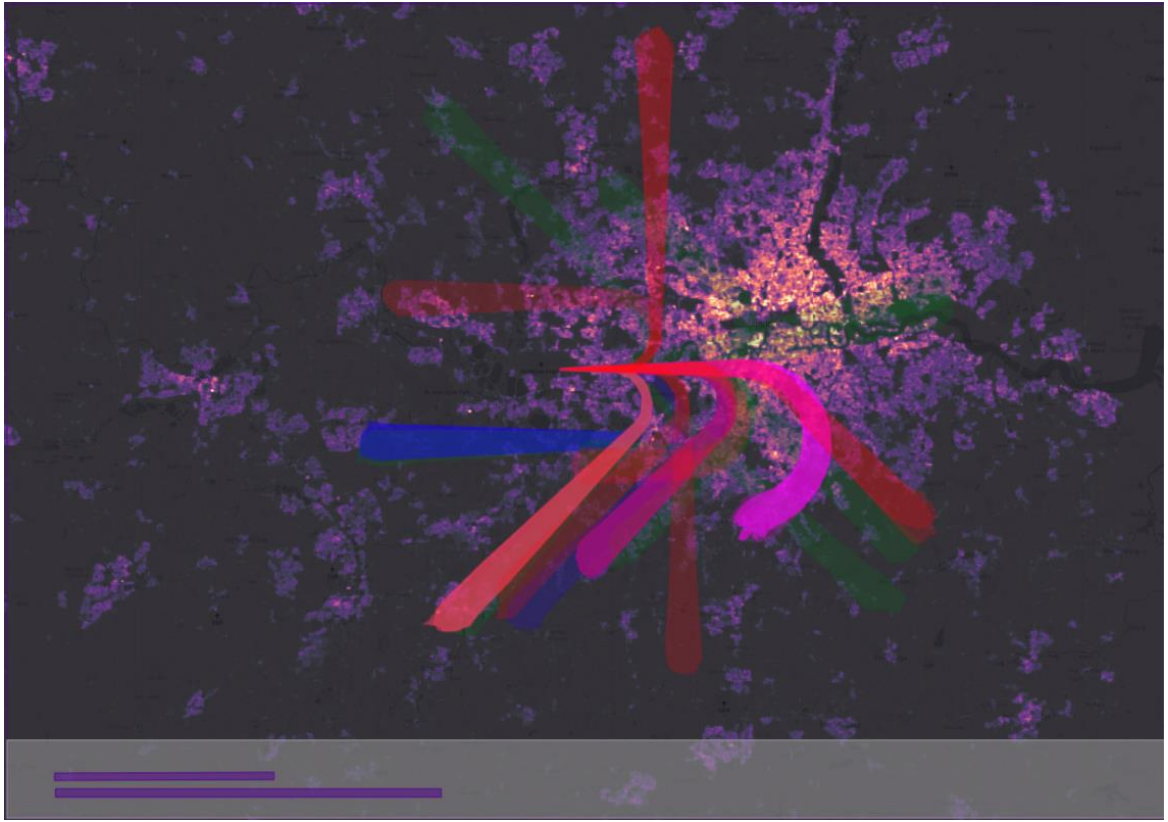
Runway 27L All PBN Arrival Options



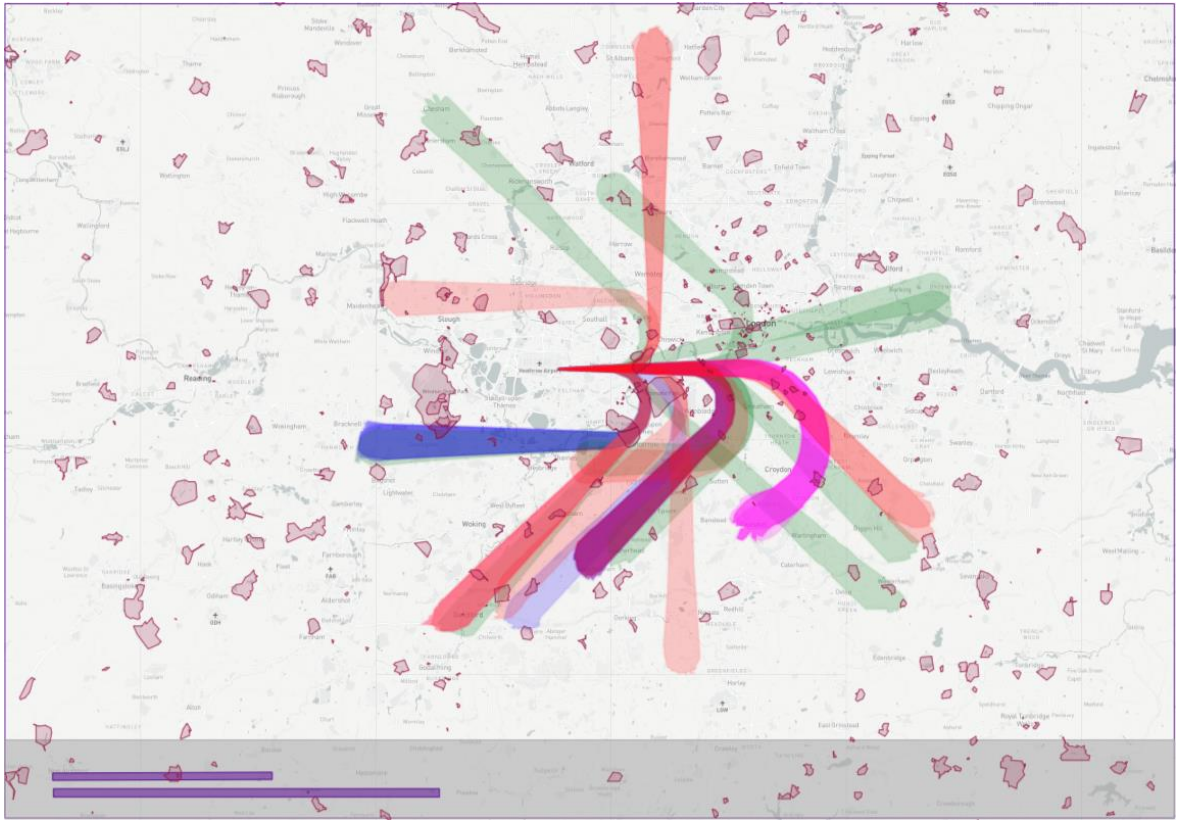
Runway 27L All PBN Arrival Options (LA boundaries)



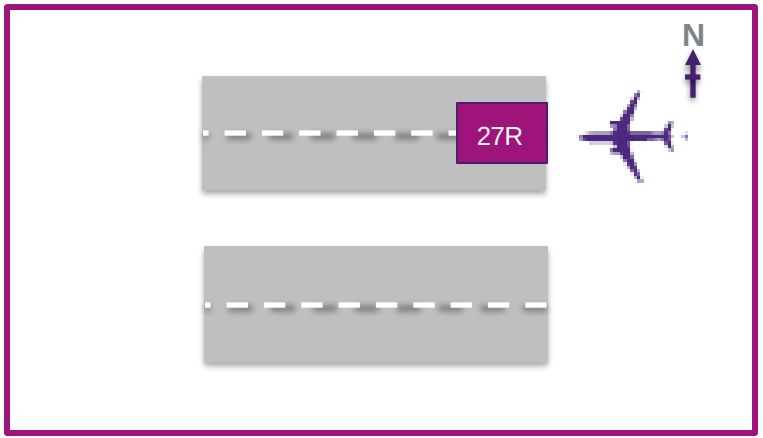
Runway 27L All PBN Arrival Options (Population)



Runway 27L All PBN Arrival Options (Parks and Gardens)



Runway 27R PBN Arrivals



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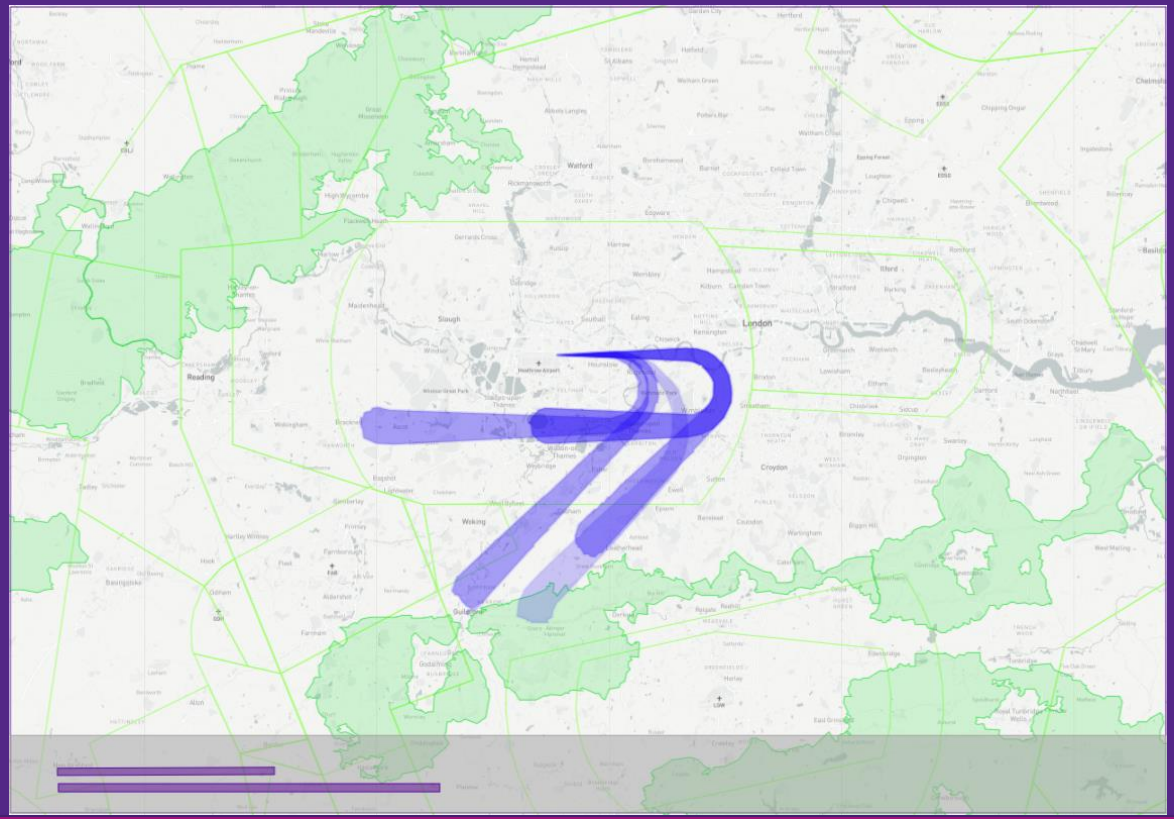

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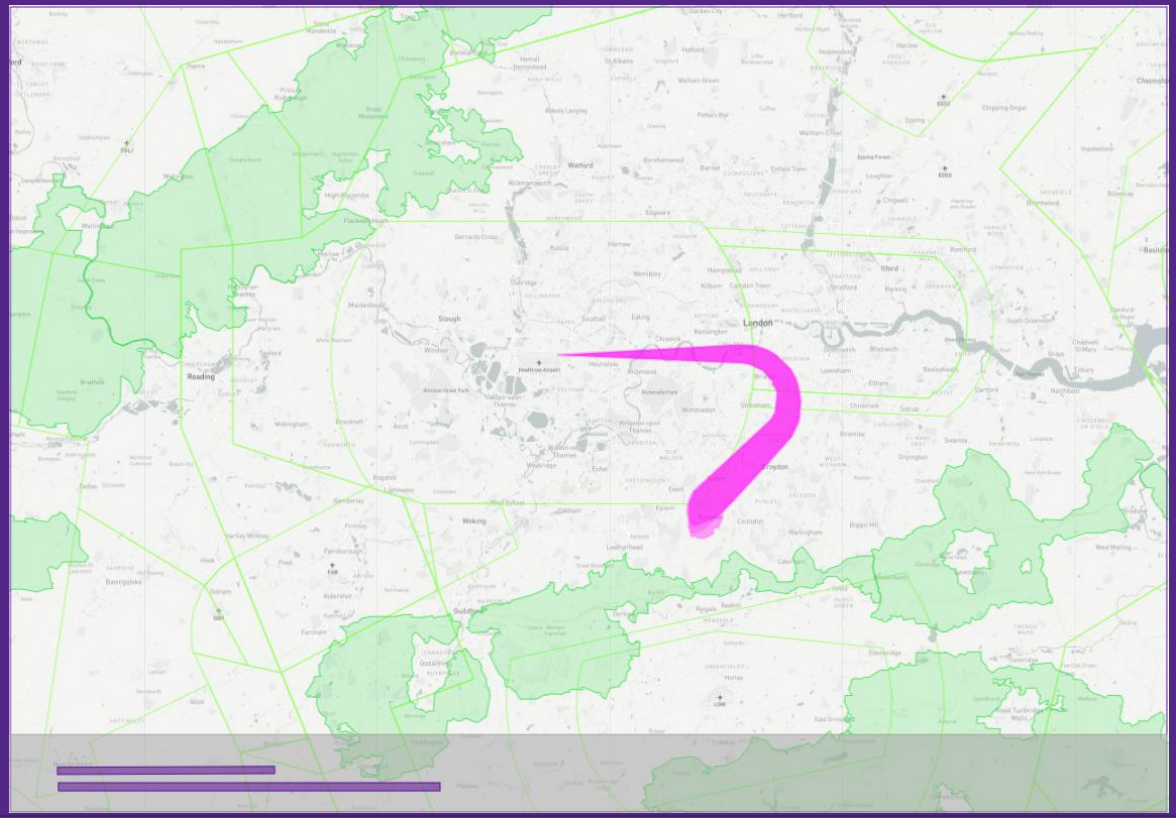
Runway 27R Design Principle 9



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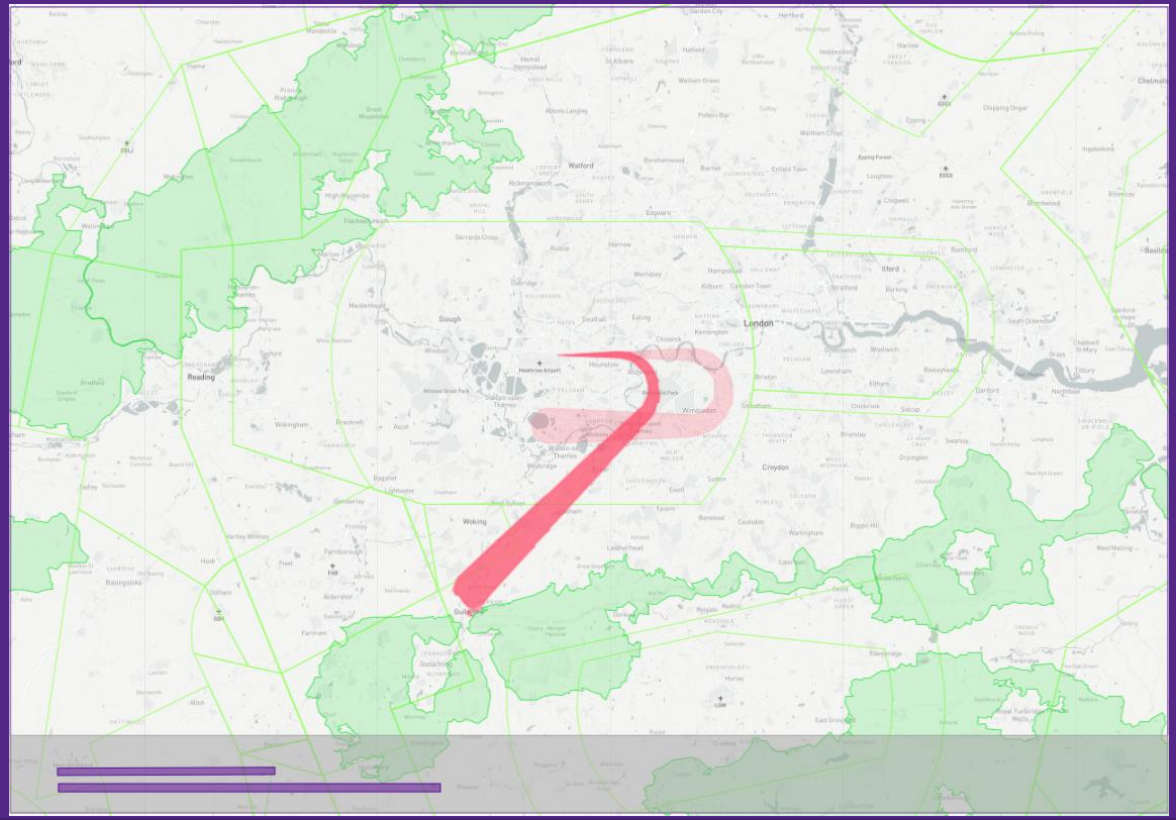
Runway 27R Design Principle 10



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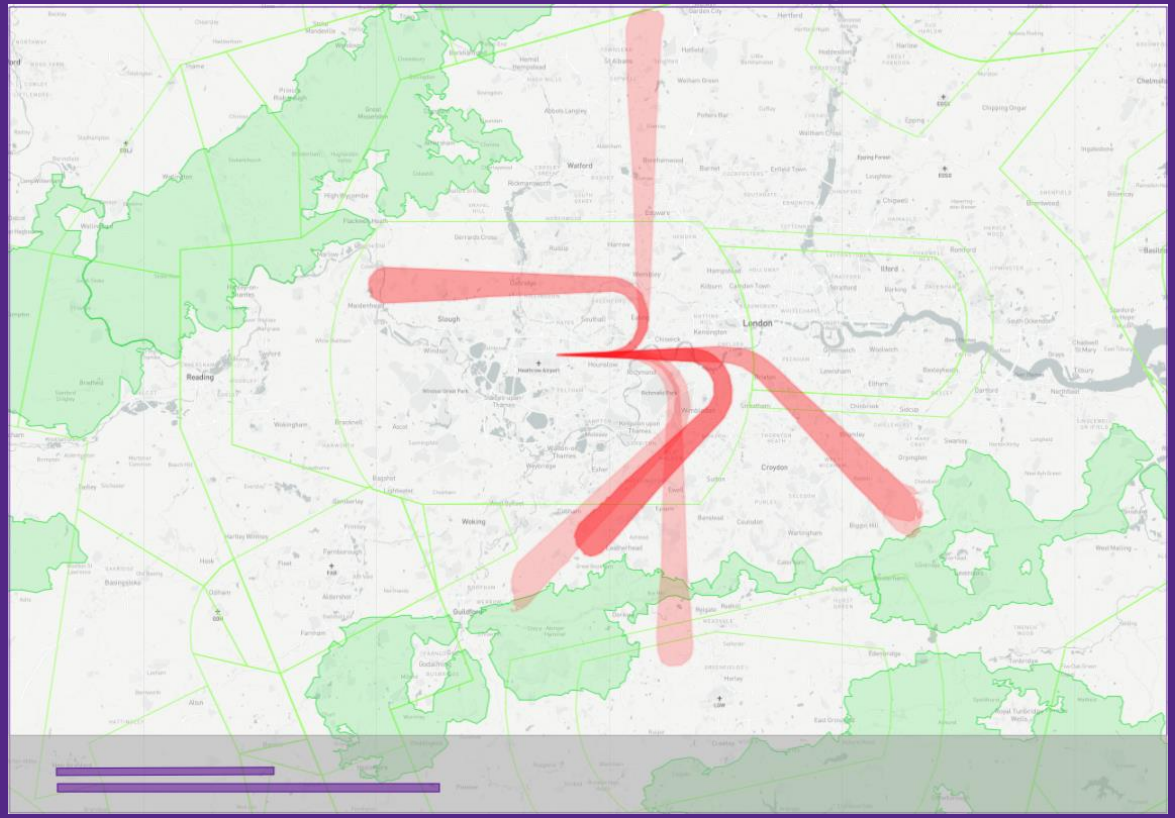
Runway 27R Blend of Design Principles 2, 4, 9 and 10



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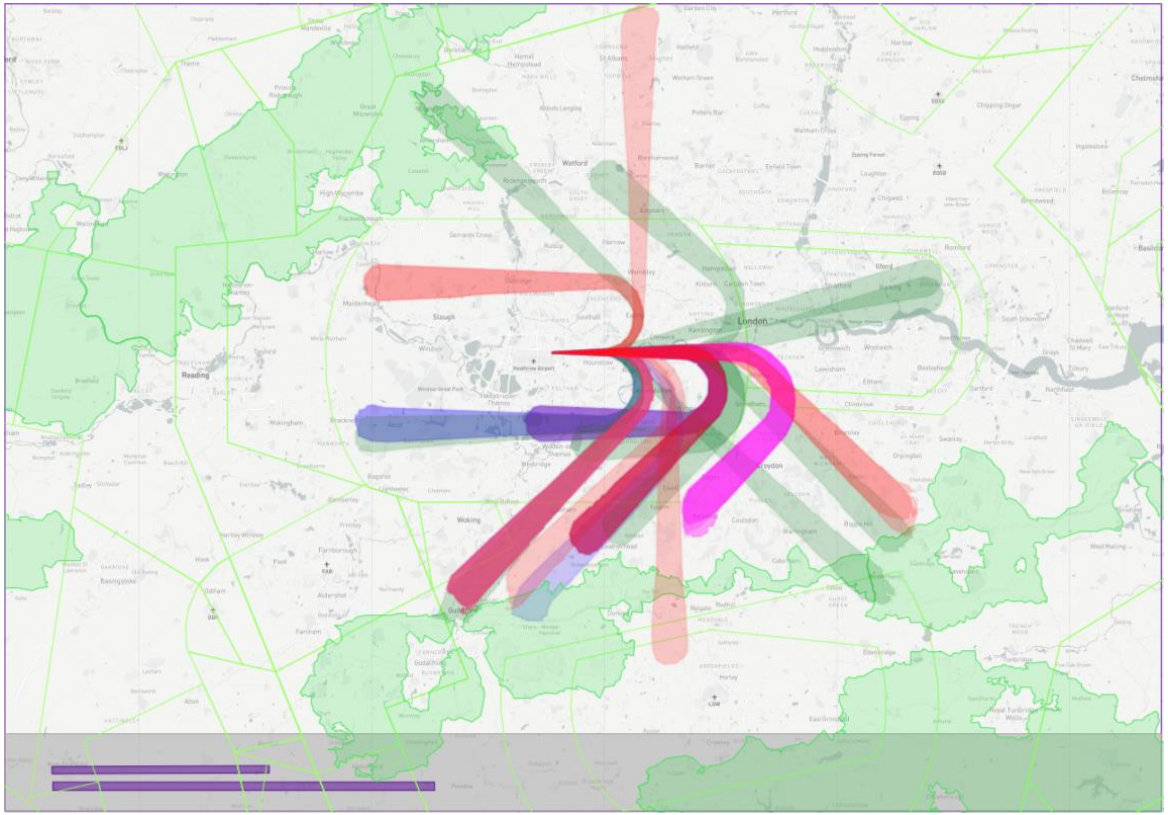
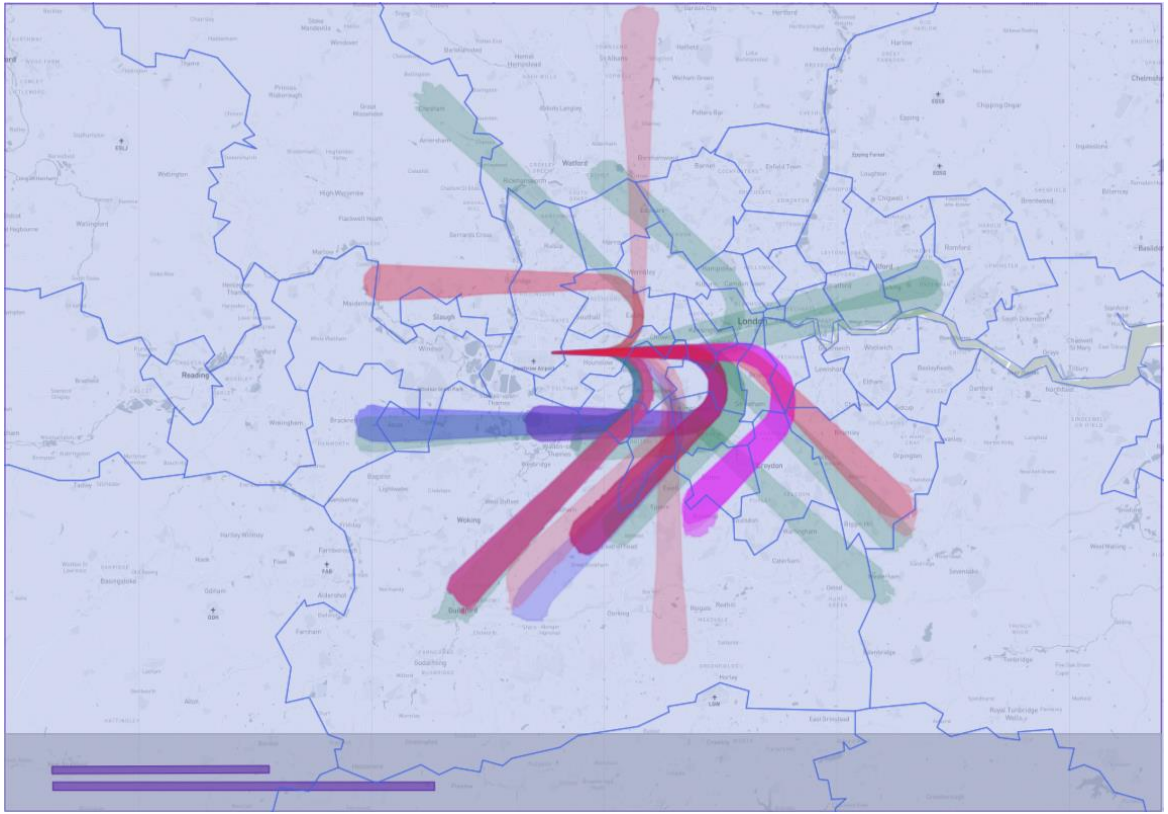
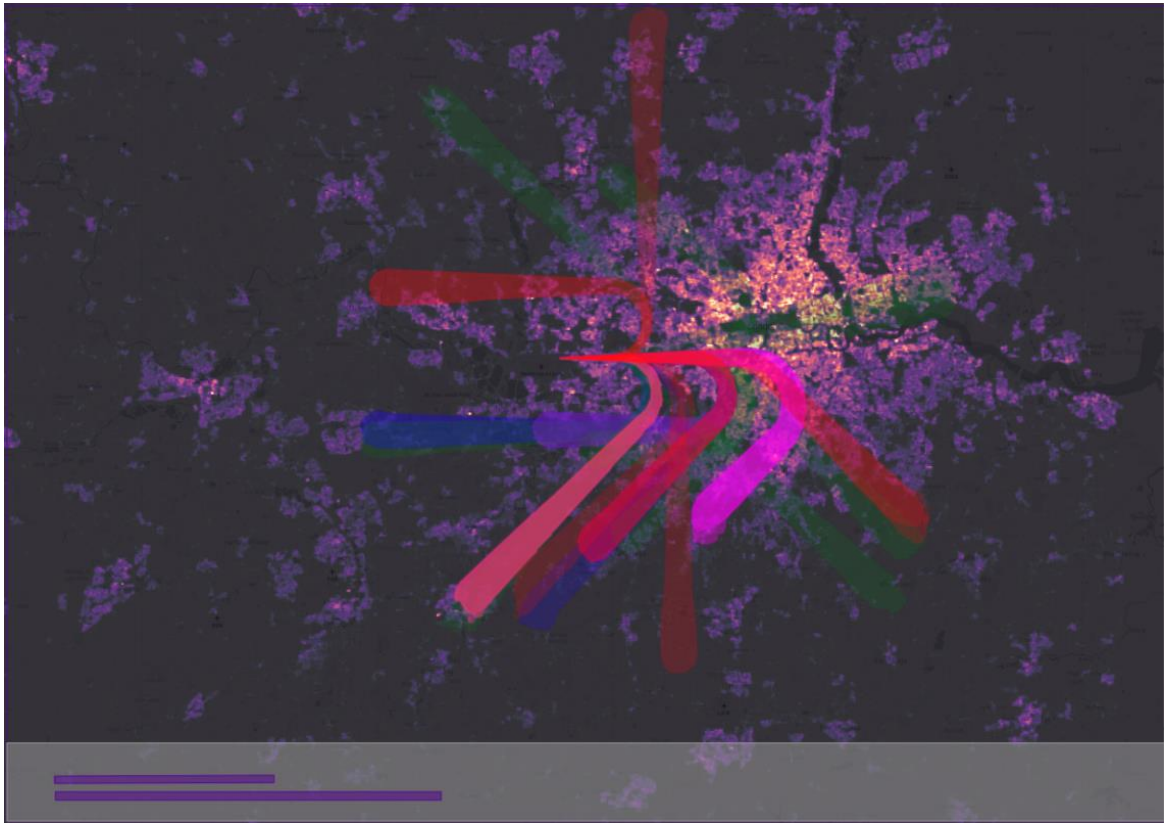
Runway 27R All PBN Arrival Options



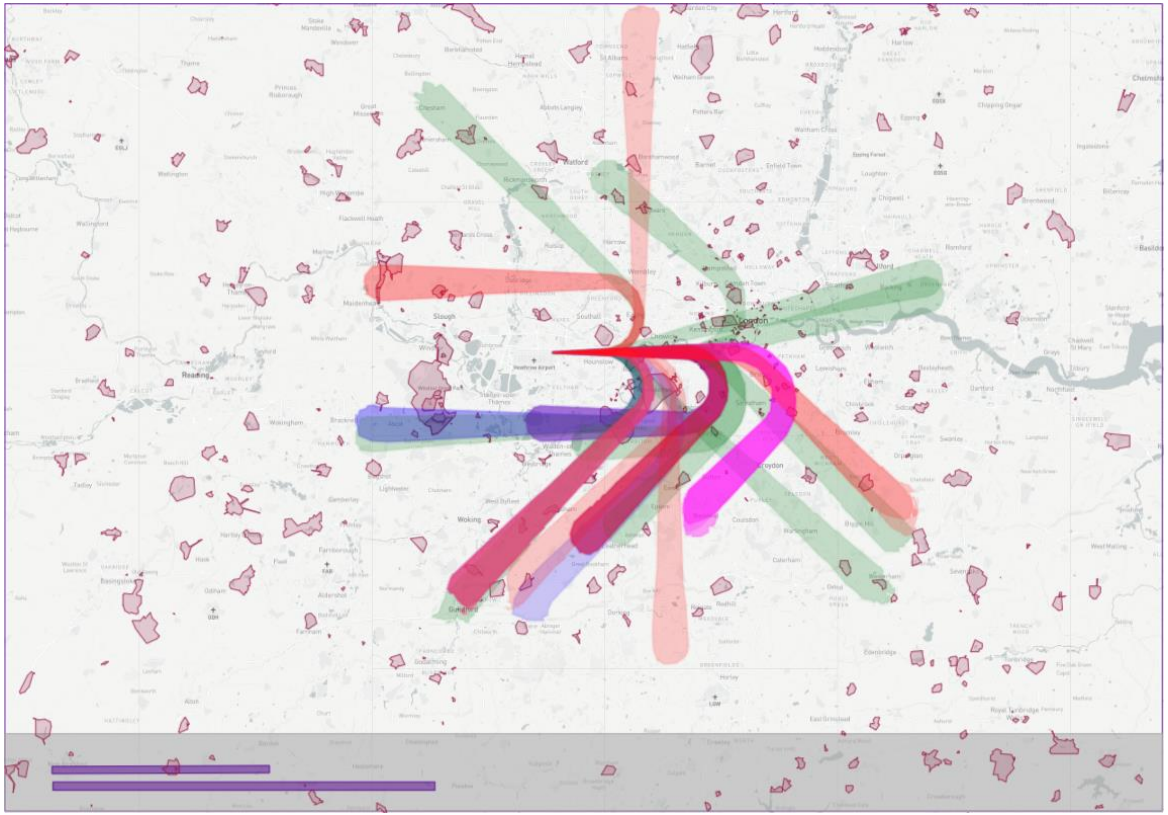
Runway 27R All All PBN Arrival Options (LA boundaries)



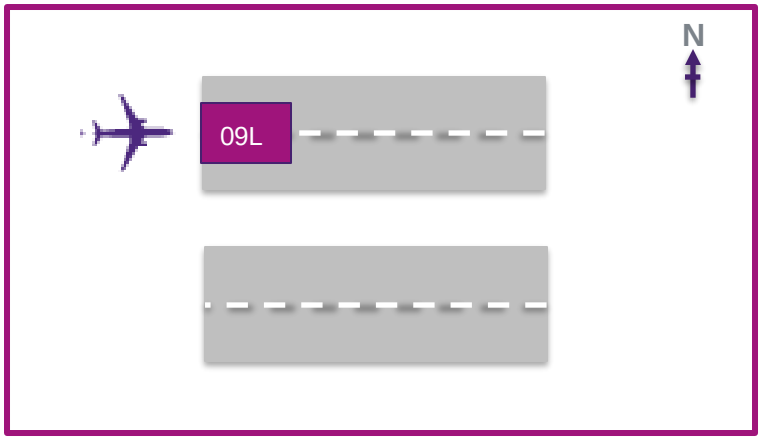
Runway 27R All PBN Arrival Options (Population)



Runway 27R All PBN Arrival Options (Parks and Gardens)



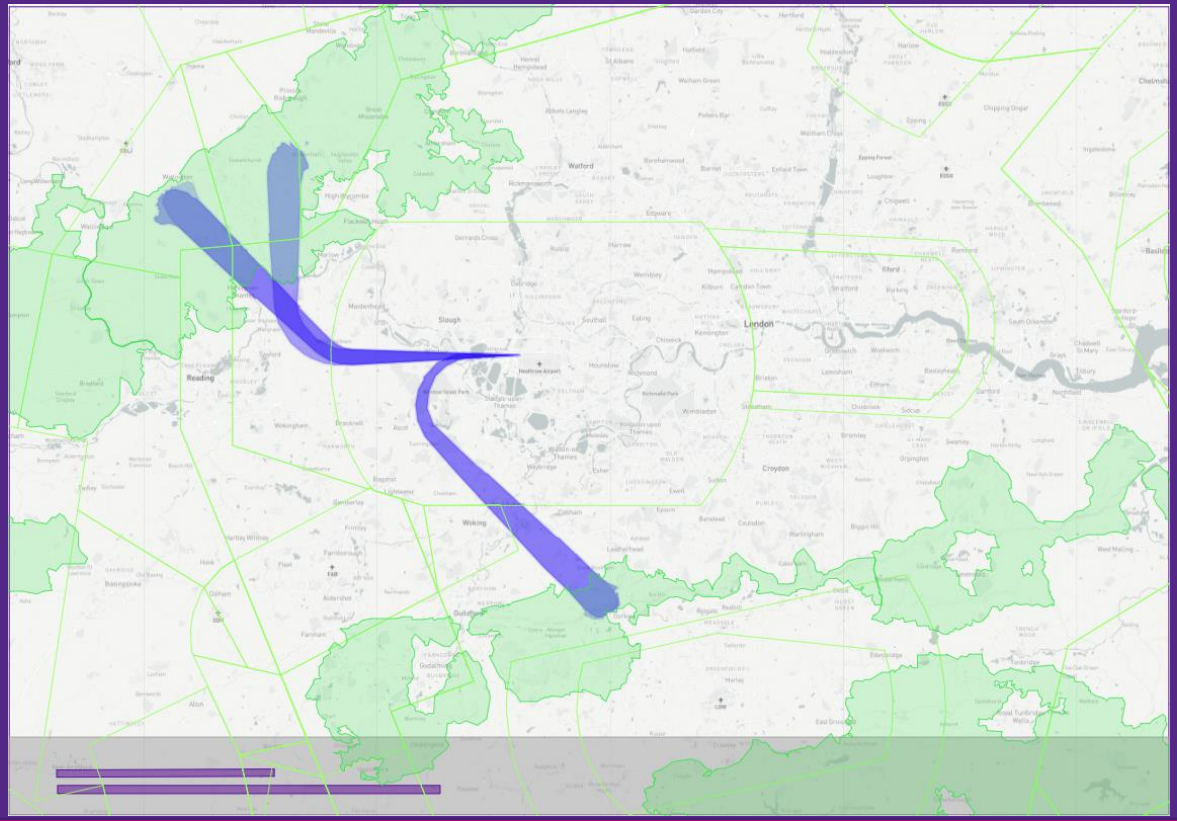
Runway 09L PBN Arrivals



09L = Aircraft departing the Northern runway to the East

When the wind blows from the East Heathrow need to operate on their Easterly runways. This is approximately 30% of the time.

Runway 09L Design Principle 2



This option was designed to minimise the number of people exposed to noise up to 7,000ft whilst also considering CO_2 and AONBs

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Runway 09L Design Principle 4

These options were designed to minimise the number of track miles flown

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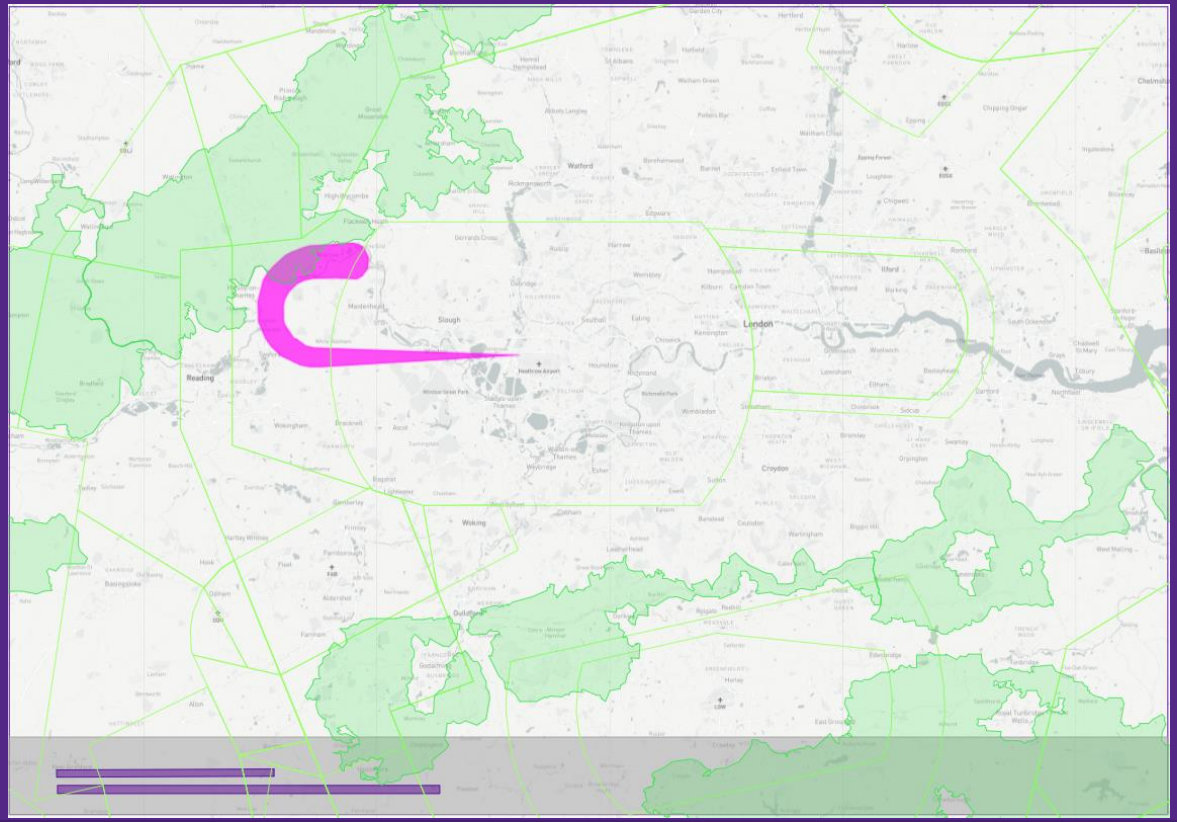
Runway 09L Design Principle 9



These options were designed to minimise the number of people newly overflown

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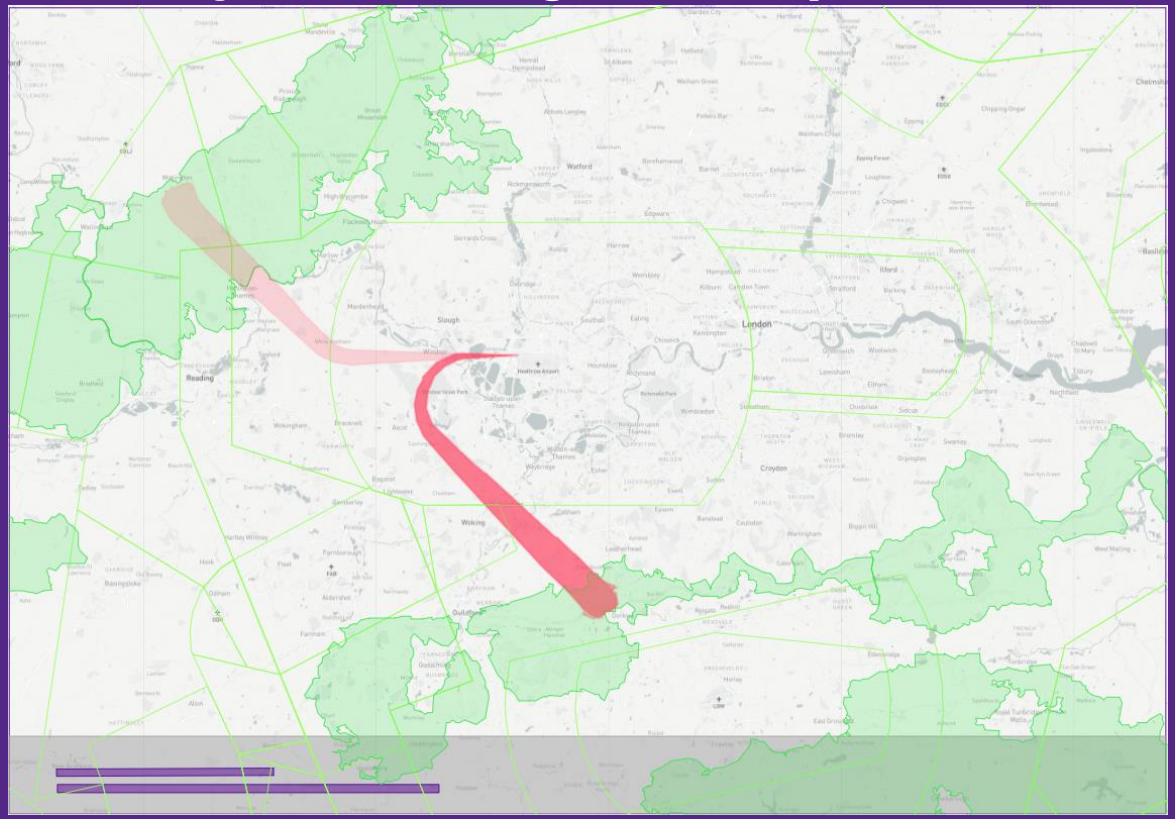
Runway 09L Design Principle 10



These options were designed to minimise the number of people exposed to noise up to 7,000ft.

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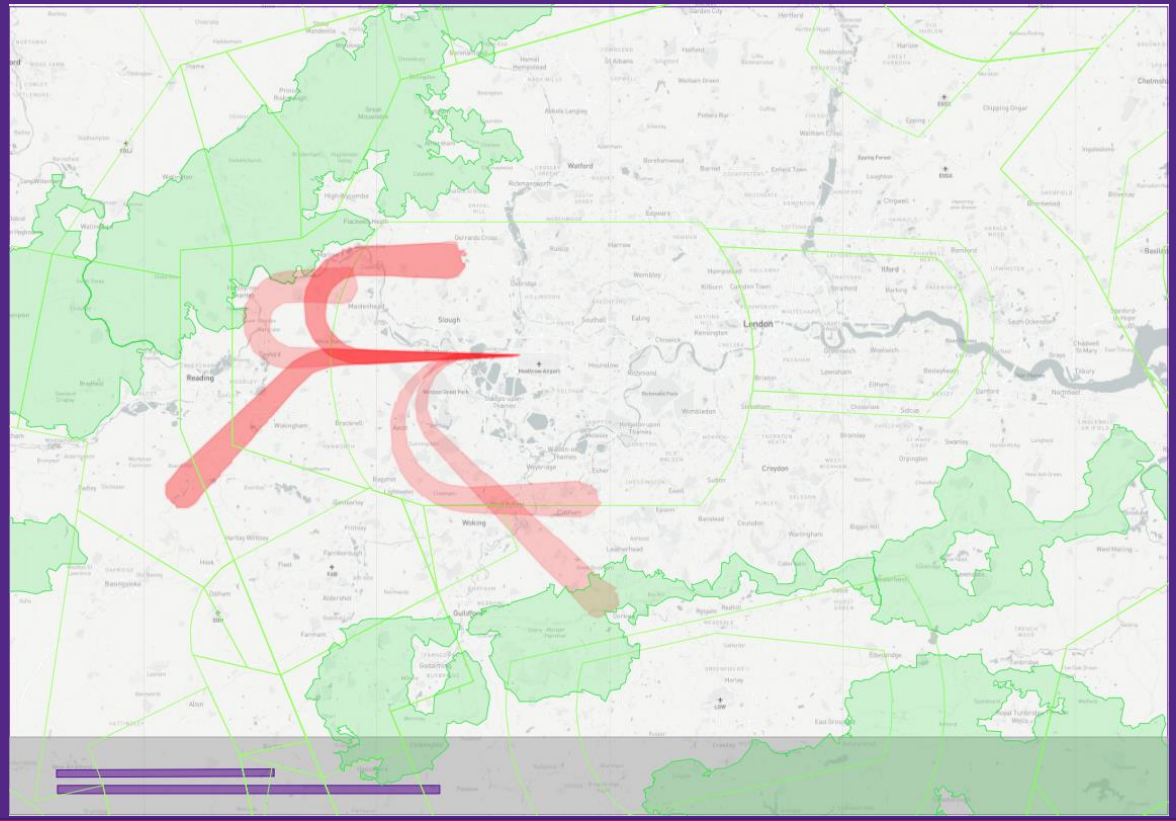
Runway 09L Blend of Design Principles 2, 4, 9 and 10



These options were designed to balance population numbers, newly overflown, CO_2 and AONBs

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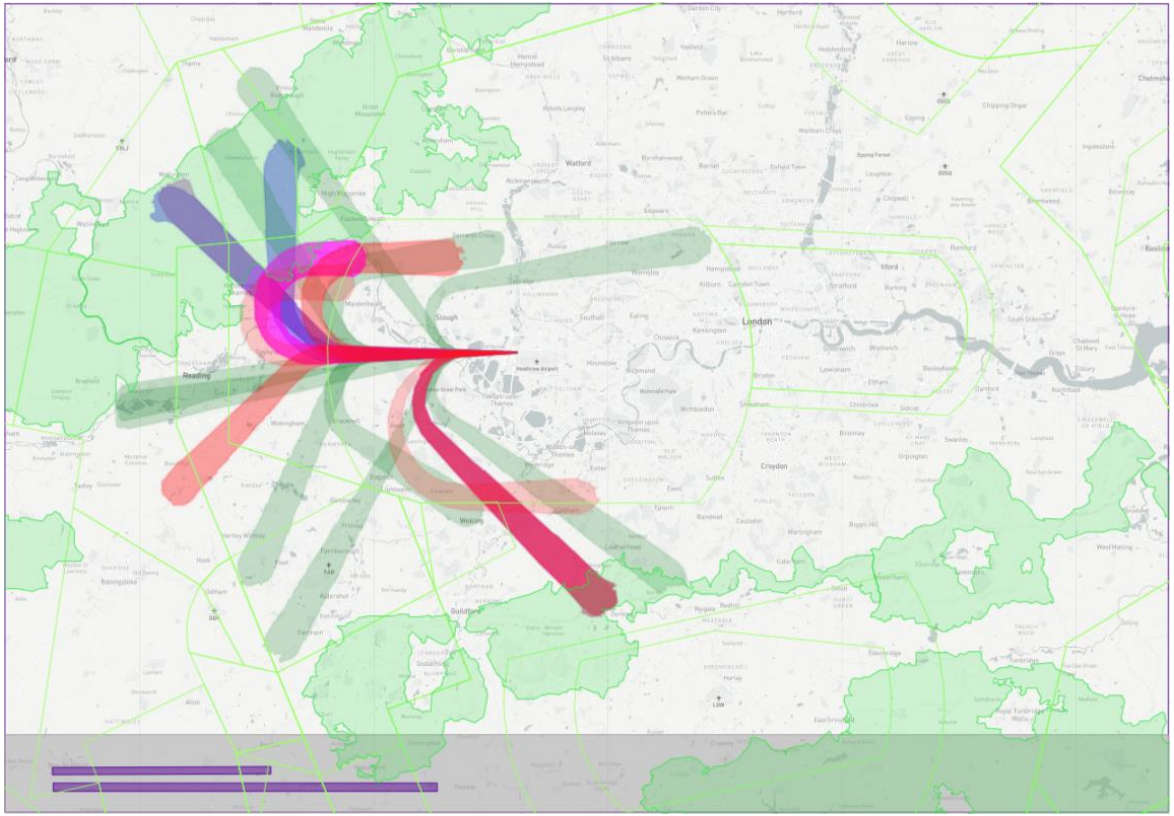
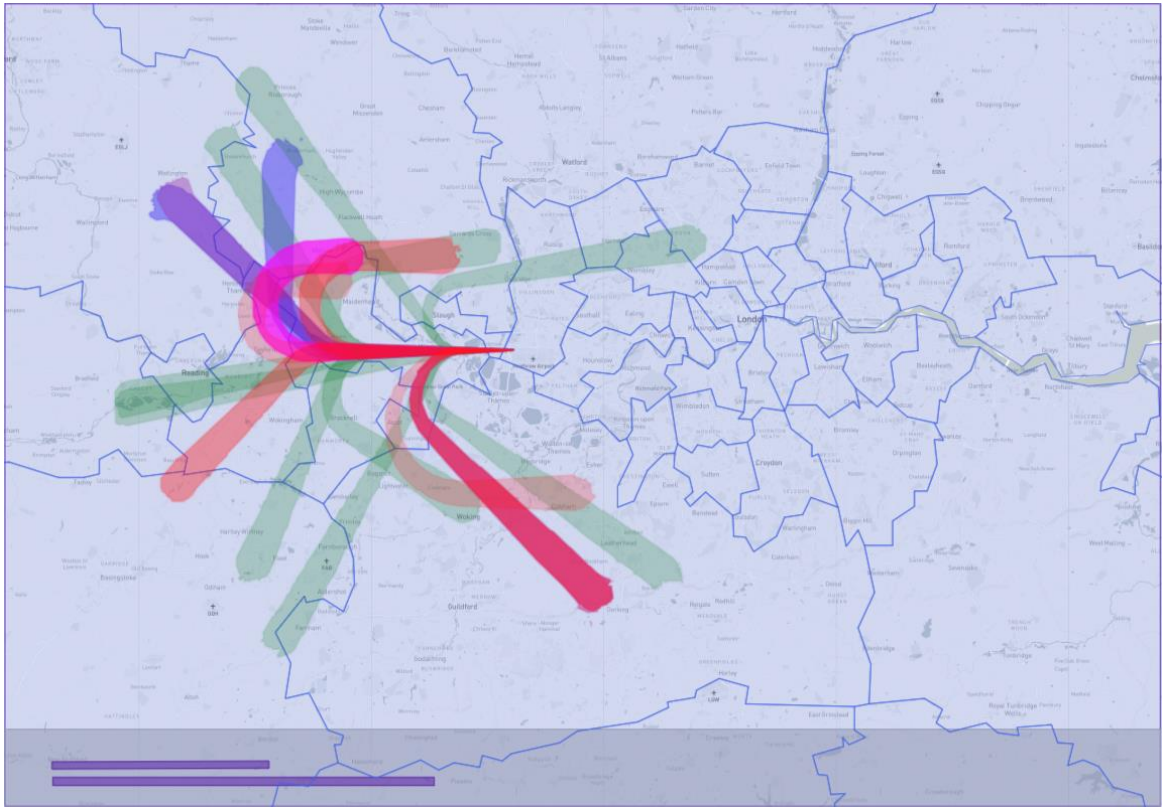
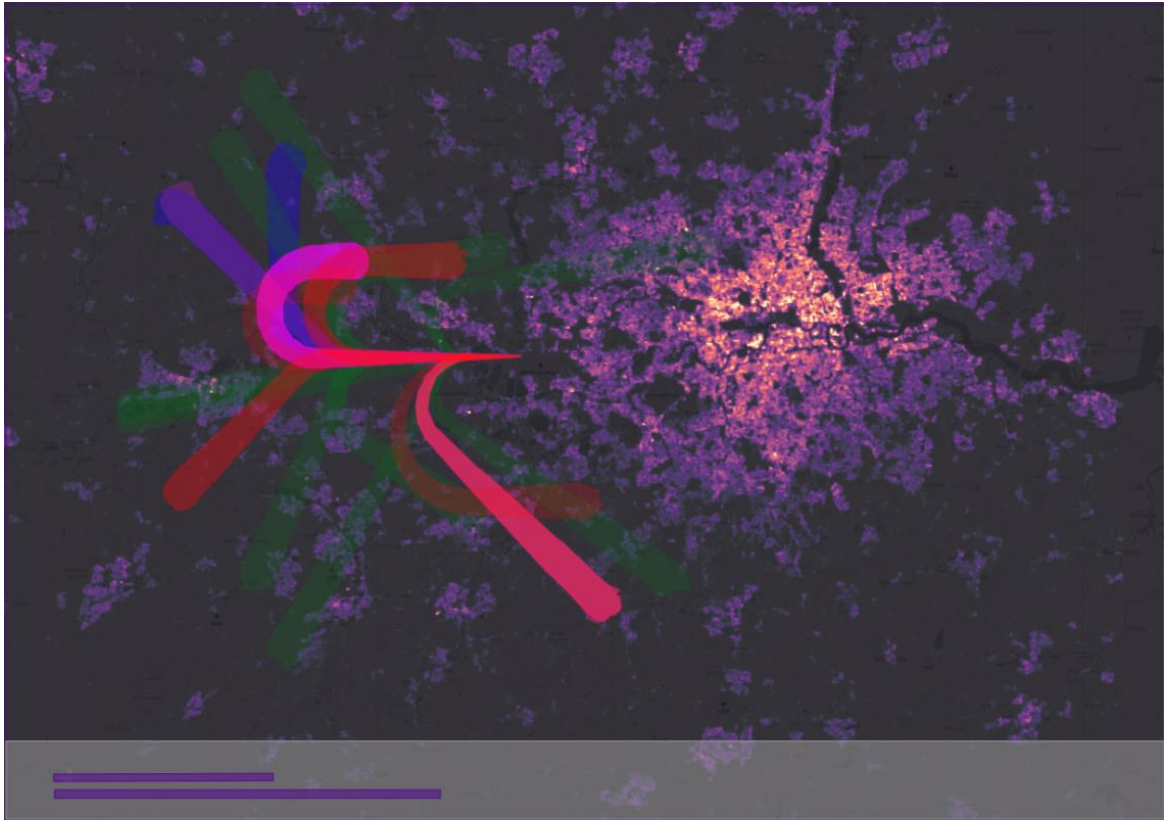
Runway 09L All PBN Arrival Options



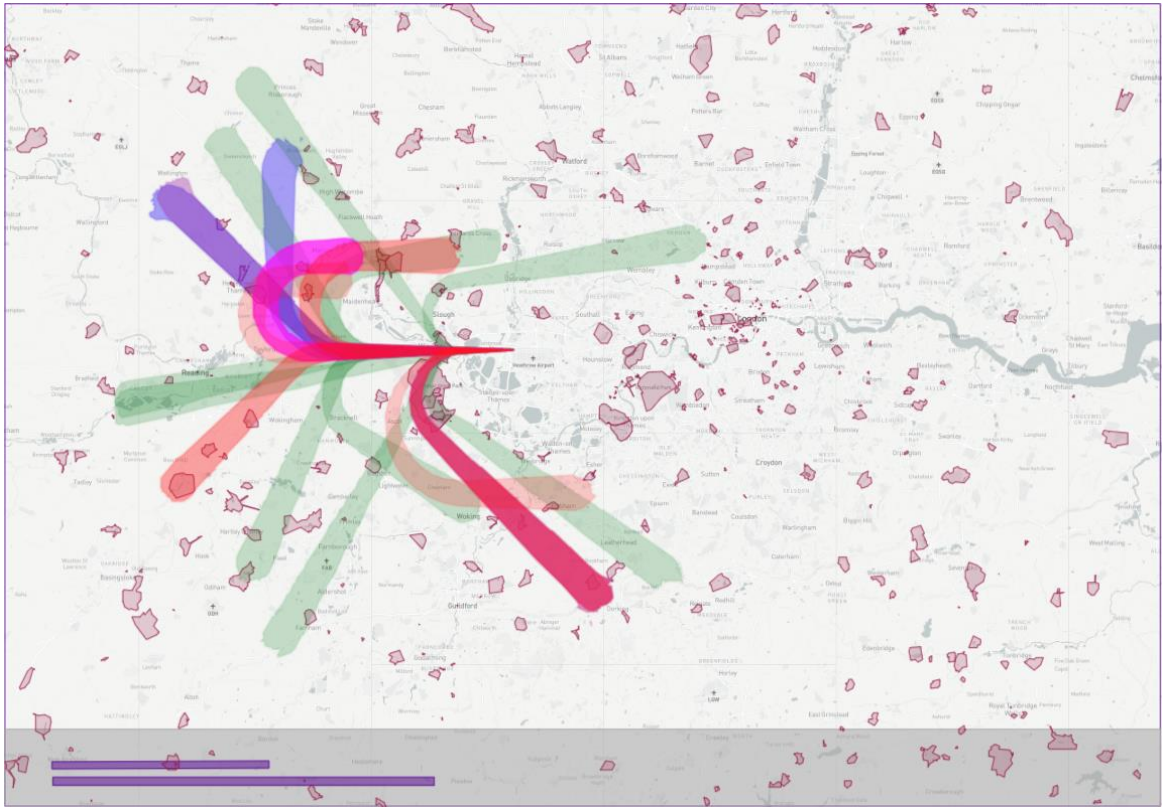
Runway 09L All All PBN Arrival Options (LA boundaries)



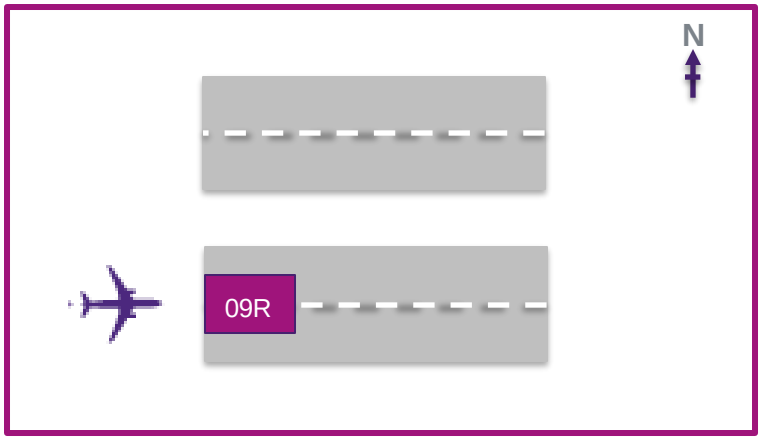
Runway 09L All PBN Arrival Options (Population)



Runway 09L All PBN Arrival Options (Parks and Gardens)



Runway 09R PBN Arrivals



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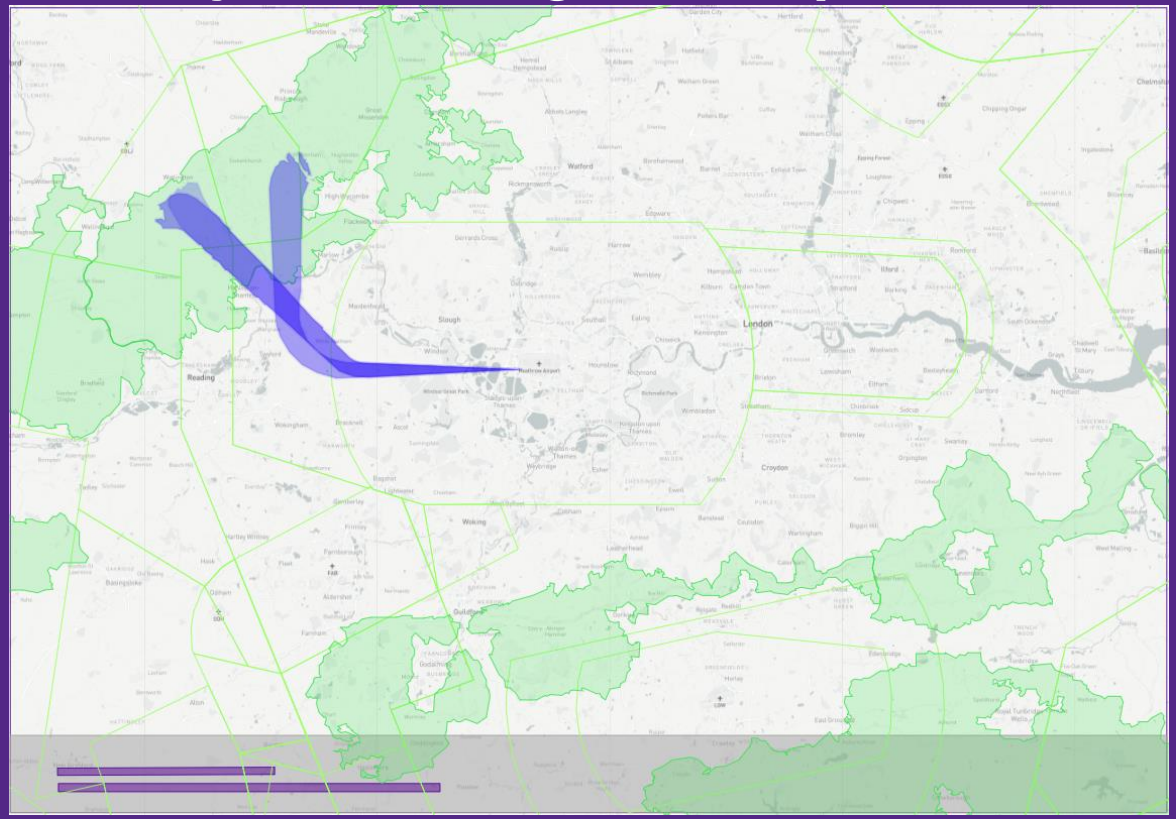
Runway 09R Design Principle 2



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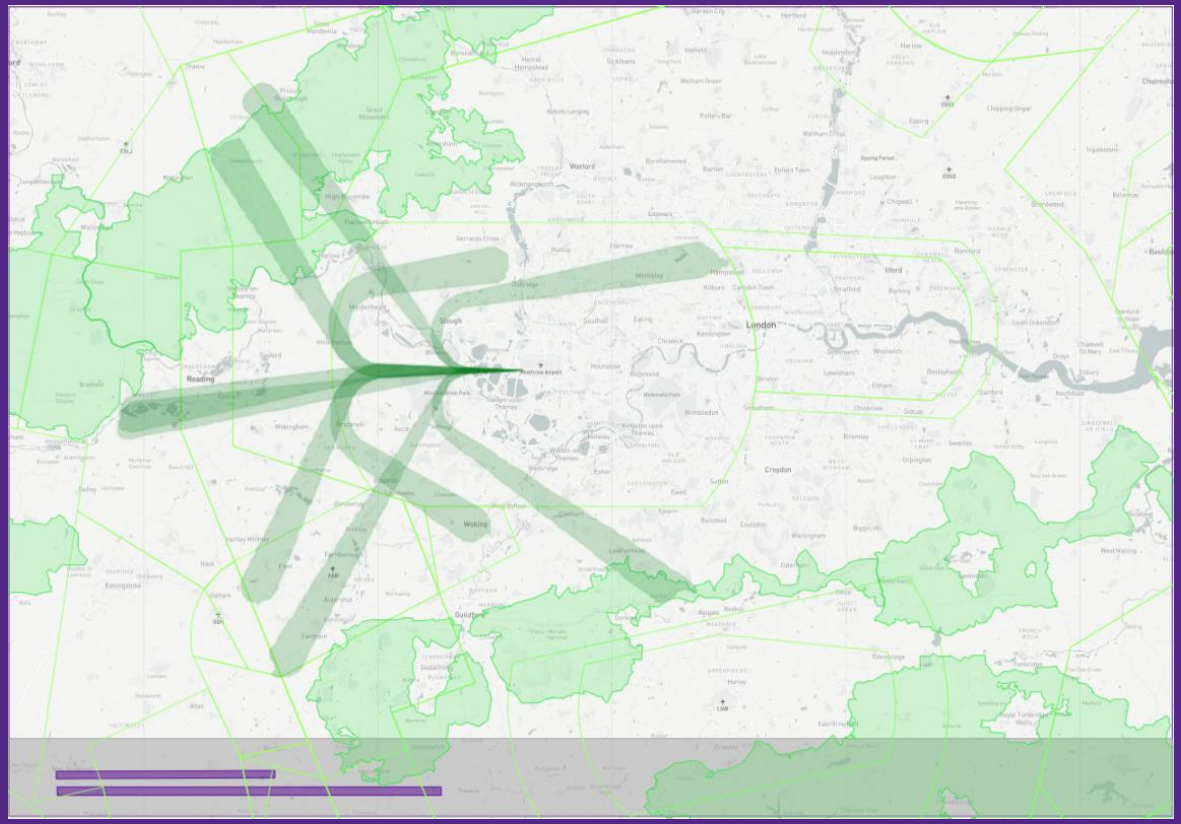
Runway 09R Design Principle 4



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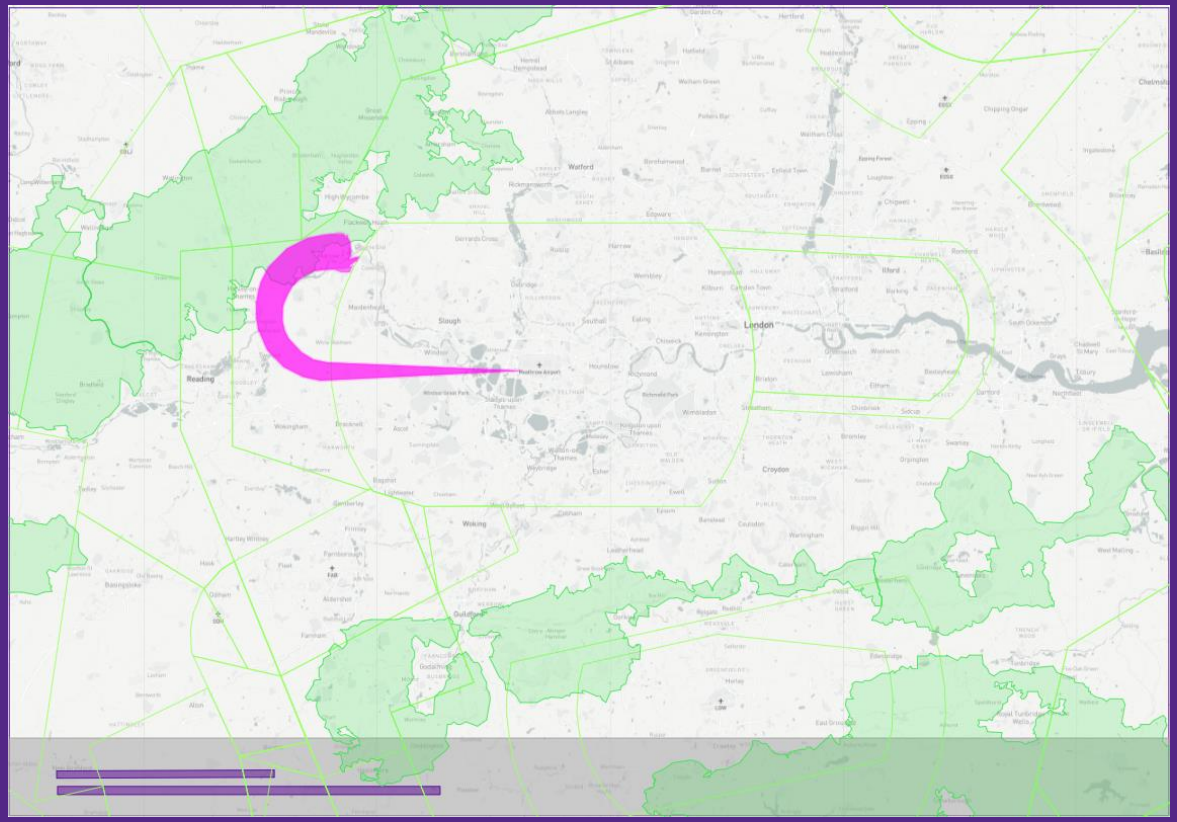
Runway 09R Design Principle 9



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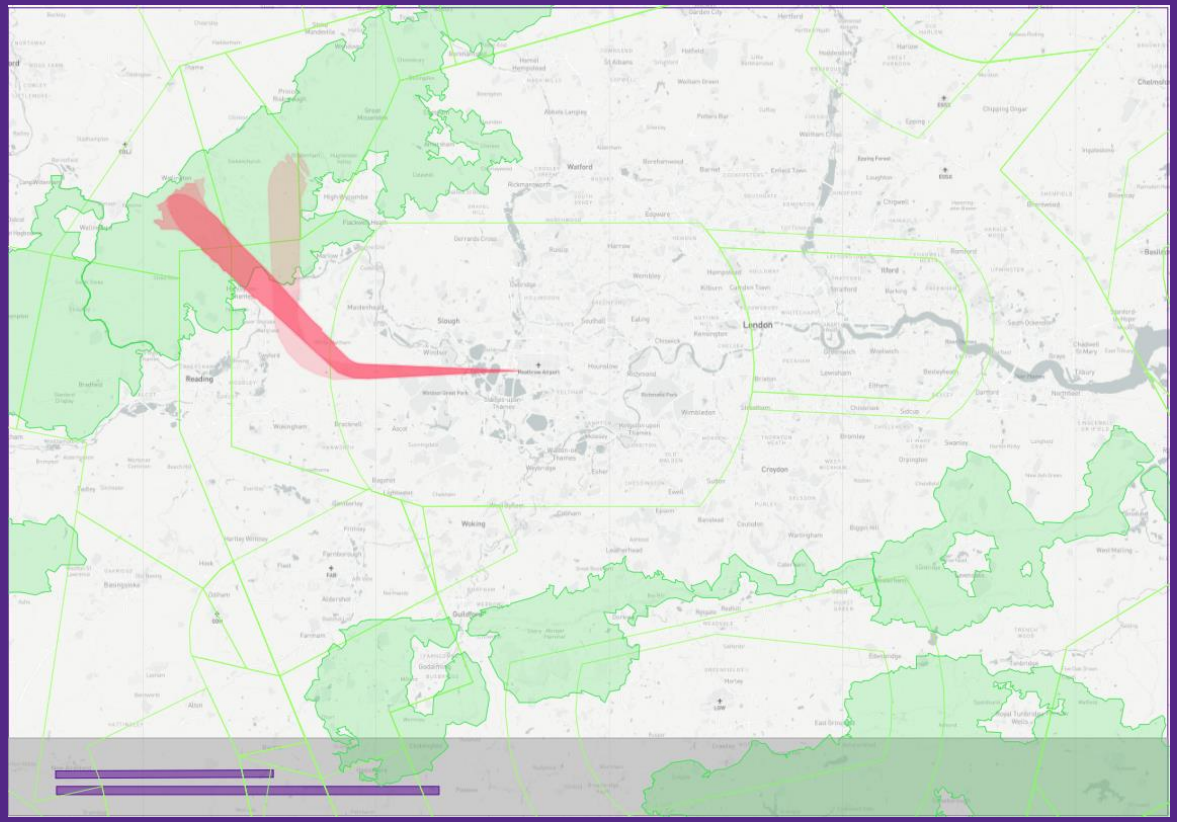
Runway 09R Design Principle 10



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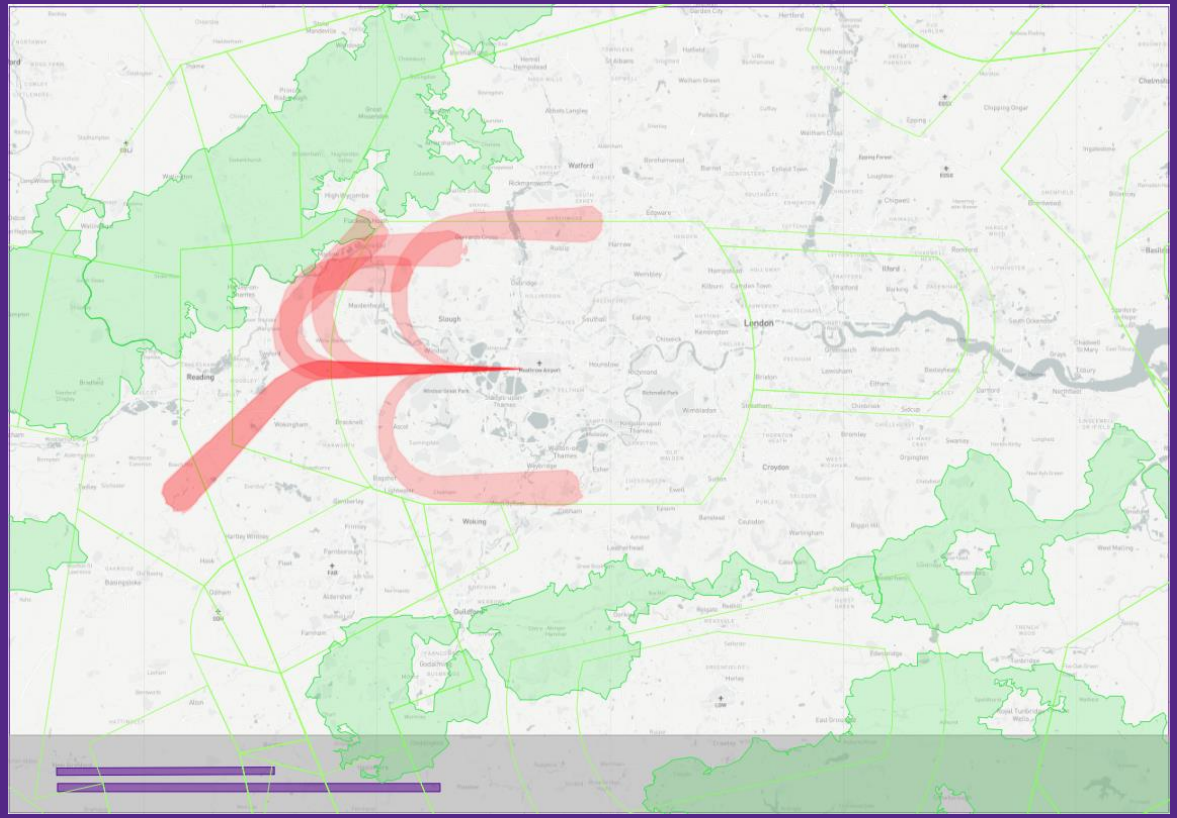
Runway 09R Blend of Design Principles 2, 4, 9 and 10



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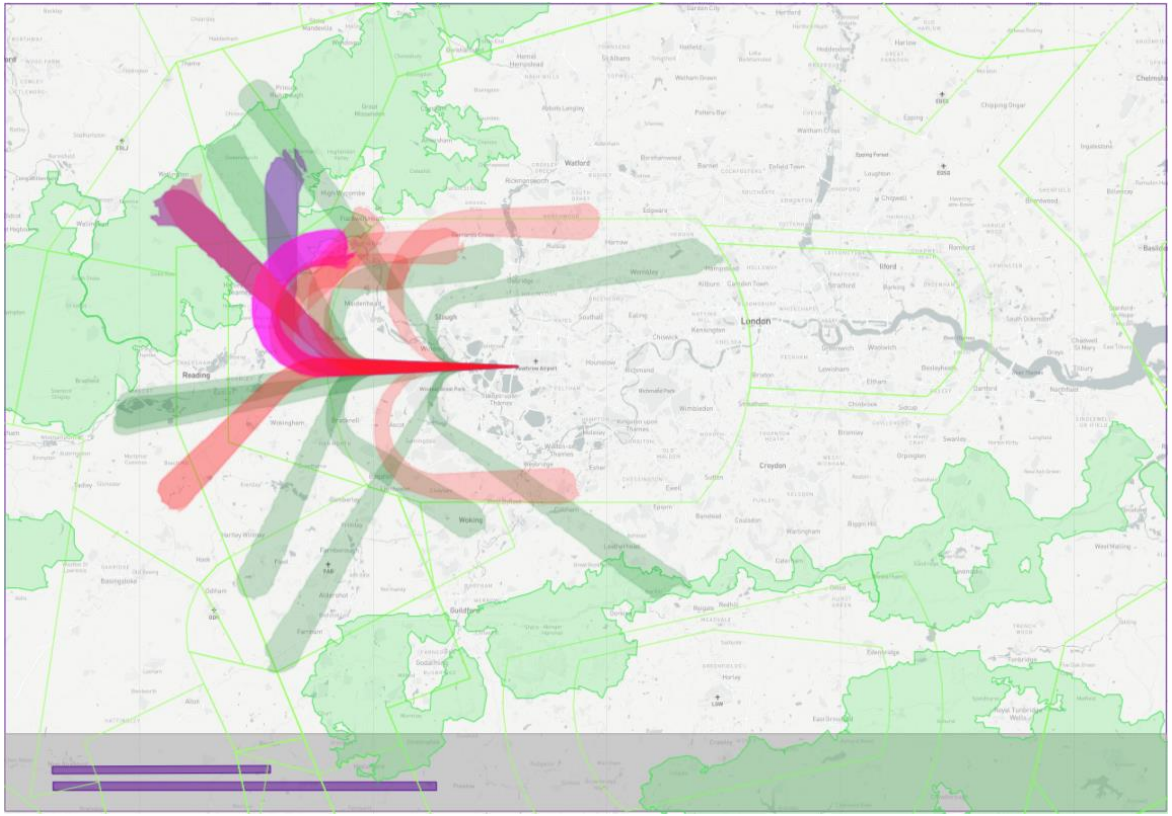
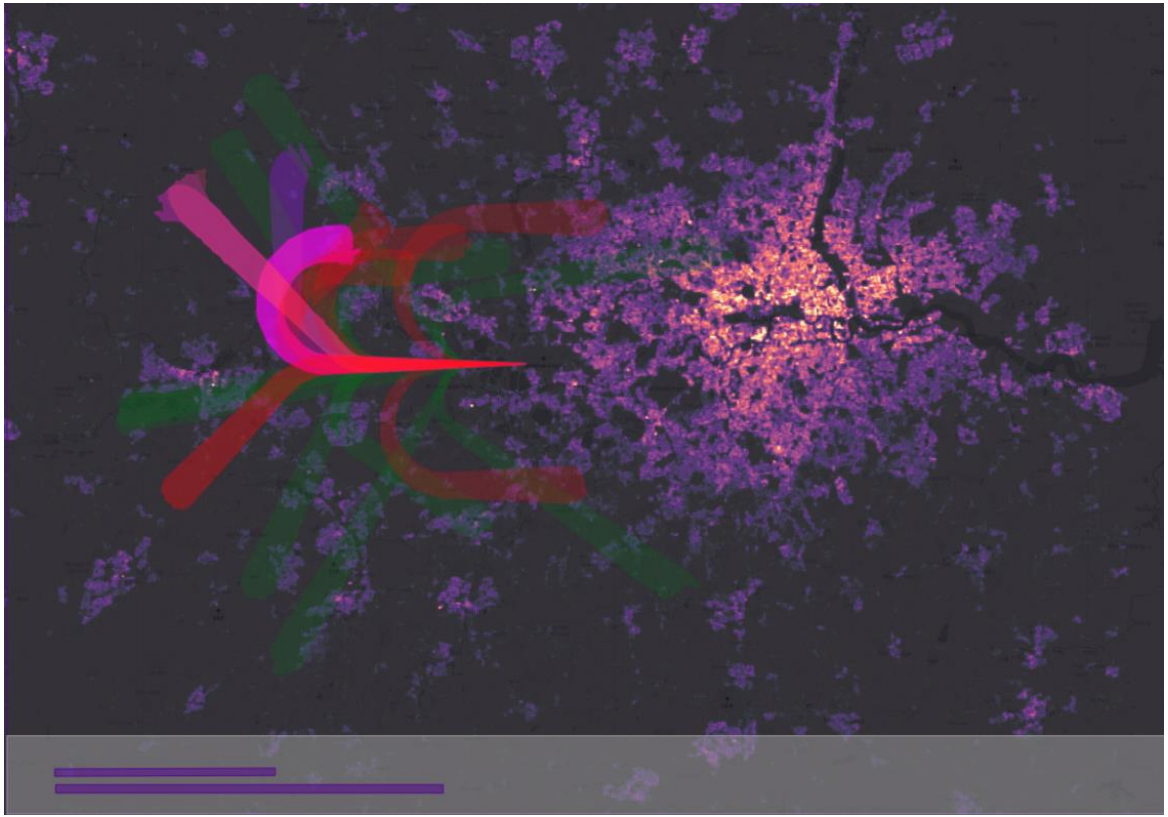
Runway 09R All PBN Arrival Options

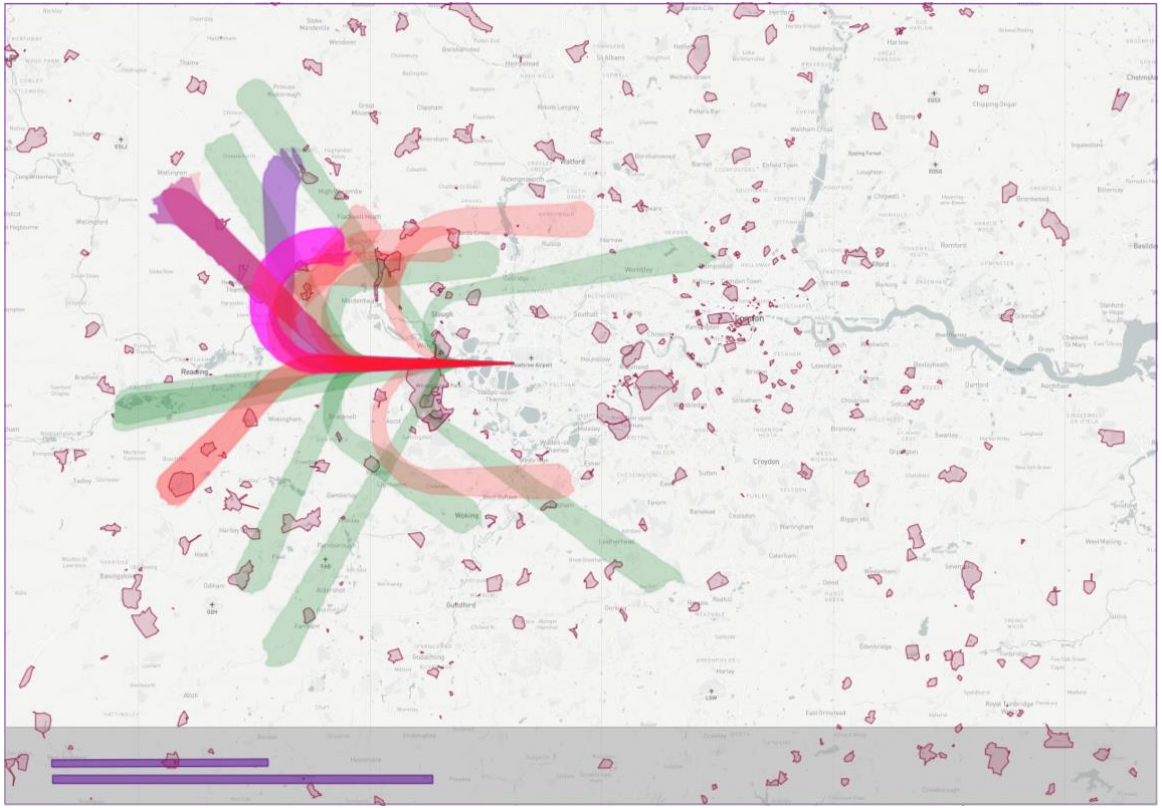


Runway 09R PBN Arrival Options (LA boundaries)

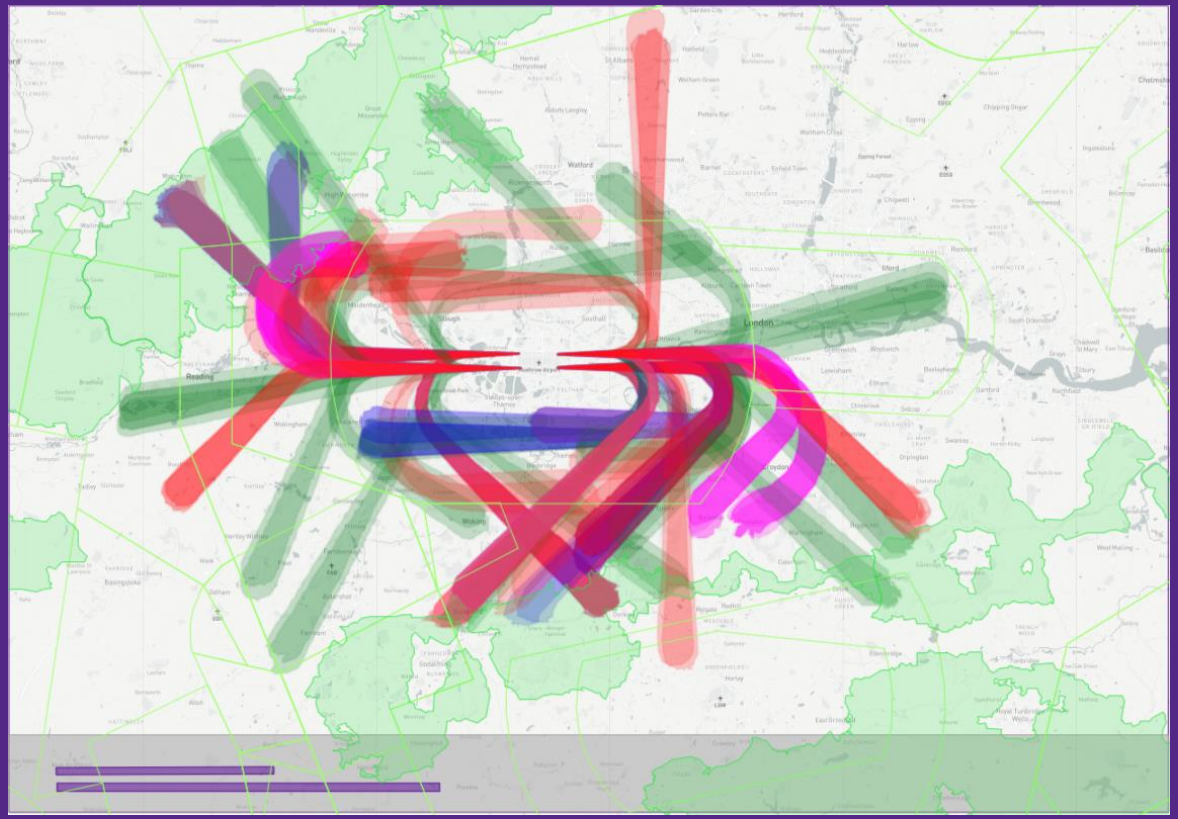
Runway 09R All PBN Arrival Options (Population)



Runway 09R All PBN Arrival Options (Parks and Gardens)



All PBN Arrival Options



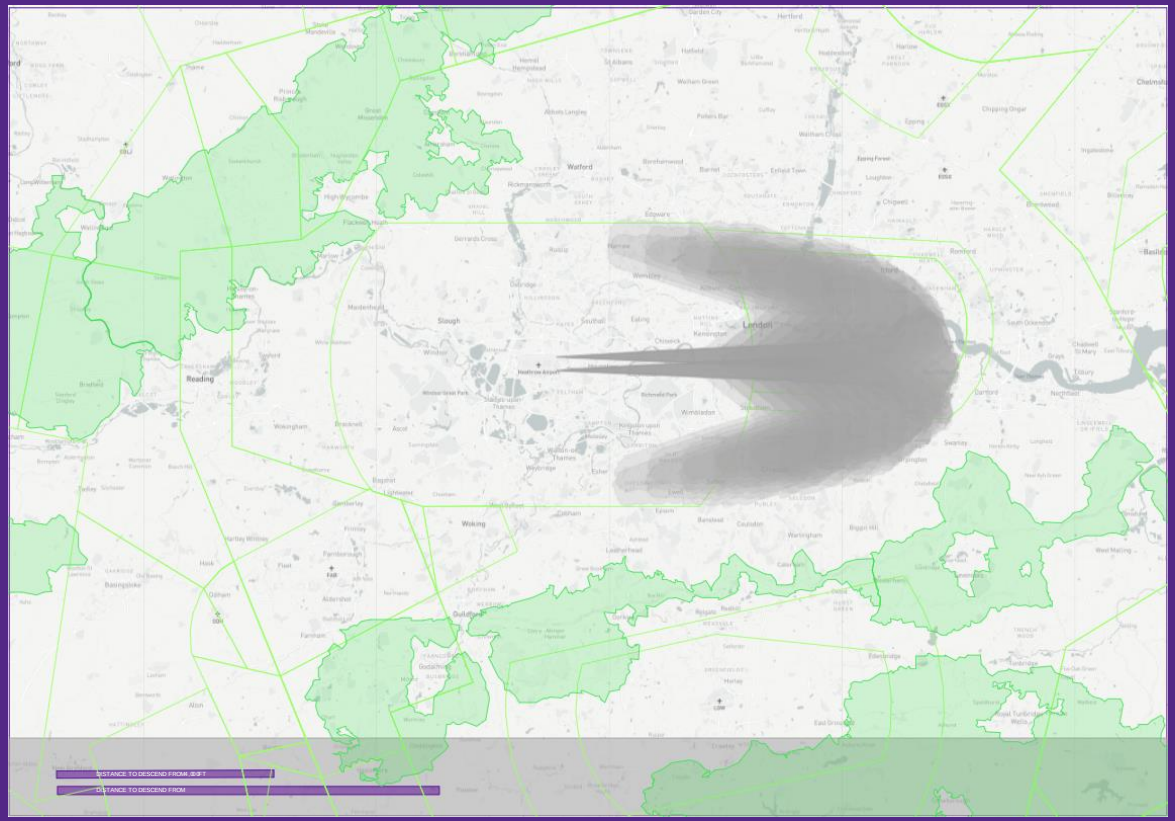
November 2022

Airspace Modernisation: Airspace Change Proposal

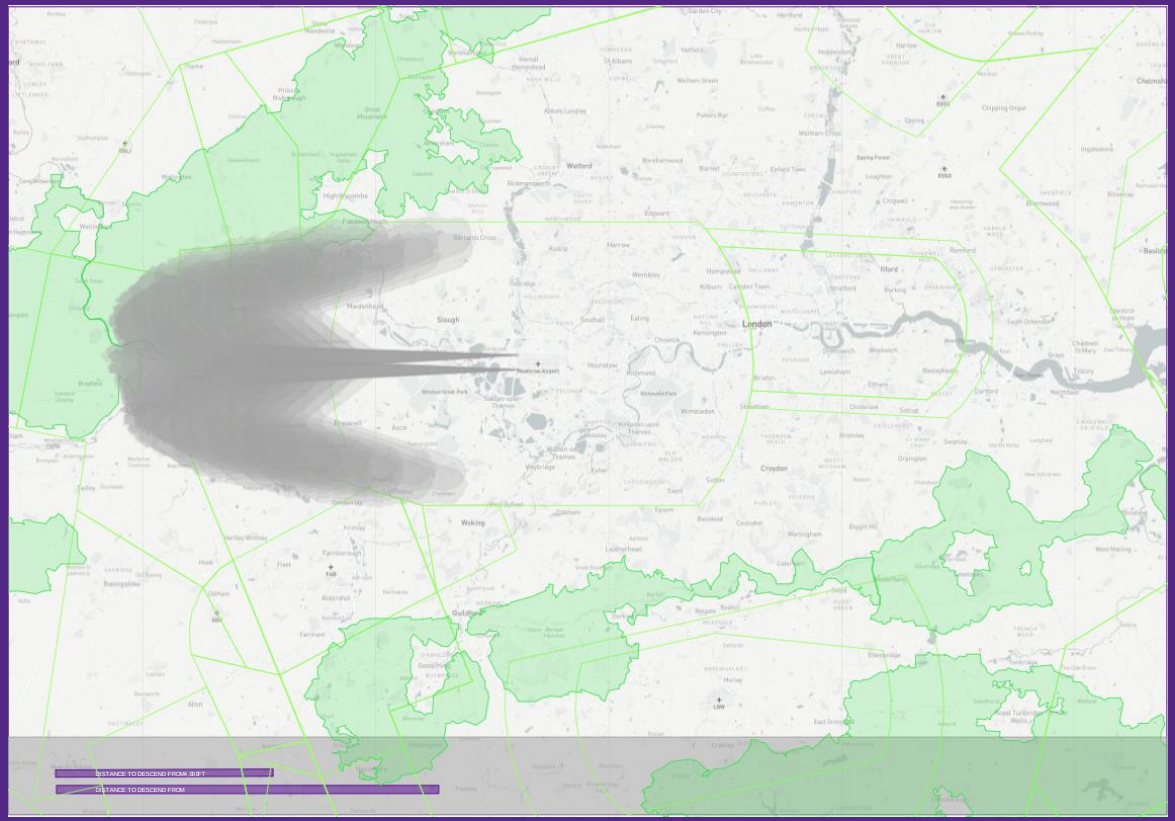
Comprehensive List of Options – Vectored Arrivals

Heathrow

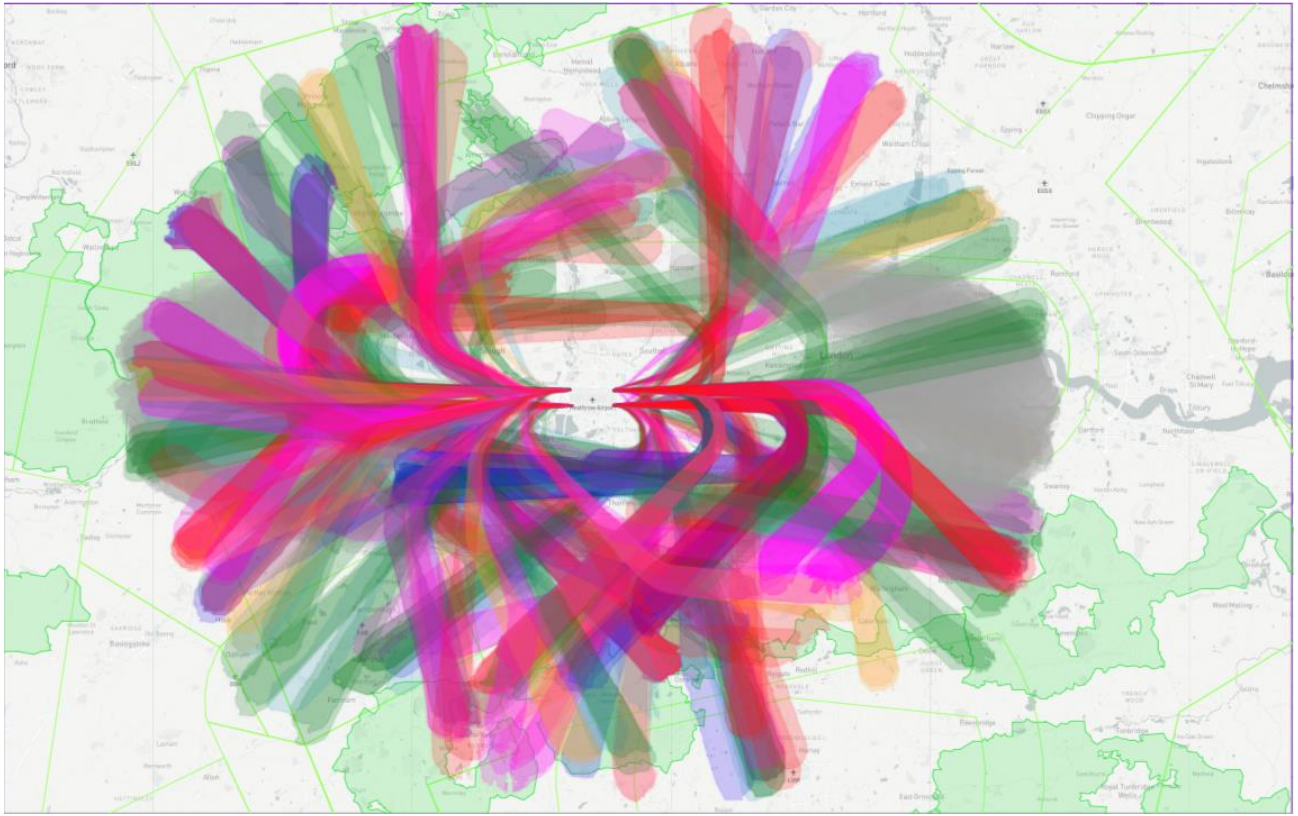
Runways 27L and 27R: All vectored arrival options



Runways 09L and 09R: All vectored arrival options



All Arrival and Departure Options



Have your say

We will provide you with:

1. A copy of the engagement material presentation;
2. A link to our Feedback Form; and
3. This Appendix with the full set of our Comprehensive List of Options by Design Principle.

In order to input into Stage 2 of this airspace change proposal, please use the Feedback Form to provide your feedback on our Comprehensive List of Options and the information we have shared.

Please submit your feedback by Friday 9 December 2022.

Please remember: we are seeking feedback on the approach at this stage, not the specific geographical areas or potential impacts of the flight path options


Heathrow
Making every journey better