GLASGOW AIRPORT

PROUD TO SERVE SCOTLAND

Glasgow Airport FASI-North Airspace Change Proposal

Stage 2A Engagement on Comprehensive List of Options

AGENDA

1. Introductions and project overview
2. Purpose of Stage 2A engagement
3. Our approach to developing the initial comprehensive list of options
4. Comprehensive List of Options
5. Our questions for you
6. Next steps

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1. Introductions and overview

1. INTRODUCTION AND OVERVIEW: RECAP

Glasgow Airport is developing an airspace change proposal (ACP) to upgrade the airport's arrival and departure routes. The ACP will cover a review of routes from the ground up to 7000ft and will also review the boundaries between controlled and uncontrolled airspace.

Every ACP sponsor must follow the regulatory process for changing the airspace design known as CAP1616 (Civil Aviation Publication no. 1616).

- CAP1616 sets out the process for developing airspace change options. This entails engaging with affected stakeholders, evaluating the impacts of options, consulting the public, regulatory approval and implementation.
- The CAA review our submission at each stage of the process to ensure the engagement and analysis is robust prior to moving to the next stage.

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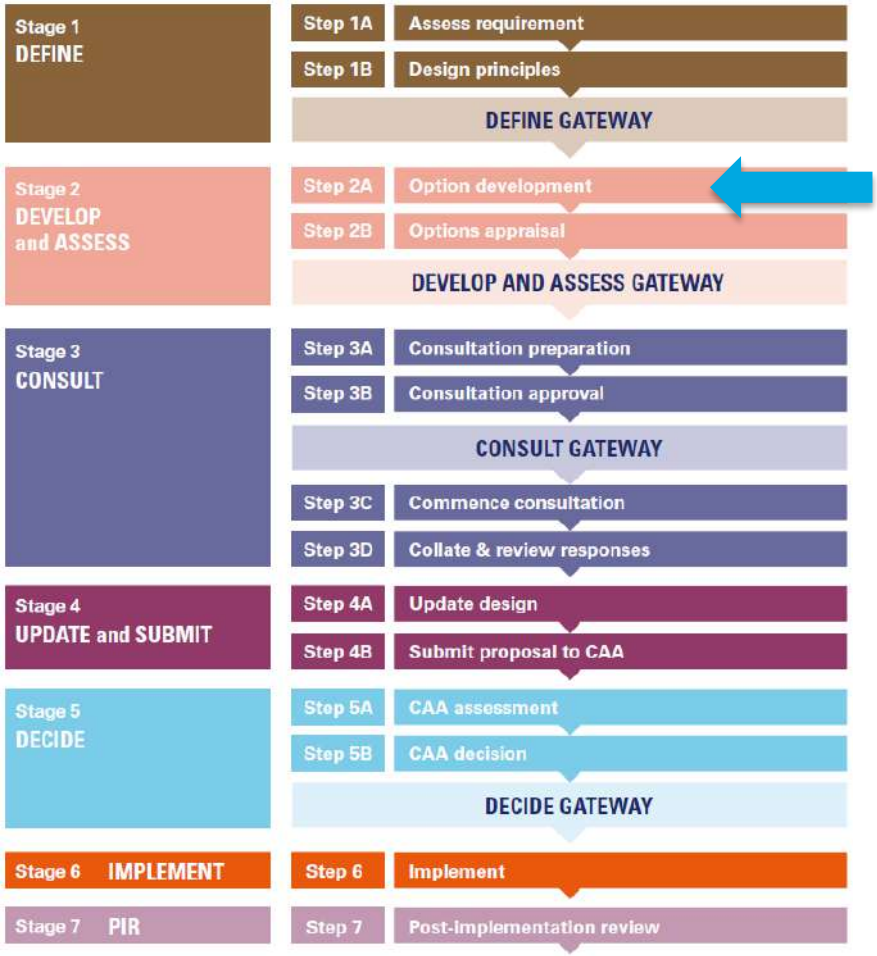
1. CAP1616

Nov 2019	Glasgow Airport submitted the Stage 1 Design Principles documents to the CAA and moved onto Stage 2 of the 7-stage CAP1616 process.
April 2020	Due to COVID-19 the ACP was paused
Mar 2021	Following the announcement in March 2021 from the Department for Transport and the CAA of short-term financial support for the next phase of the FASI project, Glasgow Airport have been able to progress this ACP.
	In line with CAP1616 guidance, during Stage 2, Glasgow Airport will continue to seek involvement from the same stakeholders that were engaged as part of Step 1B.



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1. CAP1616 STAGE 2 DEVELOP & ASSESS

Our ACP is currently in Step 2A of the CAP1616 process – known as Options Development

Step 2A requires Glasgow Airport to first develop a comprehensive list options to the extent that a list is possible. This list of route options should address the Statement of Need and align with the Design Principles which were developed in Stage 1.

We are now engaging with stakeholders to ensure that they are satisfied that the route options are aligned with the design principles and that the airport has properly understood and accounted for stakeholder concerns, specifically related to the design options.

Glasgow Airport will then produce a design principle evaluation which will set out how our route options have responded to each of the design principles. This will be published on the CAA's Airspace Change Portal.

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2. Purpose of Stage 2A Engagement

2. PURPOSE OF THIS ENGAGEMENT

- The purpose of this session is to explore and test our approach to developing the options and answer questions relating to our approach.
- We will use your feedback to try and address any concerns raised. We are able to refine or develop more options, based on your feedback.
- The purpose of this engagement is **NOT** to seek feedback on individual route options by examining the detailed specific geographical position of the options.
- We do not yet have any detail on the potential impacts of each option, that will come later.
- At this stage we are engaging community groups, local authorities, airline, general aviation bodies, other airports and NATS.
- This is not a public consultation exercise, that comes later, on the preferred option(s).

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3. Our approach to developing the initial comprehensive list of options

3. OUR APPROACH

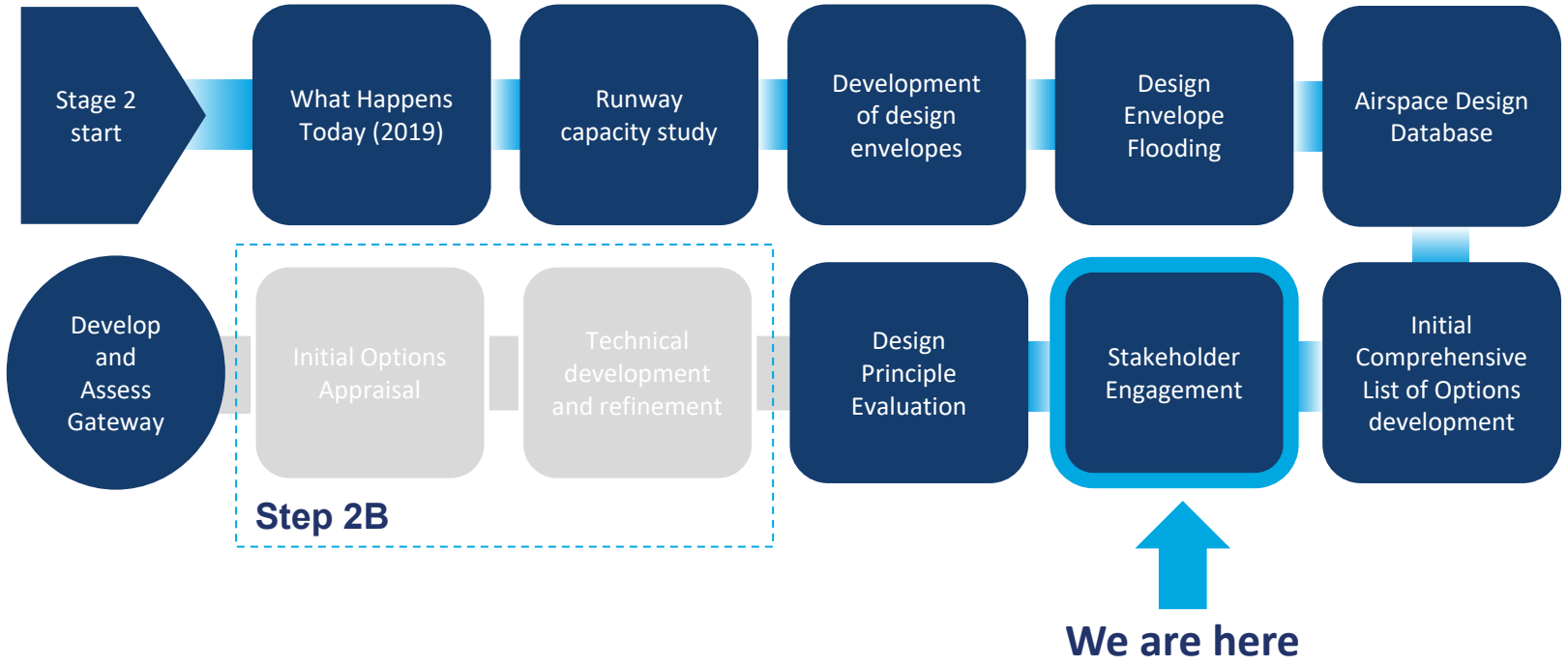
When developing Airspace Change options, Glasgow Airport must address the Statement of Need and align with the Design Principles which were developed in Stage 1 with stakeholders:

#	Design Principle
1	The airspace design and its operation must be as safe or safer than today.
2	Facilitate the growth in quicker, quieter and cleaner traffic by configuring the airspace to improve efficiency and meet the forecast demand for air transport.
3	Design the appropriate volume of controlled airspace to support commercial air transport, enable safe, efficient access for other types of operation and release controlled airspace that is not required.
4	Mitigate any future requirements for airborne holding for inbound traffic and holding on the ground pre-departure for outbound traffic.
5	Minimise the total adverse effects of aircraft noise and visual intrusion on physical and mental health and wellbeing.
6	Offer communities options for both noise concentration and noise dispersion through the use of predictable and transparent multiple route options and other respite methods that are possible within the technical ATC system, en-route network and procedural constraints.
7	The arrival and departure routes that serve Glasgow Airport below 7000ft should avoid noise sensitive areas and buildings, national parks, areas of outstanding natural beauty/National Scenic Areas and areas that are not currently affected by aircraft noise.
8	Mitigate the impacts on local communities that are currently affected by aircraft noise on final approach or the vicinity of the immediate climb out, where overflight is unavoidable.
9	Reduce complexity and bottlenecks in controlled and uncontrolled airspace and contribute to a reduction in airspace infringements.
10	Collaborate with other Scottish airports and NATS to ensure that the airspace design options are compatible with the wider programme of lower altitude and network airspace changes being coordinated by the FASI North programme.
11	Routes to/from Glasgow and Edinburgh airports should be procedurally deconflicted from the ground to a preferred level in coordination with NATS Prestwick.
12	Minimise the growth in aircraft emissions, the further degradation in local air quality and adverse ecological impacts to address growing concerns about the impact of aviation on climate change.
13	Aircraft operating at Glasgow Airport should climb and descend continuously to/from at least 7000ft with a preference for the most environmentally beneficial option to be chose, if both cannot be achieved simultaneously.
14	Routes should be designed to meet a RNAV1 specification as a minimum in order to gain maximum benefit of the performance capabilities of the modern aircraft fleet operating at Glasgow Airport in line with the guidance provided in CAA CAP1385 on enhanced route spacing for PBN and provide sufficient resilience and redundancy against Global Navigation Satellite System (GNSS) failure.
15	The GLA ACP accords with the CAA's published Airspace Modernisation Strategy (CAP1711), any current or future plans associated with it and all other relevant policies and regulatory standards.

3. OUR APPROACH

In practice, developing a comprehensive list of options that address the statement of need and align with the design principles is a complex task, especially when faced with a 'blank sheet' approach. There are several stages of work that are required to take place in order to arrive at a comprehensive list of options. The following slides summarise the methods employed to develop as many options as practicable.

Overview of our approach:



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3. OUR APPROACH

What happens today

All Design Principles

The first step in developing our Comprehensive List of Options is to understand what happens today. When we restarted the project after COVID-19, we refreshed this analysis.

We took initial steps to understand the existing Airspace Environment and how we can change and improve it to meet the Design Principles. This included:

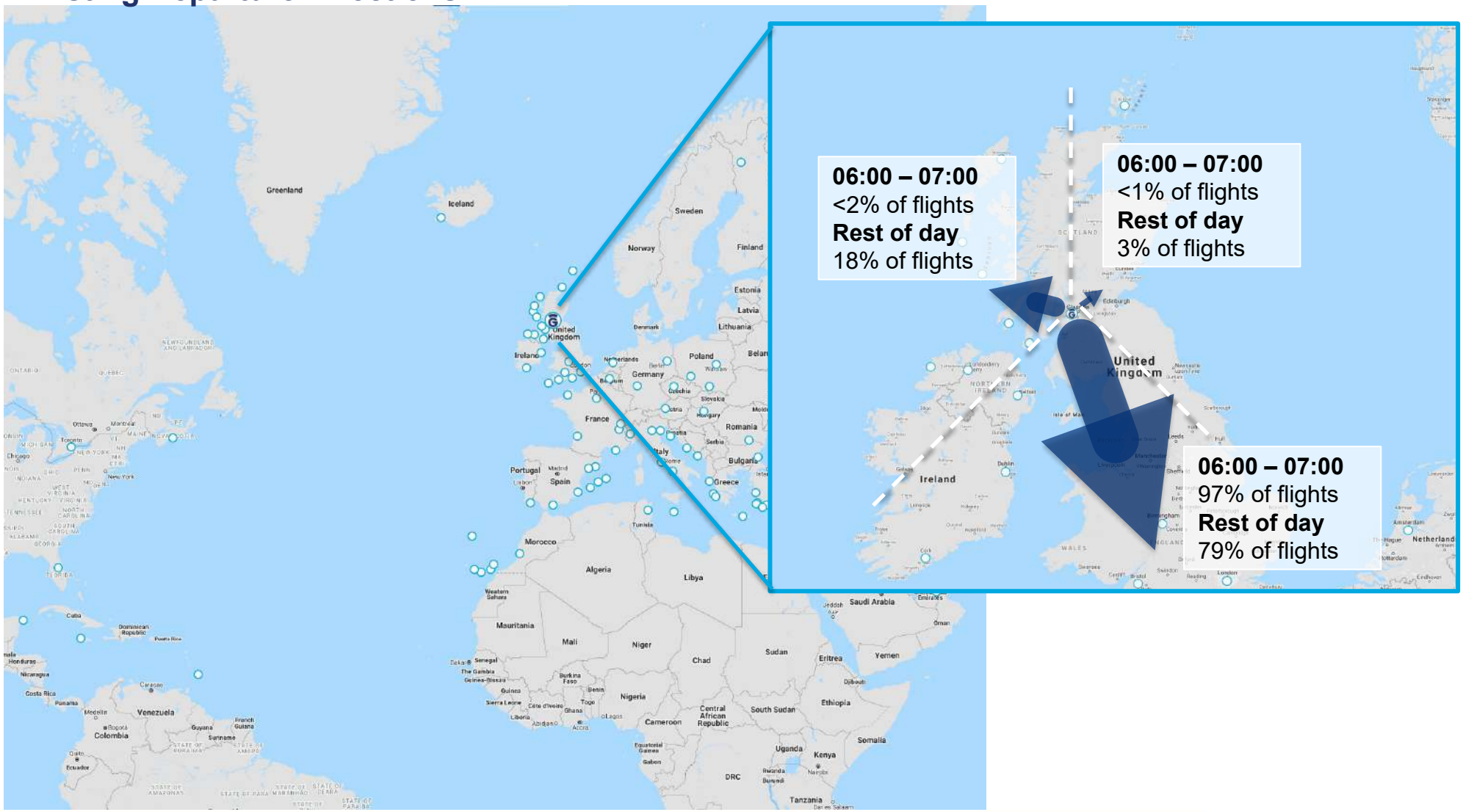
- Analysing flight track data to understand how aircraft currently operate at Glasgow Airport
- Engaging with General Aviation and Airlines around the Controlled Airspace structure
- Engaging with Airlines to understand their future fleet capabilities

The following information is based on 2019 data, as this is most representative of a recovered COVID-19 scenario.

3. OUR APPROACH

What happens today

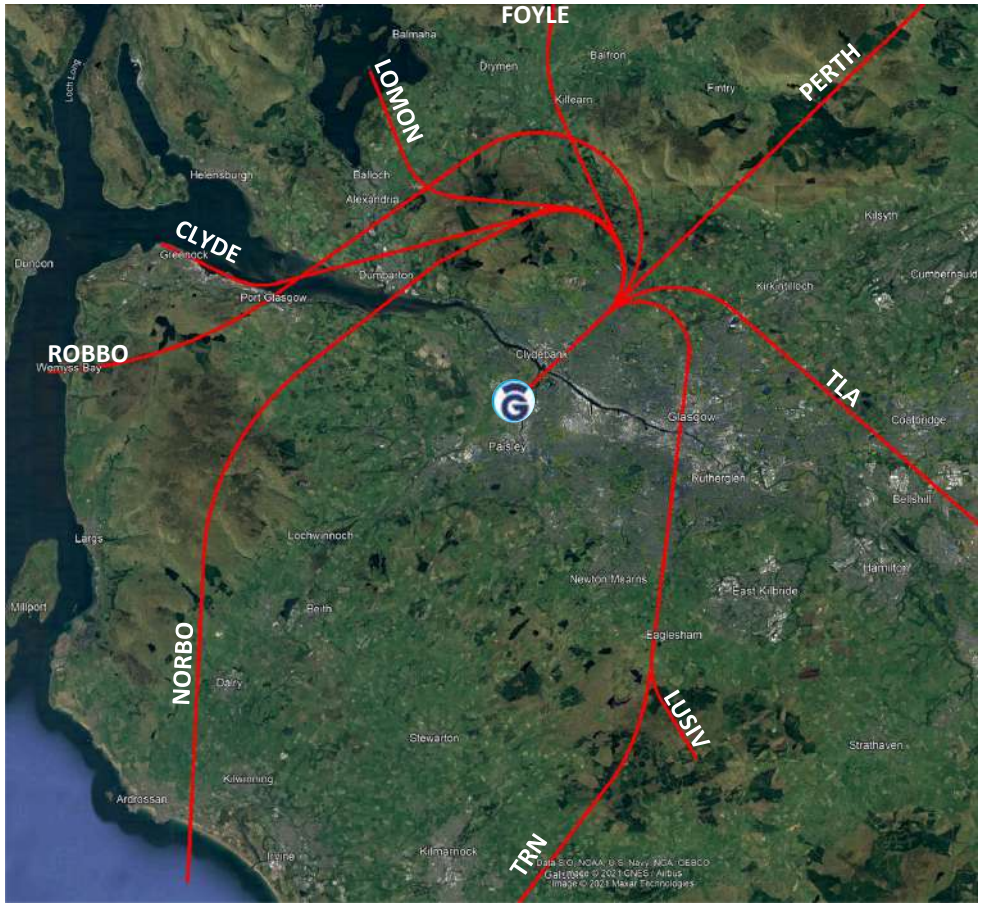
Existing Departure Directions:



3. OUR APPROACH

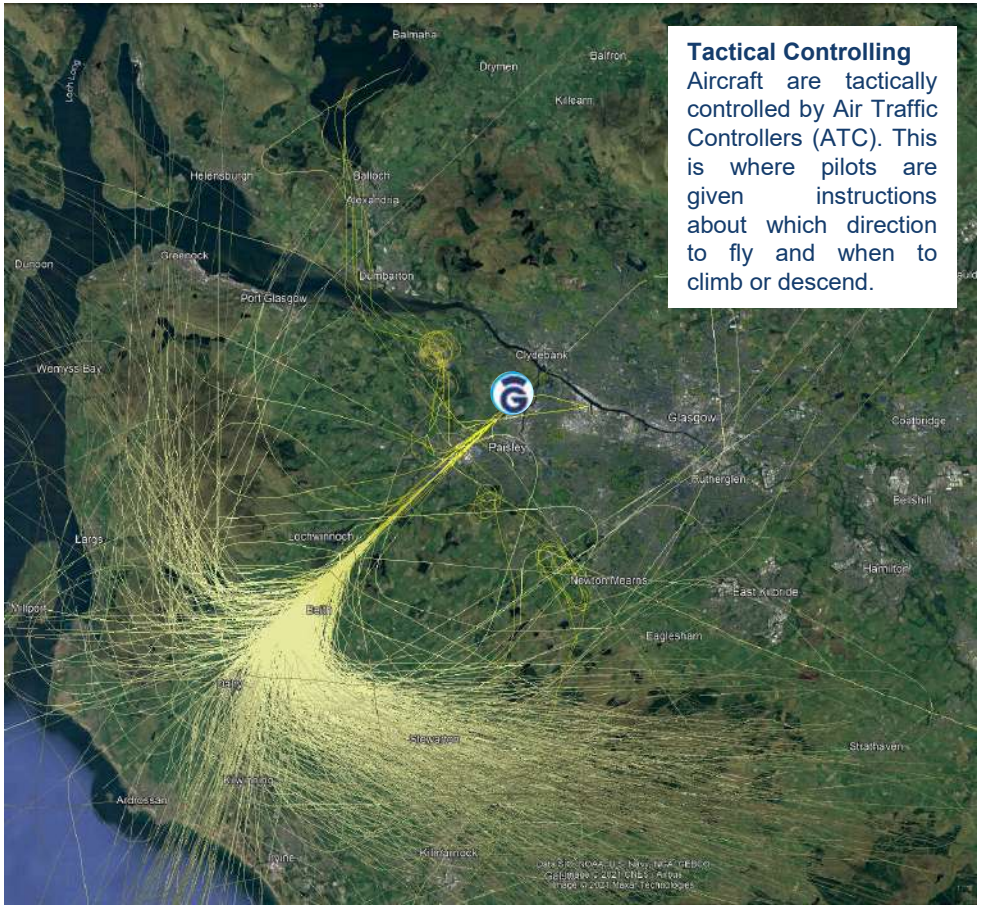
Existing Routes: Runway 05

Aircraft land from the Johnstone/Linwood direction and take-off towards Clydebank and Bearsden (28% of the year in 2019)



Runway 05 Departures

Glasgow publish 9 departure routes (Route centerlines shown in red)



Tactical Controlling
Aircraft are tactically controlled by Air Traffic Controllers (ATC). This is where pilots are given instructions about which direction to fly and when to climb or descend.

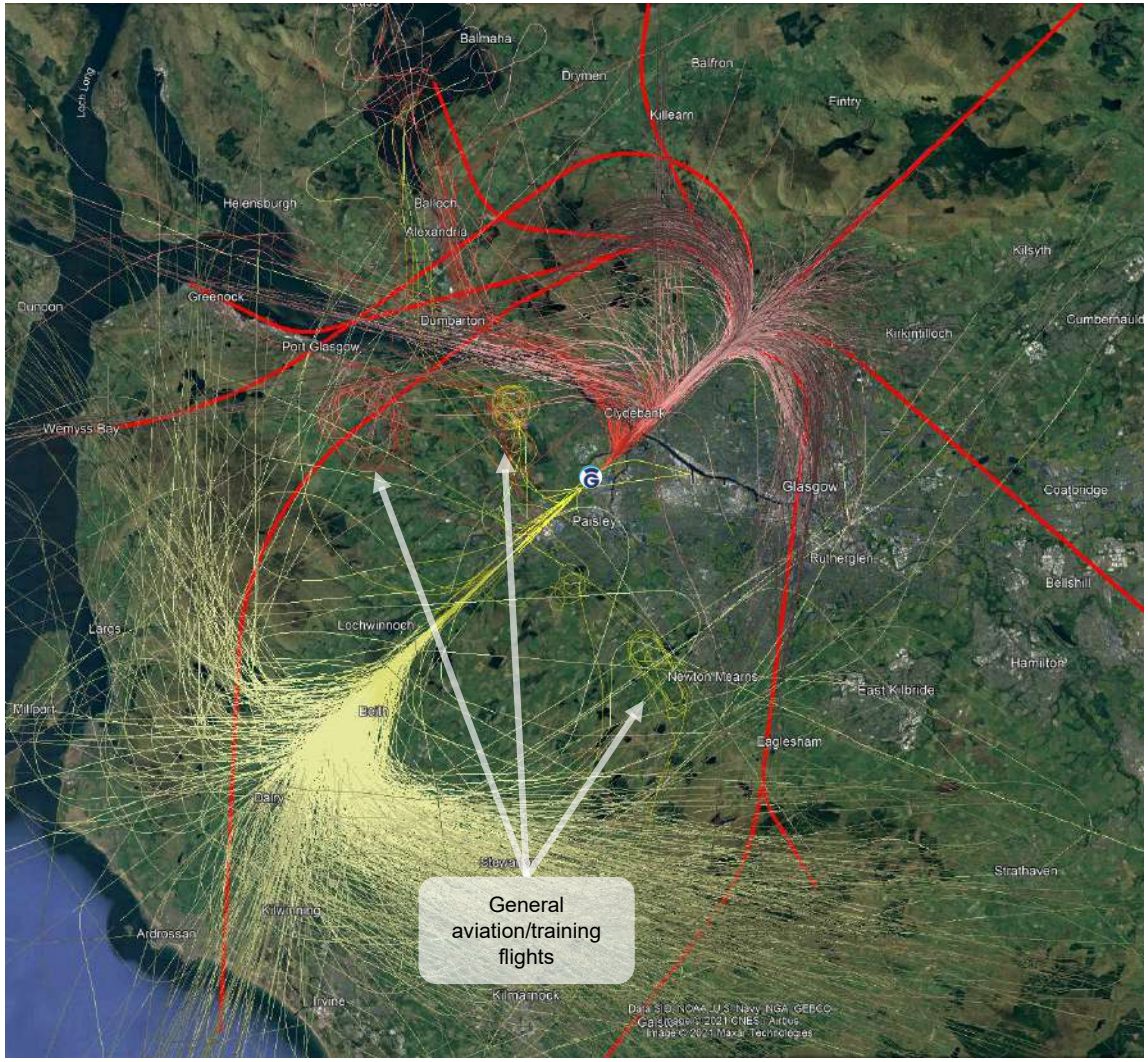
Runway 05 Arrivals (1 week of 2019 flight track data)

Arrivals are tactically controlled by ATC onto Final Approach. Aircraft join final approach at around 7 – 12 nm. There are no published routes.

3. OUR APPROACH

Runway 05: Actual flight tracks

(28% of the year in 2019)



In reality aircraft are frequently tactically controlled off the departure centerlines by Air Traffic Controllers (ATC). This is where ATC give pilots instructions about which direction to fly and when to climb or descend. This means that aircraft do not follow a set route.

This can be seen when we look at a week's flight track data captured during the summer of 2019.

This data shows each flight up to 7000ft (within the scope of this ACP)

Altitude (ft)	Departures	Arrivals
0-1000		
1000-2000		
2000-3000		
3000-4000		
4000-5000		
5000-6000		
6000-7000		

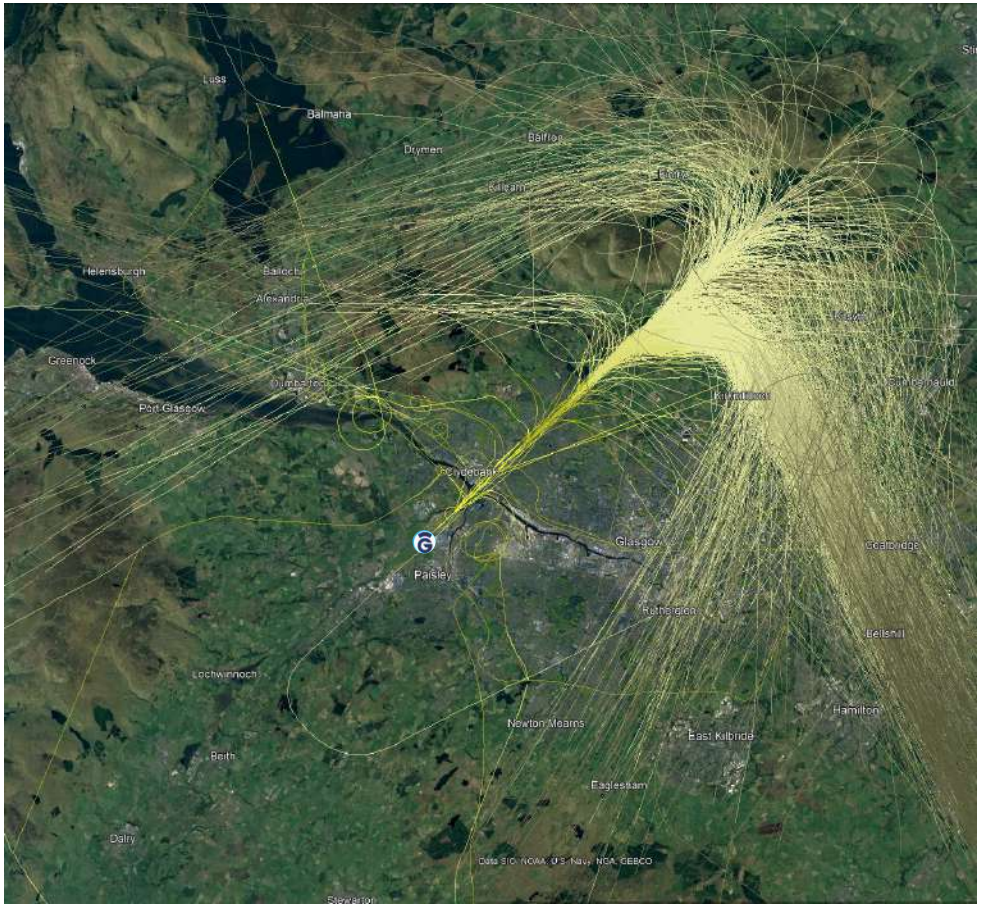
3. OUR APPROACH

Existing Routes: Runway 23

Aircraft take off towards Linwood and Johnstone and land from the Bearsden and Clydebank direction (72% of the year in 2019)

Runway 23 Departures

Glasgow publish 7 departure routes (Route centerlines shown in red)



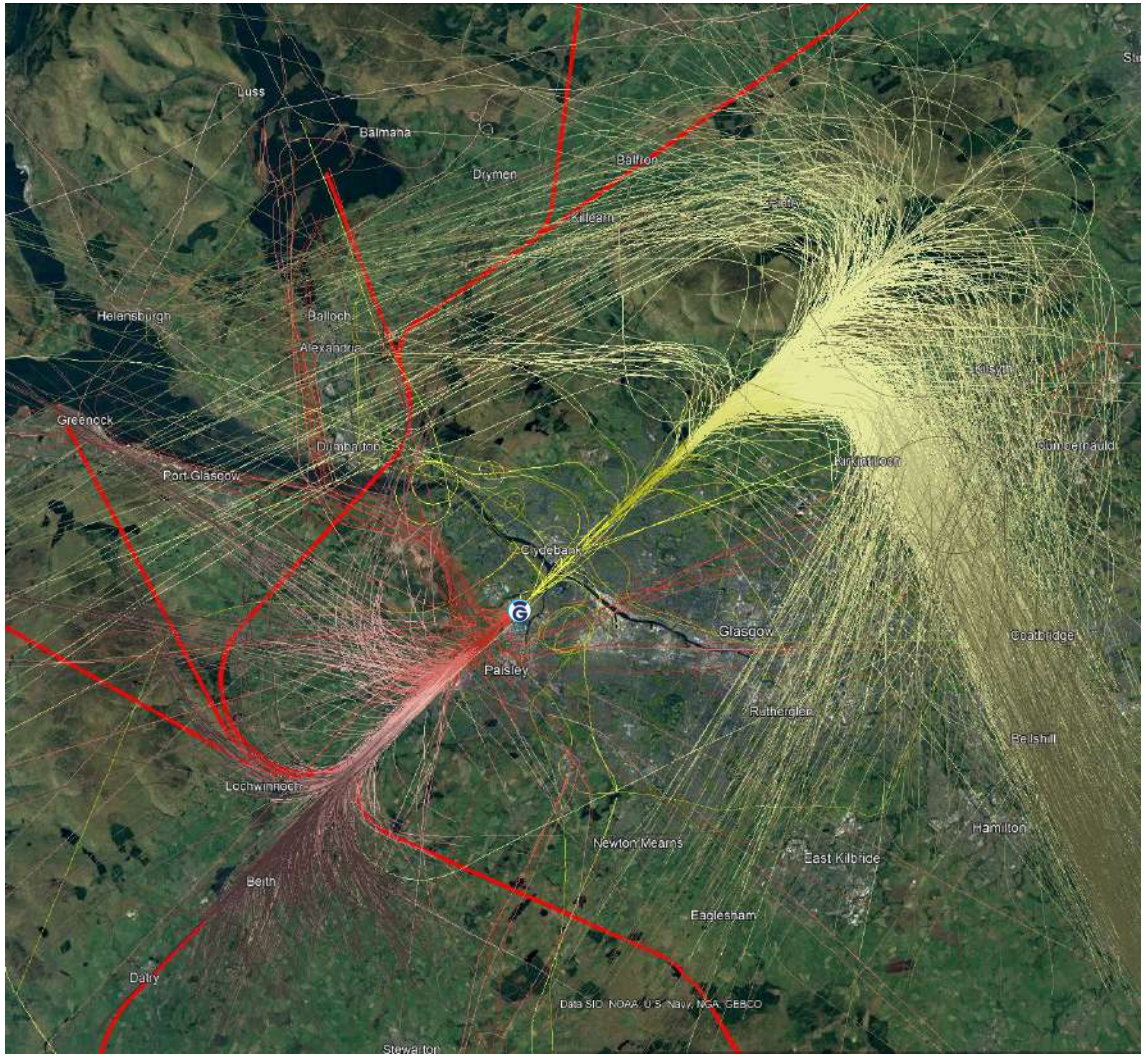
Runway 23 Arrivals

Arrivals are tactically controlled by ATC onto Final Approach. Aircraft join final approach at around 5 – 14 nm. There are no published routes.

3. OUR APPROACH

Runway 23: Actual flight tracks

(72% of the year in 2019)



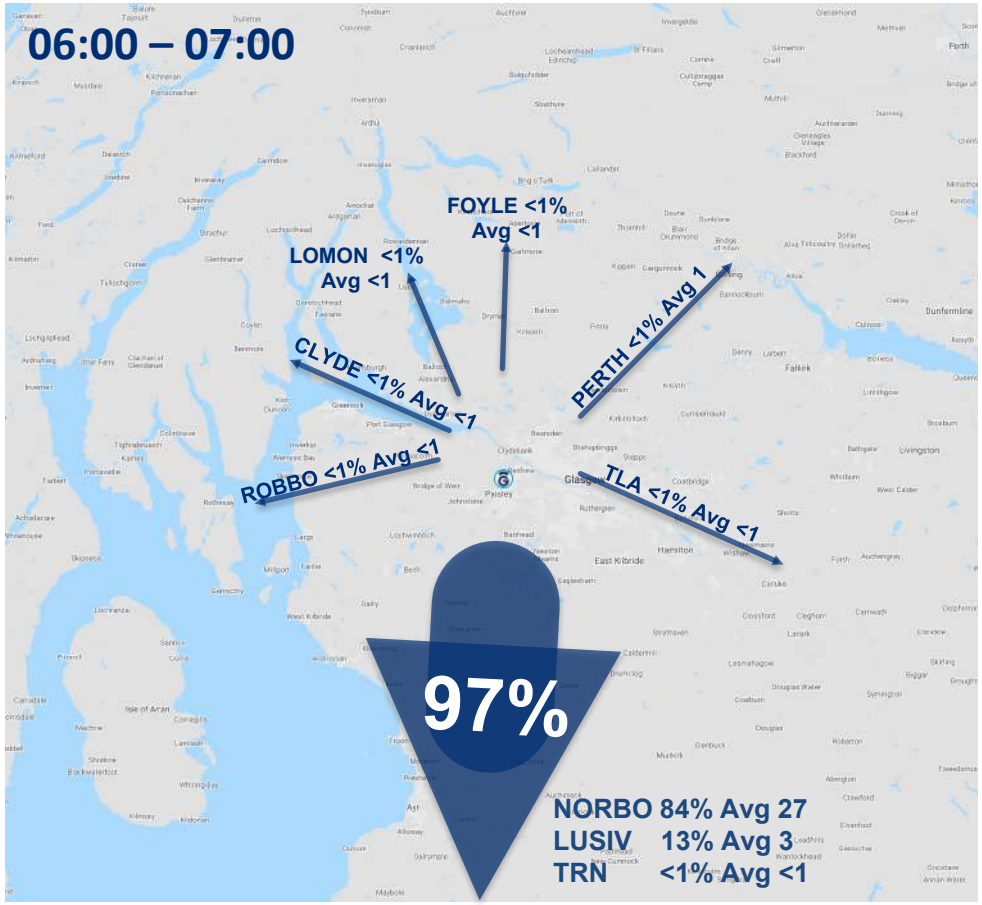
In reality aircraft are frequently tactically controlled off the departure centerlines by ATC. This can be seen when we look at a week's flight track data captured during the summer of 2019.

This data shows flights up to 7000ft (within the scope of this ACP)

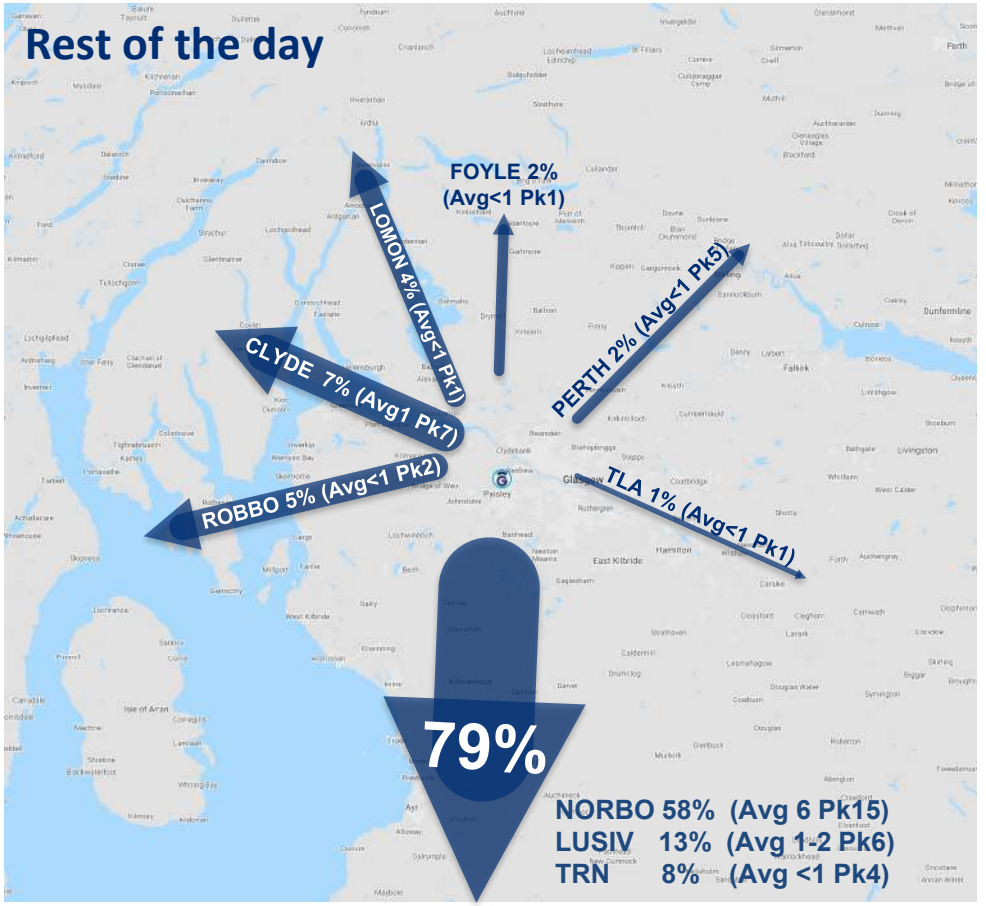
Altitude (ft)	Departures	Arrivals
0-1000		
1000-2000		
2000-3000		
3000-4000		
4000-5000		
5000-6000		
6000-7000		

3. OUR APPROACH

Existing Departure Usage/Directions



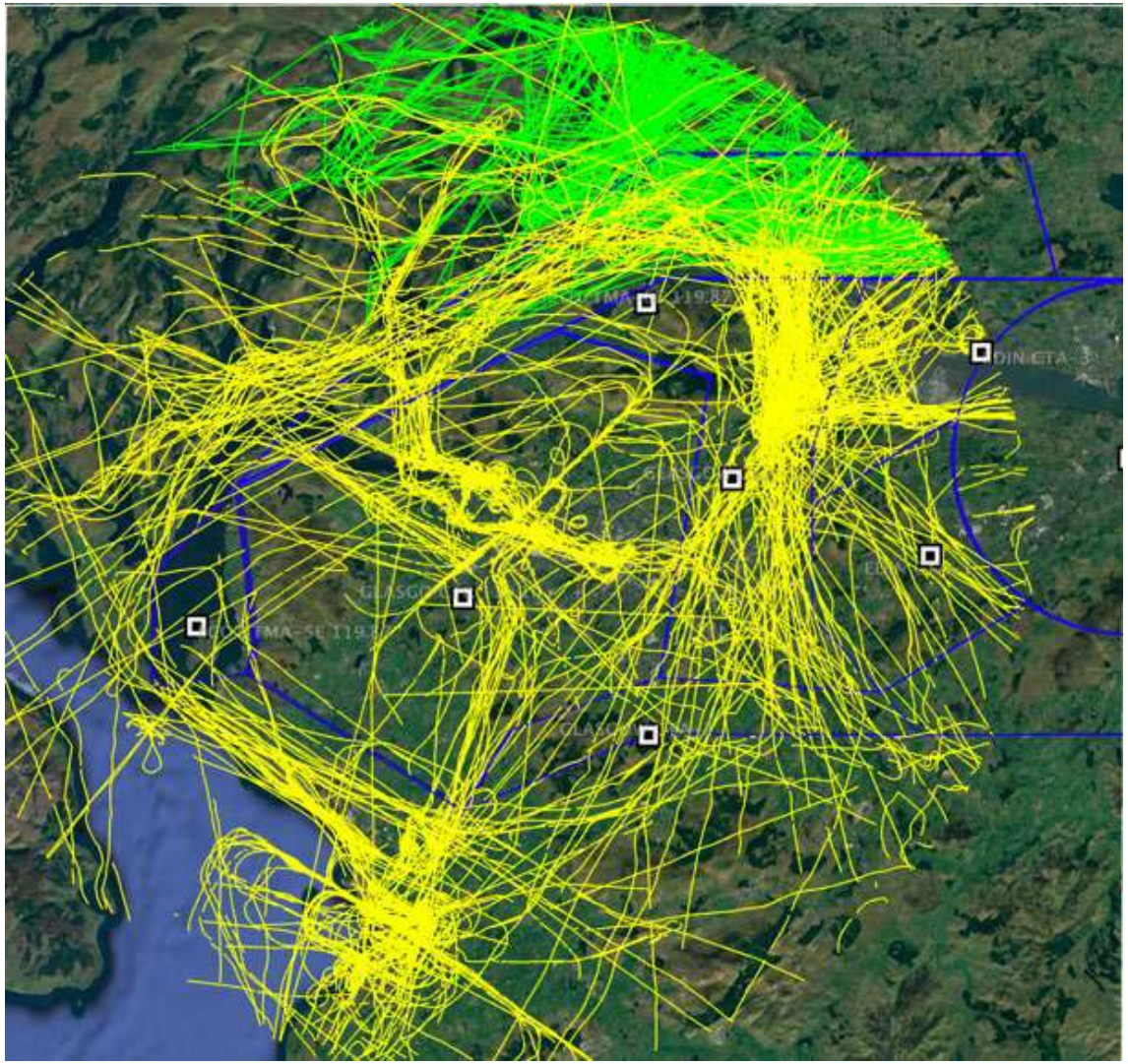
Avg = average number of hourly movements in 2019



A = average movements per hour P = Peak hour movements in 2019

3. OUR APPROACH

Controlled Airspace



General Aviation activity up to 6000ft

We also looked at the existing controlled airspace arrangements (blue) and how other airspace users (green and yellow) use the airspace surrounding Glasgow.

This was the starting point for engagement with the local General Aviation community around how the controlled airspace could be improved.

Technical Information for Aviation Stakeholders

The following image displays ADS-B and Mode S track data derived from 360Radar within 30nm of the Glasgow Airport ARP between 27th August and 10th September 2019 H24.

All commercial callsigns have been removed from the data.

There was no FLARM data recorded during that time period, so we have added data received from the BGA for the whole of 2019 within 30nm of the Glasgow Airport ARP. It includes only those flights that were posted to the BGA National Ladder site, which is entirely voluntary.

BGA data is in green

ADS-B and Mode S data is in yellow

Existing CAS boundaries are depicted in blue

Any questions?

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3. OUR APPROACH

Runway Capacity Study

Design Principles 2, 4, 12 & 15

In April 2020, we undertook a runway capacity study which we have used to inform the way we develop our initial Comprehensive List of Options. This ensures that we meet our Statement of Need, and Design Principles 2, 4, 12 and 15.

The Runway Capacity model was based on a pre-covid forecast schedule, grown from 2019 busy day traffic data.

The study concluded that in order to achieve capacity at Glasgow and minimise avoidable delays, a minimum of 2, ideally 3 departure routes would be required off each runway end.

3. OUR APPROACH

Development of design envelopes

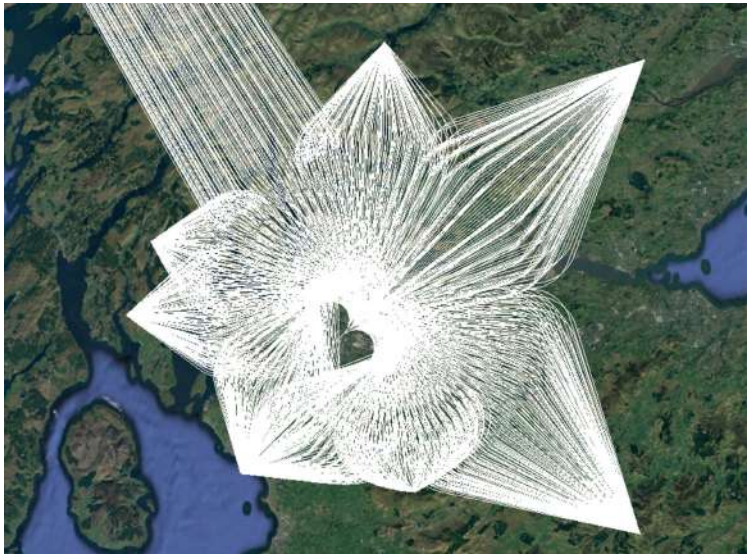
Design Principles 1 2 5 7 10 12 13 14 15

We next developed design envelopes. These are outlines of geographic areas within which flight paths could technically be positioned.

The Glasgow airspace change presents a blank sheet approach to airspace design and as such, we did not initially constrain ourselves with any existing airspace limitations.

The design envelopes were created by an Instrument Flight Procedure (IFP) designer so that we could ensure the areas considered met the rules used for designing arrival and departure routes.

Example Runway 05 Departure design envelope



Example Runway 05 Flooded with notional departure flight paths (See next slide)

3. OUR APPROACH

Design Envelope Flooding

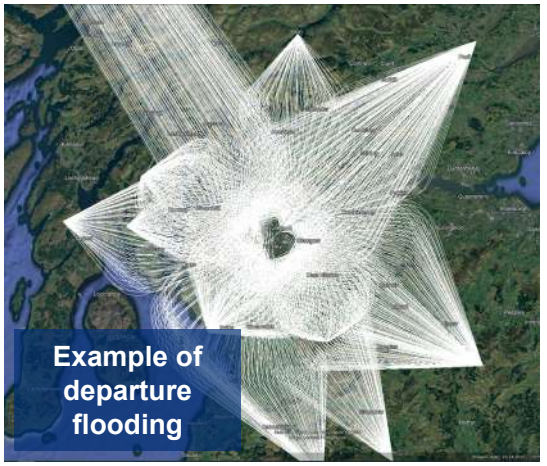
DP 1 5 7 8 12 13 14

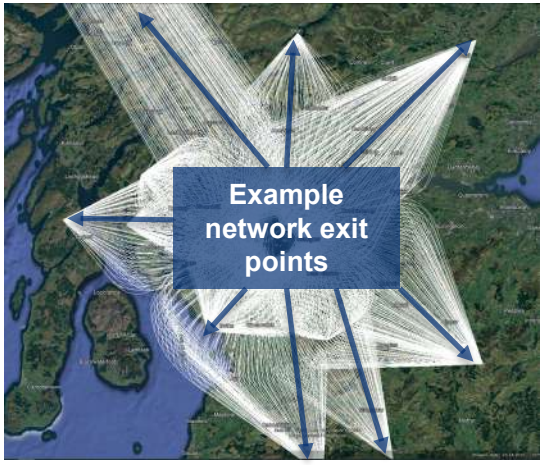
To ensure we investigate as many options as practicable within the envelopes, the design envelopes have been ‘flooded’ with hundreds of notional flight paths.

This allows insight into which areas of the design envelope may have the potential to best meet the design principles.

The notional flight paths are developed to join network entry/exit points (where aircraft enter/exit the airspace above 7000ft). These groupings allow us to create system options (groups of workable departure and arrival routes) later in this process.

Although notional flight paths are based on the basic principles of the rules Instrument Flight Procedure designers use when designing arrival and departure routes, **they are not considered final flight paths.** It is intended that they will be refined as we progress through the process to incorporate greater IFP detail. As we are undertaking this work, we will use map underlays and continue to process any developments through the database.





3. OUR APPROACH

Design Envelope Flooding

Design Envelope Flooding

Design Principles 1 5 7 8 12 13 14

Arrivals

All notional flight paths assume a continuous descent from 7,000ft to meet DP13.

Arrivals were developed to turn onto the final approach at 8nm - 18nm (14.8km – 33.3km)

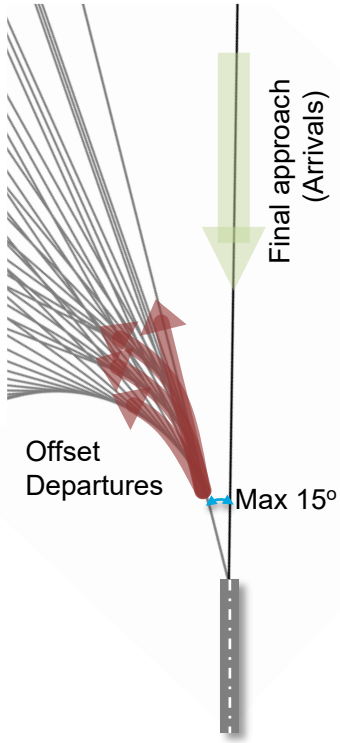
Departures

Departures were developed with initial turns at:

- 1.0 nautical miles (Around 1.9km)
- 1.5 nautical miles (Around 2.8km)
- 2 nautical miles (Around 3.7km)
- 3 nautical miles (Around 5.6km
- 4 nautical miles (Around 7.4km)
- 5 nautical miles (Around 9.26km)

All departures assume a continuous climb to 7,000ft to meet DP13.

There are also departures that have a track adjustment (a small turn) immediately after departure. These are called **offset departures**. They are used to look at options to avoid overflying communities close into the airport with arrivals and departures. An illustrative example is shown on the diagram opposite.



Illustrative example of offset departures

3. OUR APPROACH

All Arrival Notional Flight Paths:

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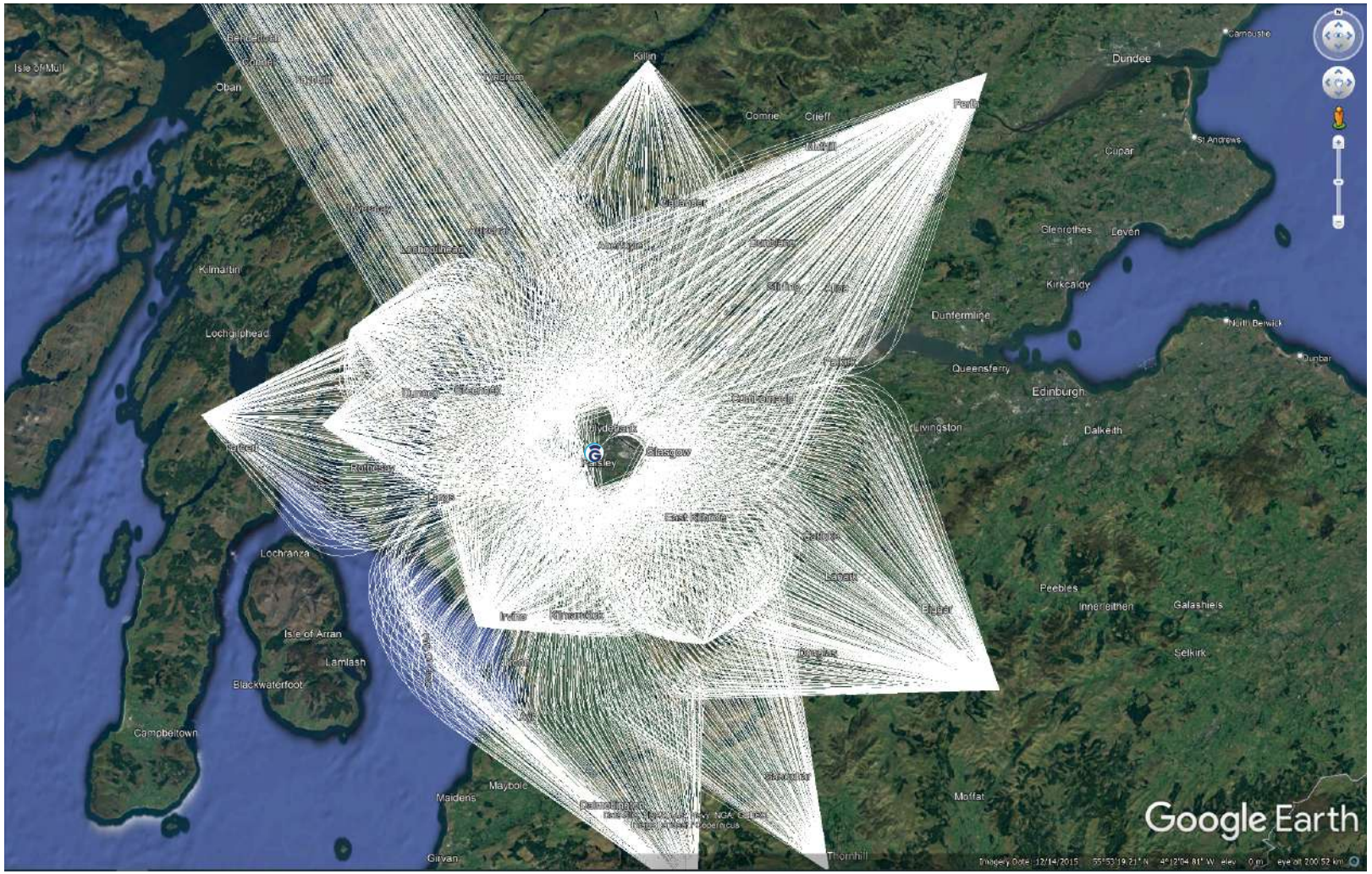
3. OUR APPROACH

All Departure Notional Flight Paths:



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3. OUR APPROACH

Airspace Design Database

Design Principles 2 3 5 7 8 12 13 14 15

An Airspace Design Database was created which allowed high performing notional flight paths to be identified. These are the flight paths which most align with our Design Principles.

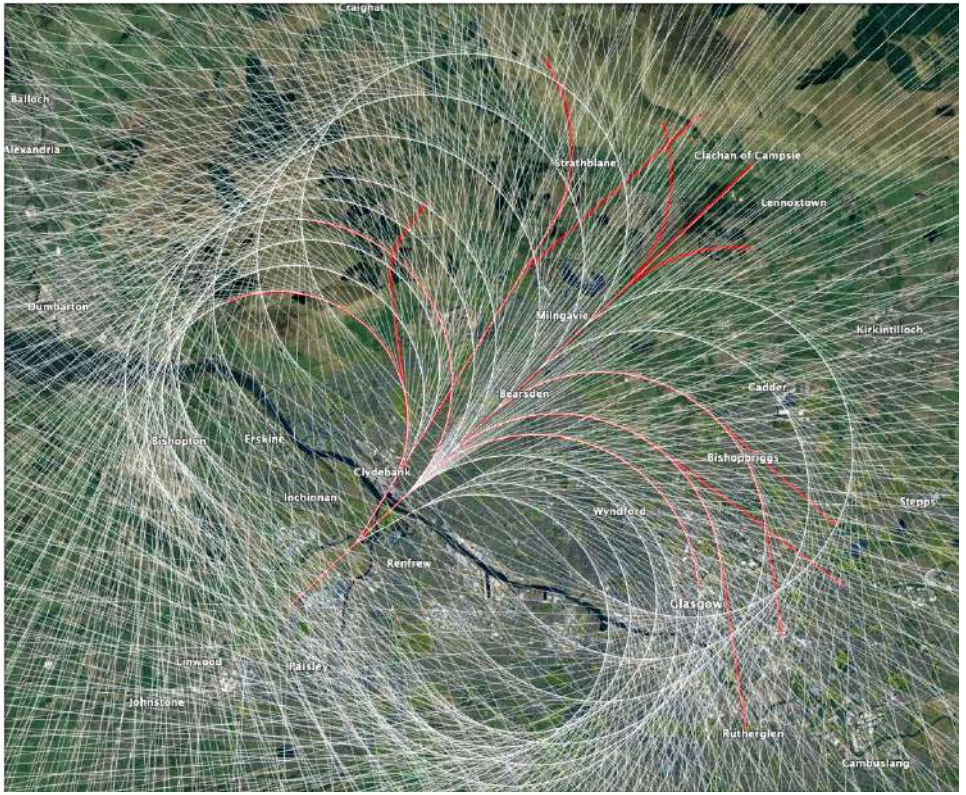
The database includes a noise assessment of each path, based on single noise events such as L_{Amax} and overflight metrics. It also includes track mileage to enable high level comparison of potential fuel burn / CO_2 and information about whether an option would require additional new Controlled Airspace.

Our Noise Assessment Methodology
Our noise assessment methodology must comply with the requirements set out in CAP1616 and CAP2091 (the CAA's policy on minimum standards for noise modelling).

However, CAP1616 advocates a proportionate approach to assessment and the CAA recognises that it is not always proportionate to undertake detailed noise modelling to the requirements set out in CAP2091 when appraising the comprehensive list of options at Stage 2.

Therefore, in consultation with the CAA, we have developed a more proportionate approach for this stage of the assessment. This involves the use of a noise calculation tool with simplified assumptions such as standard flight profiles, allowing us to calculate noise indicators for thousands of flight path options.

For the Full Options Appraisal at Stage 3, and any subsequent noise assessment, we will undertake detailed noise modelling with airport specific assumptions in line with the standard of noise modelling set out in CAP2091.



Comprehensive List of Options Development

3. OUR APPROACH

Comprehensive List of Options Development

All Design Principles

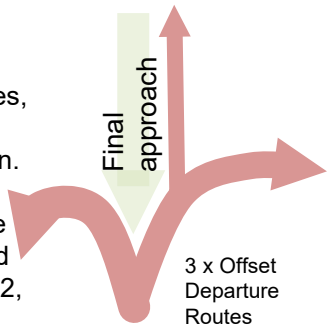
The Airspace Design Database has given us the high performing notional flight paths for each network exit/entry group however this only looks at the paths as individuals. In order to develop options that meet DP2, 4, and 6, we needed to consider how systems of arrivals and departures routes would work together, for example to create respite.

To achieve this, we developed concepts. The final stage in the process was to bring together the concepts and the best performing notional flight paths from the Airspace Design Database:

Concept

Concepts describe broad directions or splits of routes, that take into account expected traffic distribution.

These are informed by the runway capacity study and in order to try to meet DP 2, 4 & 6.



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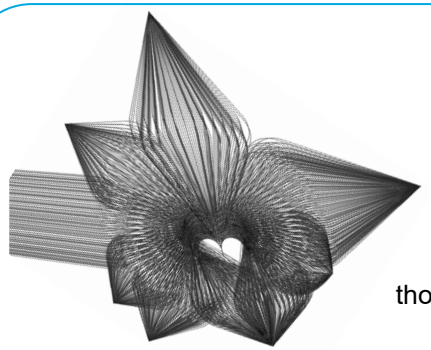

Airspace Design Database

Contains noise, environment and airspace data on thousands of notional flight paths.

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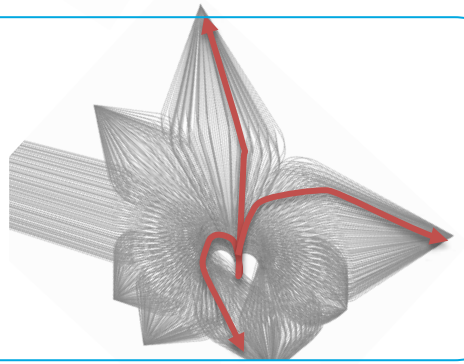
Airspace Option

The airspace option brings together the concept and the best performing notional flight paths alongside separation standards and other technical experience*, to build system options that form our initial comprehensive list of options.

*To create working systems is a complex task and therefore this is a collaborative group exercise between ATM experts, IFP designers, and ATC.



Illustrative example only

Any questions?

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