Edinburgh Airport Airspace Change Programme 2022

Stage 2 Develop and Assess

Options Development

Document control

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Edinburgh Airport: Airspace Change Programme
Stage 2: Develop and Assess
ACP-2019-32

Options Development

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1 Introduction

1.1 Background

The airspace change project for EDI as per UK CAA CAP1616 is currently at Stage 2; a stage that involves two steps – Develop (2A) and Appraisal (2B). As part of this stage, EDI - as the proposal's sponsor – is required to develop a comprehensive list of options that meet the Statement of Need and that are aligned with the Design Principles in Stage 1.

This document provides an explanation of steps taken by EDI in the first part of Stage 2; Step2A to develop the options for revised arrival and departure routes at EDI. The document also shows how the options have evolved from an initial list of all possible options through to a longlist of options that will be taken forward to Step 2B Options Appraisal.

The explanation is supported by a number of maps that portray the options over a simplified map of the part of Scotland under the Edinburgh TMA[1]; the Firth of Forth and associated population settlements.

1.2 Operational concepts at EDI

As background to the Design Principles, the operational concepts that affect the flight operations at EDI are discussed here. In principle, this material is reflected in that already published in the Stage 1 documentation and is available on the CAA airspace change portal[2].

Like many airports, EDI's air traffic consists of a complex mix of air operators. This includes domestic passenger and cargo operations, European & long-haul passenger operations and general / business aviation. In addition to the above operating into and from EDI, some general aviation flights pass through the EDI TMA. Using 2019 figures, the last prior to the COVID-crisis, EDI had about 360 flights[3] a day and 130 000 flights a year.

Table 1: Runway usage at Edinburgh Airport

Runway	2015		2016		2017		2018		2019		2020		2021	
	ATMs	**%age**	**ATMs**	**%age**	**ATMs**	**%age**	**ATMs**	**%age**	**ATMs**	**%age**	**ATMs**	**%age**	**ATMs**	**%age**
06	23,365	20.6	38,692	31.9	27,761	21.8	39,994	30.9	43,696	33.2	8,039	17.5	13,654	23.8
24	89,842	79.3	82,629	68.1	99,667	78.2	89,437	69.1	87,924	66.8	37,927	82.5	43,680	76.2

Air Traffic Movements (ATMs) per runway at EDI

Edinburgh Airport is Scotland's capital city airport. The strong demand for services makes it Scotland's busiest airport, flying to more destinations than any other Scottish airport. In 2018, we helped 14.3 million passengers on their journeys putting us in the top 10 UK airports, in position six behind the three big London airports - Heathrow, Gatwick, Stansted: plus, Manchester and Luton.

The airport has a single runway, oriented northeast / southwest. By reference to the compass heading, when the runway in use is used to the northeast, it is referred to as 06 (generally 060 degrees) and 24 (generally 240 degrees) when the used towards the southwest. The runway direction in use on a given

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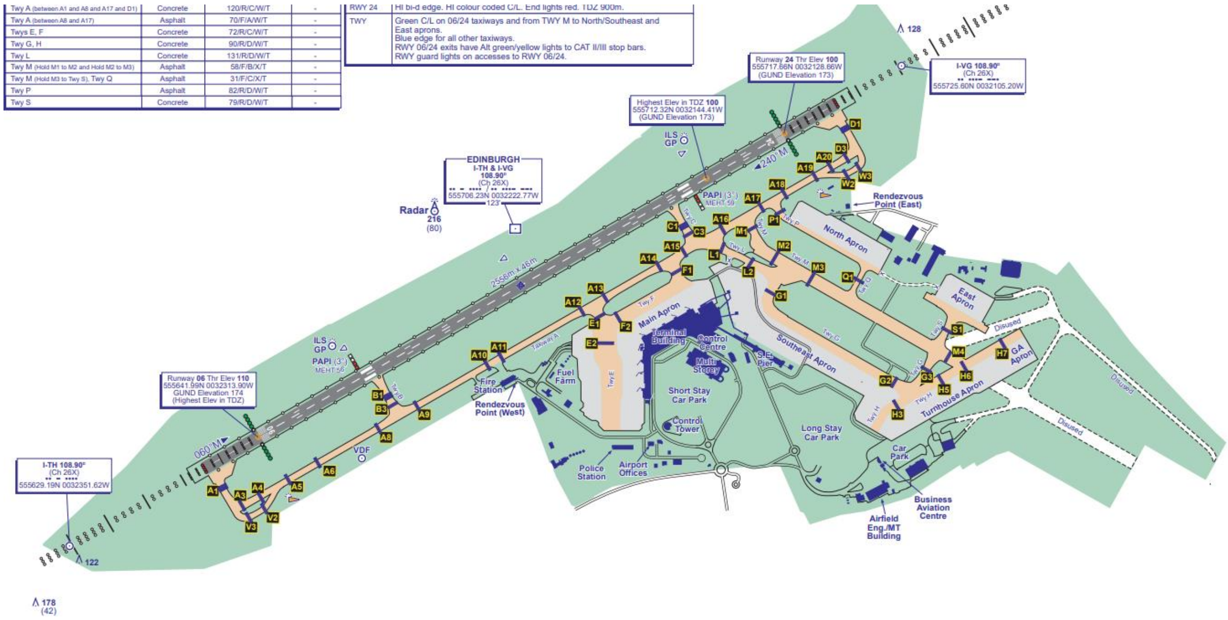
1 TMA = Terminal Manoeuvring Area; a designated area of controlled airspace surrounding a major airport where there is a high volume of traffic.

2 See Airspace change proposal public view (caa.co.uk)

3 In this context, a flight is equal to one arrival and one departure

day is selected based on the wind direction. Aircraft take off and land in the same direction, a direction that is into the wind. This means that the runway in use may change during the day if the wind direction changes.



EDI runway orientation

The typical flight patterns include a wide range of flights, including night-time mail & cargo flights to the Highlands and Islands, business & leisure flights to and from the rest of the UK and Europe and some intercontinental passenger flights. A specific feature of flight operations at Edinburgh Airport is that a relatively large number of aeroplanes end their working day at the airport and depart, often close together in the morning. This is known as the first wave of departures. The practice arises from the need, on the part of airlines, to maximise their utilisation of their aircraft and as soon as possible after the airport opens, they wish to depart. The practice is partly influenced by the fact that no airlines have their home base at EDI.

The traffic mix at EDI may be divided into various categories, including speed, mass and engine type. Doing so, provides the following distribution:

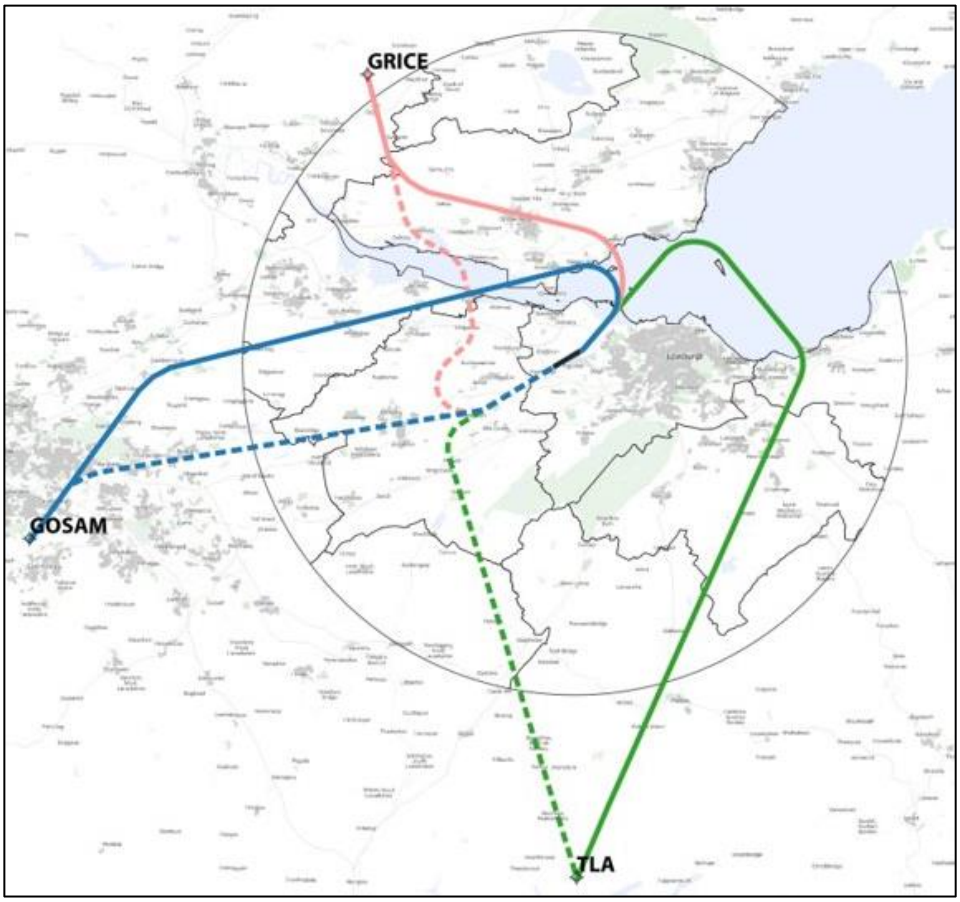
Speed	**Slow**	**Semi-fast**	**Fast**
	11%	19%	70%
Mass	**Light (< 5700 kg)**	**Medium**	**Heavy (> ca. 100 tons)**
	1%	97%	2%
Engine type	**Piston propeller**	**Turbo-propeller**	**Jet**
	1%	29%	70%

The destinations that EDI serves are such that they can divided geographically as follows:

- Northbound: ca. 7% of flights
- West / Southwest-bound: ca. 43% of flights
- East / Southeast-bound: ca. 50% of flights

This traffic has, historically, been channelled to and from the airport via three waypoints

- GRICE – north of Dollar, Clackmannanshire (56° 11.48N 003° 41.08W)
- GOSAM – north of East Kilbride (55° 47.19N 004° 12.02W)
- TALLA - between the Talla and Megget reservoirs in the Borders (55° 29.57N 003° 21.10W)



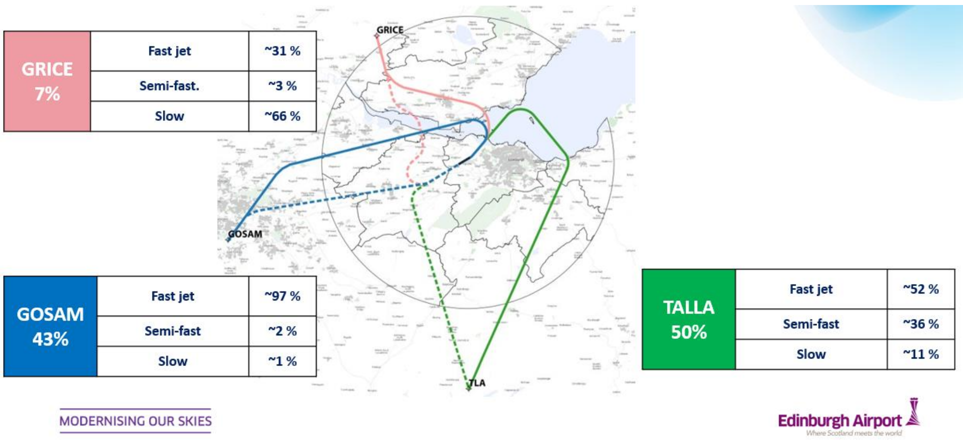
Current routes to and from EDI from the GRICE, TALLA and GOSAM

The three points are part of the controlled airspace surrounding EDI.

These three points are used for both runway 06 and 24. In reality, aeroplanes fly variations of these routes due to weather, navigational inaccuracies and instructions from air traffic control.

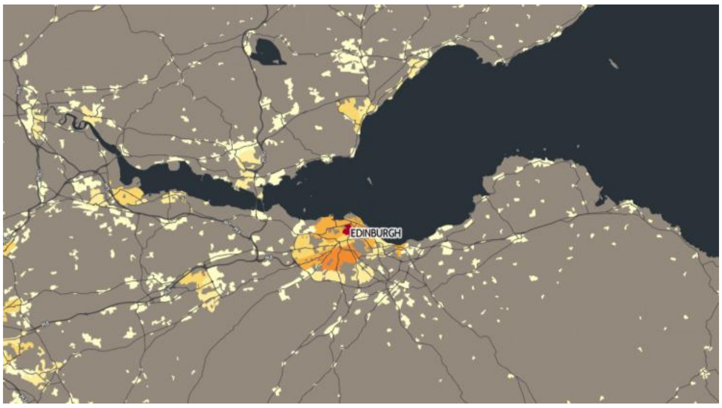
Instrument flight procedure regulations dictate, to an extent, where the routes may be placed. For example, according to the requirements, routes must be placed within the TMA and no closer to 3 NM from the boundary of that TMA. In EDI's case, a long standing exemption exists whereby routes are as close as 2 NM from the boundary, thus reducing the size of the controlled airspace.

The typical division of traffic types, by speed category, per route is as follows:



It is the purpose of air traffic control to safely and efficiently handle the air traffic that the airport attracts. Commercial aeroplanes, especially jet powered ones, operate most efficiently at altitude. It is therefore ATC's preference that flights climb to their cruising altitude as soon as possible. Conversely, a continuous descent towards the runway when landing is also desirable. This is not always possible. Weather and other aeroplanes may affect the traffic flow. Nevertheless, as a rule, ATC will normally try to have departing traffic climb over arriving traffic. This has the benefit of reducing the area on the ground that is most exposed to noise as departing traffic produces more noise than arriving traffic.

1.3 Areas of population within the EDI TMA



Population (2011 census data) map of the eastern part of the Central Belt (Source: Datashine Scotland)

Edinburgh's TMA is slightly smaller than the eastern part of Scotland's Central Belt. Population density in the Central Belt is higher than elsewhere than in the rest of the country. Significant density is noted in the City of Edinburgh, with that area bounded by the Forth coast and the city's by-pass. Other main population concentrations include[4]:

- along the M8 motorway; e.g. Livingstone;
- the Forth crossing; e.g. a north-south line from Queensferry to Dunfermline;
- an area in Mid-Lothian to the south and south-east of the City of Edinburgh, e.g. Penicuik and Dalkeith.
- locations along the southern Forth coastline, e.g. Musselburgh and Prestonpans;
- locations along the norther Forth coastline, e.g. Burntisland, Kinghorn and Kirkcaldy, and
- towns in central Fife orientated in an east-west line including Cowdenbeath and Glenrothes.

The centre of the City of Edinburgh has the highest population density in the TMA; approximately 119 persons per hectare. The rest of the city has densities that vary from 15 to 50 persons per hectare. The range of 15 to 50 persons per hectare is typically for the population concentrations mentioned in the list above. Rural areas between the towns have population densities of between 10 and < 1 persons per hectare.

When seeking to minimise the number of persons that are overflown (see Design Principles 7, 8 and 9), it is important to recognise that flying over the centre of the City of Edinburgh will not achieve that design goal. In addition, and as an extension of the same idea, the rural areas between areas of more dense populations do help meet these goals. Without prejudice to the CAP1616 process, this means that

[4] this list is solely illustrative

a route over Musselburgh of Prestonpans meets Design Principles 7, 8 and 9 less well than one that passes between, say, Longniddry and Aberlady.

1.4 Effect of COVID on capacity

The COVID-19 crisis on 2020 and 2021 had a great impact on flight operations at Edinburgh Airport in the same way as it did across the world. It is important to note that the problems experienced at airports in the summer of 2022 – delays, longs queues and inefficient handling – are, in part, the result of flight numbers picking up again and at a faster rate than was planned for. We believe that the general picture of growth from 2023 that was predicted prior to 2020 remains valid.

Studies conducted by Edinburgh Airport have shown, however, that there are some effects of the COVID-19 crisis that have a bearing on future air traffic. An increase in remote working, when compared to 2019, will result, we believe, in less business traffic between Edinburgh and London. This will have an impact on traffic on the TALLA route.

The figures below show how the forecast traffic numbers have changed with the effects of Covid. This forecast has been produced by the Edinburgh Airport Aero team.

	Peak demand in 2022			Peak demand in 2019		
Year	Peak A Flights	Peak D Flights	Peak A+ D	Peak A Flights	Peak D Flights	Peak A+ D
2019	23	25	38	22	26	37
2023	23	25	38	24	29	40
2024	24	26	41	25	30	42
2025	25	26	43	25	31	42
2026	25	27	44	26	31	43
2027	26	28	46	27	33	45
2028	26	28	46	27	33	46
2029	26	28	45	28	34	46
2030	27	28	46	28	34	47
2031	27	29	46	29	35	48
2032	27	29	47	29	36	49
2033	28	30	47	30	37	51
2034	28	30	48	31	38	52
2035	28	30	48	31	38	52
2036	29	31	48	32	39	53
2037	29	31	49	32	40	54
2038	29	32	49	33	41	56
2039	30	32	50	34	42	57
2040	30	33	50	34	42	58
2041	31	33	51	35	43	59
2042	31	34	51	35	44	59
2043	32	34	52	36	44	60
2044	32	35	52			
2045	32	35	53			

The effects are quite marked and for comparison the peak demand in the recent forecast for 2037 for example is 49 movements per hour (arrivals and departures) compared to the 54 movements per hour that was forecast pre-pandemic.

2 Airspace change process

2.1 Recap of Stage 1

Using material published in EDI's Stage 1 gateway submission to the CAA[5], the following recap of Stage 1 is provided as information.

EDI submitted a Statement of Need (CAA reference DAP1916-2788) to the CAA on 12 April 2019 and published this on the CAA's airspace change portal on 14 April 2019 as pr CAP1616[6]. In that document, EDI proposed to:

"… modernise Edinburgh Airport's flight paths to meet technical requirement and improve airspace and capacity. These new routes will take advantage of improved navigational capability, which will allow better planning and increase the capacity of the airspace and the runway, particularly in peak times. This will also minimise the environmental impacts of flights in terms of the total number of people flown, as well as when and how often they are overflown – while also cutting average CO_2 emissions. We believe an improved airspace with the right flight paths and technology for Edinburgh Airport will ensure that our airport can meet existing and future demand by increasing the capacity of its runways and allow flights to depart with fewer delays and environmental impacts".

The Statement of Need can be summarised in three main drivers for the airspace change project. These are described in the table below and are reflected in the sixteen design principles that were developed in Stage 1.

Driver	Purpose of driver	Relationship to Statement of Need
PBN	Modernise airspace	"to meet technical requirements"
Airspace capacity	Reduce delays, prepare for future growth	"can meet existing and future demand by increasing the capacity of its runways and allow flights to depart with fewer delays and environmental impacts ."
Environment	May minimise environmental impact	"in terms of the total number of people overflown, as well as when and how often they are overflown – while also cutting average CO_2 emissions."

[5] CAP1616 Stage 1 Gateway Submission to CAA, Ref. ACP-2019-32, Version Final V3, dated 28 June 2021

[6] See Stage 1, Step 1a Appendix E: Statement of Need v2

From an initial longlist of 52 principles, a list of 16 Design Principles was submitted to, and was agreed by, the UK CAA:

Category	**Number**	**Design principle**
Safety (core)	FDP1	The airspace design and its operation must be as safe or safer than it is today.
Safety (core)	FDP2	Flight paths must be flyable and technically supported by air traffic control and airport technical management systems.
Operational (core)	FDP3	Flight paths must be designed to allow modern aircraft to use performance-based navigation (PBN) in line with CAA's modernisation strategy
Operational (core)	FDP4	Routes to/from Glasgow and Edinburgh airports must be procedurally deconflicted from the ground to a preferred level in coordination with NATS Prestwick.
Operational (core)	FDP5	The predictability of flight tracks must be maximised for consistency of operations.
Operational (core)	FDP6	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 and accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it.
Health and wellbeing	FDP7	Flight paths should be designed to minimise the total adverse effect on health and quality of life created by aircraft noise and emissions.
Health and wellbeing	FDP8	For flightpaths at or above 4,000ft to below 7,000ft, 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 this would disproportionately increase CO_2 emissions.
Health and wellbeing	FDP9	Flight paths should be designed to minimise population overflown below 4,000ft and, between 4,000ft and 7,000ft, taking into account any potential adverse impact, due to those overflown having protected characteristics, as defined by the Equalities Act 2010.
Health and wellbeing	FDP10	Flight paths should be designed to minimise overflying sensitive locations and noise-sensitive receptors (for example, the zoo, retirement complexes, green spaces, historic heritage sites, and others).
Health and wellbeing	FDP11	Flight paths should be designed to include track concentration and/or track dispersal options to provide noise respite.
Operational	FDP12	Flight paths should be designed with routes that minimise track miles and fuel burn.
Operational	FDP13	Flight paths should be designed to ensure efficient and effective route management.
Technical	FDP14	Requirements of airspace users should be taken into account when designing flight paths.
Environment	FDP15	Flight paths should be designed to minimise adverse local air quality impacts.
Economy	FDP16	Airspace should be designed to maximise capacity in order to contribute economic benefits to Scotland, including tourism and trade.

Design Principles

The list of 52 initial principles was refined and distilled to the sixteen described above during a workshop held at EDI in October 2019. Attendees at this workshop were brought together by the change sponsor for their expertise in technical, aviation, air traffic, environment, noise, health and operational areas. The workshop was observed by The Consultation Institute as part of the Institute's evaluation of our engagement activity. The Stage 1 submission to the CAA, including Appendices P and R, provides more detail on how the initial list was reduced to the above sixteen Design Principles. It is from these Design Principles that Options will be developed so that the Statement of Need can be met. The table in 3.1 below contains some basic metrics per Design Principle to help stakeholders understand what it is that the Design Principles are intended to achieve.

2.2 Step 2A - Options Development

2.2.1 Process to be followed

According to CAP1616[7], Step 2A "…requires the change sponsor to develop a first comprehensive list of options … that address the Statement of Need.

As part of Step 2A EDI has developed a first comprehensive list of options – represented by a number of swathes. These options address the Statement of Need and are intended to align with the Design Principles that were developed and approved by the CAA in Stage 1. These swathes will be tested by those stakeholders that were engaged with in Step 1B of the Airspace Change Programme. This is intended to ensure that the stakeholders are satisfied that the design options are aligned with the Design Principles and that EDI has correctly addresses the stakeholder's input in Stage 1. Included in this engagement, EDI will identify critical interdependencies with neighbouring air navigation service providers and other airports and airspace users. Where such interdependencies exist, suitable mitigations will be developed to resolve any issues that arise.

This work is preparation for Stage 2B, the Options Appraisal. This stage will expand on the work performed in 2A by delivering clear and comparable evidence for a range of factors, to allow the different airspace design options to be compared and assessed on the basis of those factors.

2.2.2 From Statement of Need to Longlist of Options

Behind the descriptions of the three drivers described above, lie a number of issues, all of which need to be addressed in the final design. They have been included in the discussions around the development of the longlist of options. It is stressed that the drivers listed below do not overrule the agreed Design Principles. The drivers are however fundamental to the creation of the Options that are required by Stage 2 of the Airspace Change Programme. These issue are summarised as follows:

Driver	Issues
Modernise airspace	Whilst aircraft currently use ground-based navigation aids and ATC instructions to navigate, the ground-based navigation aids will be phased out in near future by the introduction of RNAV routes that use satellite-based navigation aids
	Systemise airspace system to lower workload for ATCOs by, for example, less vectoring and reducing the number of instructions that have to be given
	Concentrate aircraft flight paths closer to the defined routes and deliver a more predictable flight path

[7] CAP 1616 paragraphs 124 - 132

	Deconflict routes from each other at EDI and between EDI and Glasgow Airport
	If possible, make arrangements to accommodate aircraft not able to operate on RNAV routes
Reduce delays, prepare for future growth	Increase the departure interval so that there is less time between successive aircraft taking-off, whilst leaving a safe interval between successive departures. This is especially important for the so-called first-wave of departures in the morning
	Create points on the departure routes where they split from one another
	If needed, create separate routes for fast and slow aircraft
(May) minimise environmental impact	The revised routes should aim to reduce the total number of people that are overflown below 7000 ft and particularly below 4000 ft
	When overflying communities consider sensitive locations and noise-sensitive receptors
	Consideration to when and how often communities are overflown
	Future routes aim to reduce average CO_2 levels produced by air traffic

It is a complete and satisfactory answer to these issues that will dictate where the final routes are placed. This stage does not seek to propose specific routes; it proposes potentially suitable swathes between the runway and the exit points that can be evaluated against the Statement of Need.

3 Application of the Design Principles

3.1 Discussion

The Airspace Change Programme seeks to use the Design Principles to fine tune the three main drivers by making changes to the airspace system, the ATC system and/or the structure of the routes used.

The current route structure provides three possible departures from each of the runway ends.

The Options described below are those required by Step 2A of the CAA's CAP1616.

A number of aeronautical constraints are noted. These constraints are not necessarily insurmountable, but will need to be considered as part of the each option. These are:

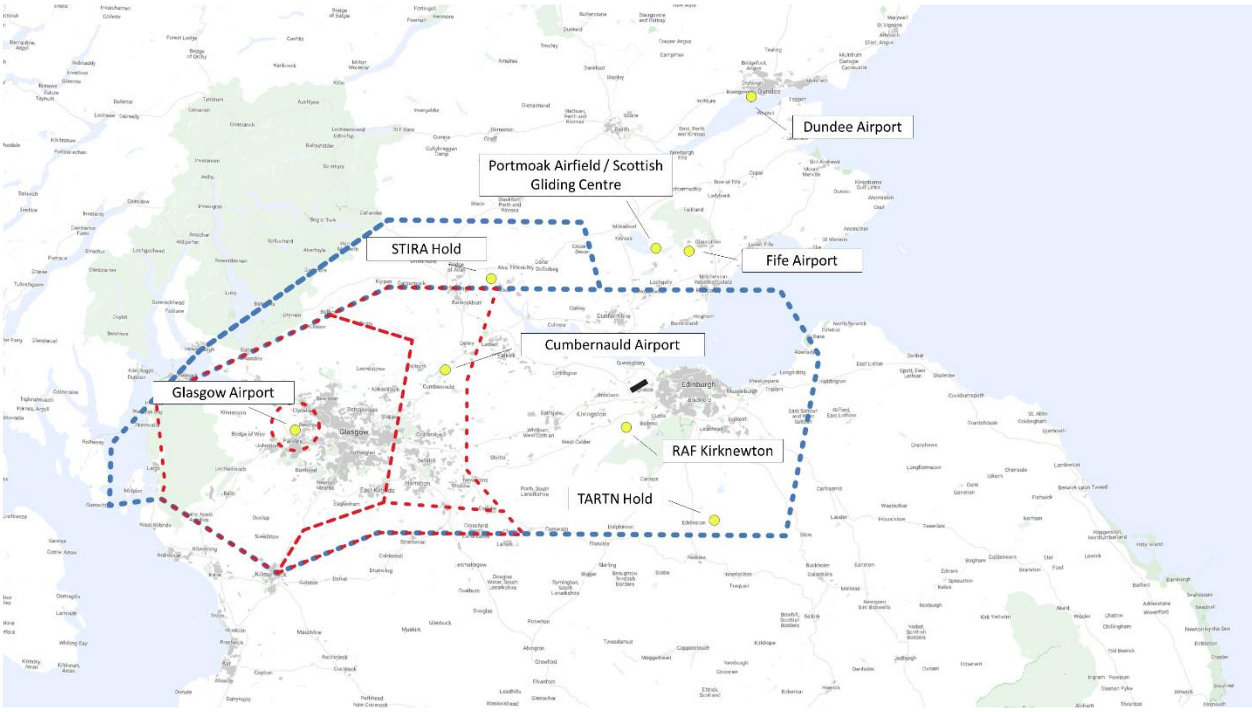
3.2 Airspace features

- Boundaries of controlled airspace around Edinburgh
- North Sea danger areas (in particular, Area 5, D613, D513)
- STIRA hold, 56°08'02.1"N 3°50'01.0"W above Tullibody, Clackmannanshire
- TARTN hold, 55°43'01.9"N 3°08'18.7"W between Penicuik and Peebles, Borders

Airports

- Cumbernauld Airport, Cumbernauld, North Lanarkshire
- Dundee Airport, Dundee, Fifie
- Fife Airport, Glenrothes, Fife
- Glasgow Airport, Paisley, Renfrewshire,
- Portmoak Airfield, Kinross, Fife / Scottish Gliding Centre
- RAF Kirknewton, Kirknewton, West Lothian

These features, together with the boundaries of the lower controlled airspace in the central belt are shown in the figure below.



3.3 Systemisation

In the table above, under modernisation, the idea of "systemisation" is introduced. This term refers to a change in the way air traffic services are provided in busy modern airspace that is managed with a high degree of automation.

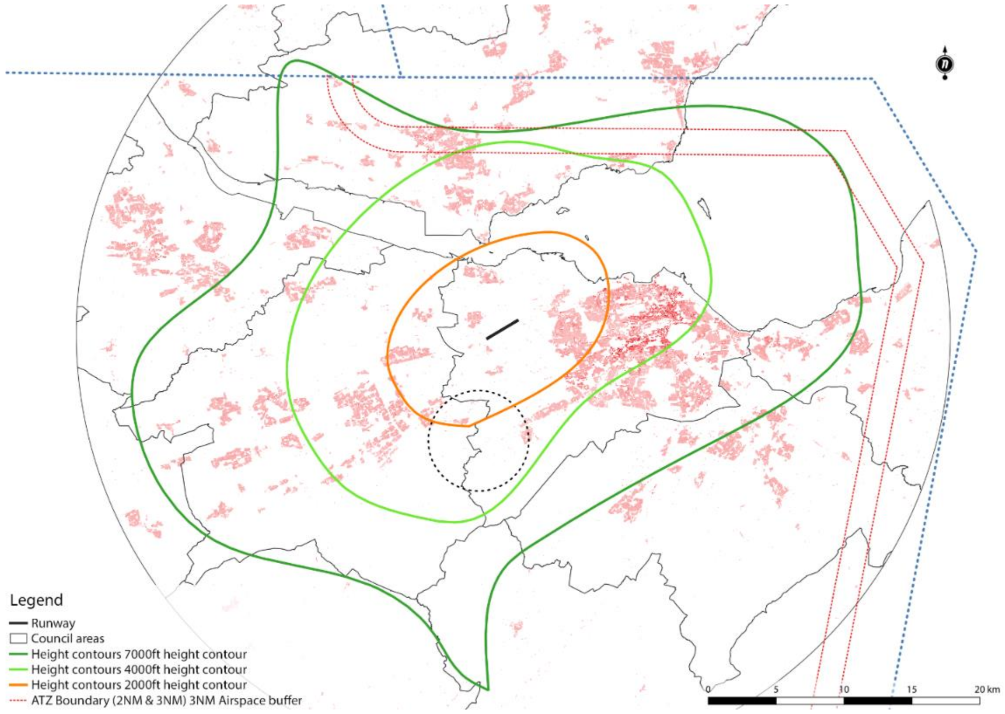
Historically, air traffic was not necessarily guided in an out of an airport with the application of strictly applied procedures. As technology developed to improve navigational accuracy and the volume of traffic grew, more and more procedures have been applied to the way that aeroplanes arrive at and depart from an airport. The more procedures that are applied, the less flexibility is available to pilots and air traffic controllers as to where they fly as the application of procedures and processes that require less tactical intervention by the air traffic controller or the flight crew member serves to improve the predictability of the service offered. This practice, this means that aeroplanes are vectored off the published routes less. For those on the ground, vectoring provides a form of respite, albeit an unpredictable one and systemisation removes it.

3.4 Options for departures

3.4.1 Do-nothing

The do-nothing option is to 'translate' the existing procedures into RNAV ones by overlaying these new procedures over the existing ones. Such a step meets the UK CAA's desire to implement RNAV-procedures in the United Kingdom. RNAV-procedures will permit greater navigational accuracy of flights out of Edinburgh. It also has the effect of concentrating traffic into a smaller swathe as the route is flown to a greater degree of accuracy. It does not generate any additional capacity for the airport.

The figure below indicates the typical location of heights above the airport achieved by departing traffic from EDI under the current system.



3.4.2 Three optimised routes

The next possible step would be to introduce RNAV-procedures but instead of an overlay of the current situation, consider optimising the track of the routes to the three exits points; GRICE, TALLA and GOSAM, so as to minimise noise at altitudes up to 4000 ft and reduce emissions between 4000 ft and 7000 ft. In practice, emissions are best reduced by flying as short a route as possible from the runway end to the exit point.

The route directions above have been transformed into a number of swathes for the purpose of Stage 2A. These swathes comprise the space wherein routes from the runway to the exit points could be placed. The inside edge of the swath is based on the minimum radius of the turn that is permitted under instrument flight procedure design regulations. The outside edge of the swathe represents an arbitrary boundary beyond which trac miles (i.e. CO_2 emissions) start to make the swath unrealistic against the design principles.

Such a step meets the UK CAA's desire to implement RNAV-procedures in the United Kingdom. RNAV-procedures will permit greater navigational accuracy of flights out of Edinburgh such that 95% of all aeroplanes will operate within 1 NM of the imaginary line between two points on a straight line. There will also be less dispersal on turns. It also has the effect of concentrating traffic into a smaller swathe as the route is flown to a greater degree of accuracy. It does not generate any additional capacity for the airport. It should be noted that, at this stage and for the purposes of CAP 1616, there is a choice of whether to turn left or right after taking off from runway 06 to head towards GOSAM and a choice of turning left of right when taking off from runway 24 to head towards GOSAM.

In the final design, it is expected that only one option per route will be selected. This step can be developed by considering swathes from both runway ends to the exit points as shown in the figure below.

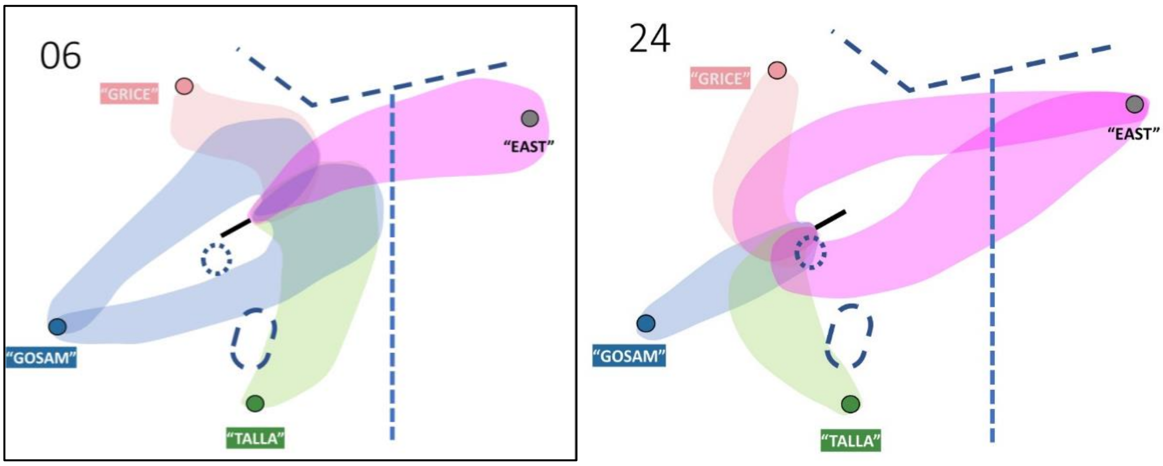
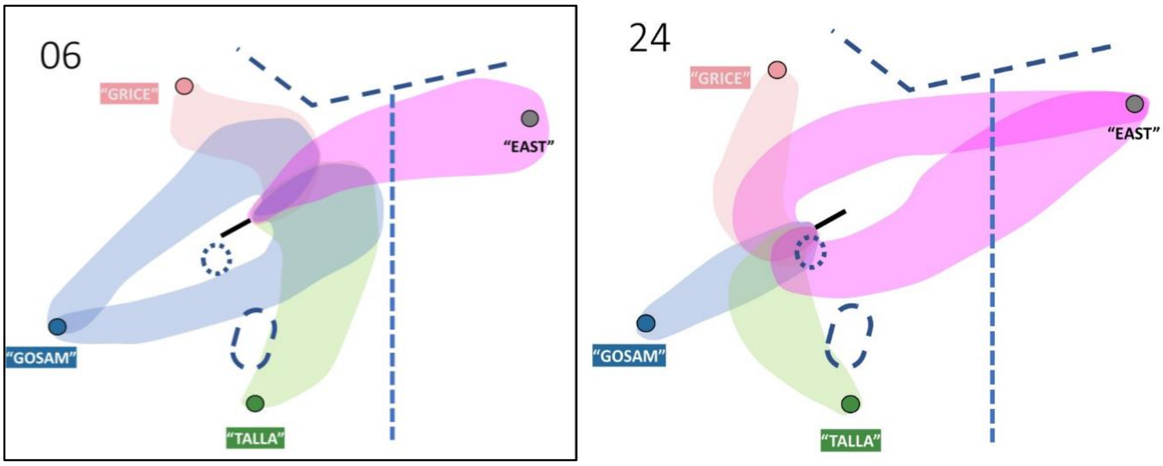


FIGURE: Swathes from both runway ends to four exit points.

3.4.3 Four optimised routes

There is an argument, for both noise and emissions considerations, to introduce a fourth entry / exit point to accommodate traffic to and from northern, eastern and central Europe. This route would reduce the volume of traffic using TALLA. This extra point is considered to be best located in the Firth of Forth and is known, provisionally, as MADAD.

Such a step meets the UK CAA's desire to implement RNAV-procedures in the United Kingdom. RNAV-procedures will permit greater navigational accuracy of flights out of Edinburgh. It also has the effect of concentrating traffic into a smaller swathe as the route is flown to a greater degree of accuracy. It does generates additional capacity for the airport by reducing bottlenecks on the TALLA route. It should be noted that, at this stage and for the purposes of CAP 1616, there is a choice of whether to turn left or right after taking off from runway 06 to head towards GOSAM, a choice of turning left of right when taking off from runway 24 to head towards GOSAM, and a choice of turning left of right when taking off from runway 24 to head towards EAST, the fourth entry / exit point. Both left and right options are shown here. In the final design, it is expected that only one option per route will be selected. This step can be developed by considering swathes from both runway ends to the exit points as shown in the figure below.



3.4.4 Methods to increase departure capacity

One element of the airspace change programme that is of fundamental importance is the examination of means to safely increase departure capacity. This is required as the most critical capacity peaks are at present, and will be in the future, are departure peaks. These are periods, usually up to one hour when the vast majority of flights are departures; i.e. the first hour of every morning.

Two methods have been studied:

- Reduction in separation interval, and
- Splits in the SIDs.

These are both described below.

Reduction in separation interval – At present, the minimum spacing between departing flight is based on time. The separation period is the time between one aeroplane becoming airborne and the next being given permission to take off. At Edinburgh Airport this is usually at least two minutes. This affords a minimum separation, in distance, of at least 3 NM during the departure. Simulation work, using actual take-off performance of flights at Edinburgh Airport, shows that for the aircraft types most often used at the airport, Boeing 737, Embraer E-jet family and Airbus A320 family, can maintain the required separation distance when the time between take-offs is reduced to 90 seconds.

Splits in the departures – At present, the design of the departure routes are such that their initial paths are considered to be the same, meaning that for the purposes of determining the time required between departures, a two-minute interval is the shortest interval possible. This is one of the main restrictions to future growth at the airport as it means that only 30 aeroplanes an hour may depart from the runway (assuming no landings in that theoretical hour). Using instrument flight procedure design regulations, one means of increasing the departure capacity is the use of so-called splits on departure routes. The interval between departing aeroplanes may, as per instrument flight procedure design regulations may be reduced if, immediately after take-off, the preceding aeroplane turns 45 degrees to left or right. In this case, "immediately" means at a point between the end of the runway and a point up to about 2 NM from the runway's end.

The application of splits has, in addition to the increase in capacity from the runway, the benefit of creating some noise respite for communities close to the airport without reducing the predictability of the flight tracks. This respite does not apply to all communities as the path from the runway end to the first split will always be the same. The respite is offered to communities that are under the path of the split. The use of splits are most beneficial from the point of view of capacity as they permit aeroplanes to depart more quickly than at present. The splits could also serve as noise respite at other times too. Splits can be more complicated for airspace users as they can, unless carefully designed, generate different distances on the same SID; something that is not desirable from a fuel-planning perspective.

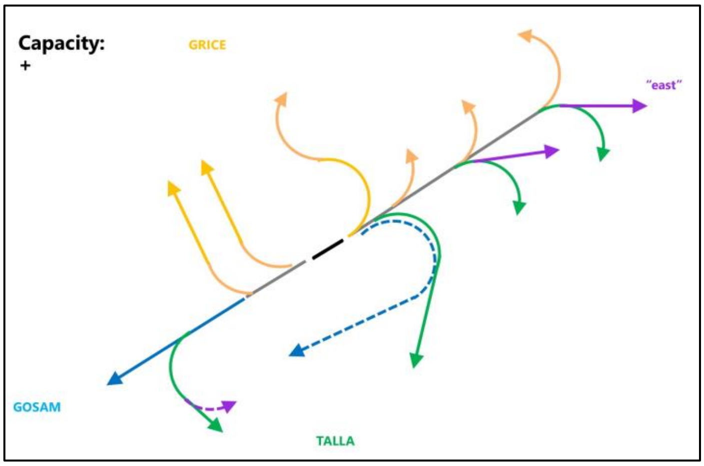


Illustration of the application of splits to departure tracks

The introduction of splits would provide extra departure capacity for EDI and could be of benefit to the airport during the first wave of departures in the morning. There are issues about the complexity of the procedures for flight crew and air traffic controllers that require examination. In addition, the use of splits can assist in providing respite to some of the communities that are overflown.

3.4.4 Other possible departure modifications

Relocate GOSAM - Input from NATS and radar data shows that aeroplanes departing EDI towards GOSAM are significantly higher than 7000 ft – the minimum altitude that would be required – well before GOSAM. It was therefore proposed by NATS that GOSAM could be moved closer to the airport. The main effect of this proposal is that it frees up an amount of controlled airspace.

Overfly RAF Kirknewton – Currently, overflight over RAF Kirknewton – a glider flying site used by the 661 Volunteer Gliding Squadron of the RAF – does not take place. This airport is not used full time – but they do have a letter of agreement with Edinburgh ATC with regard to their opening hours. A route over Kirknewton (only when they were not active) that overflies the airfield may be of benefit to reducing noise to those currently experiencing aircraft noise from EDI. It would, however, introduce a number of new communities to noise.

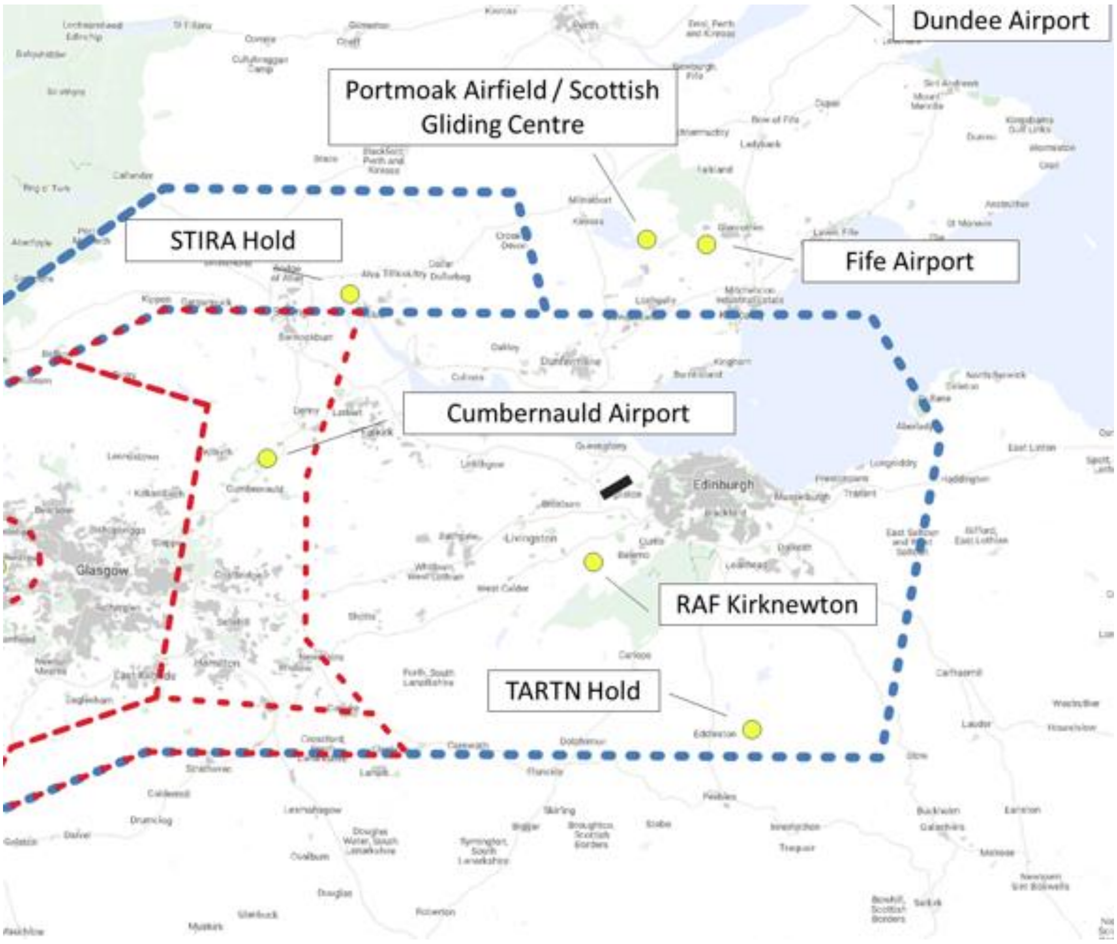
3.5 Arrivals

Instrument approaches are made to both runways using a number of different navigational aids. The most accurate and most frequently used is the ILS approach.

Before being able to commence an approach, aircraft descend from their cruising levels towards an airport in a systemised fashion. At EDI, this consists of three points, GOSAM, GRICE or TALLA. From there, flights descend further to a point at which they are aligned with the runway but are 10 – 15 NM from the runway. Final approach is made towards, the runway with the last part of the descent being made along a three-degree glidepath; the glidepath that the ILS facilitates.

Most traffic arriving at EDI passes over one of three points, GOSAM, GRICE or TALLA. These are the same three points that are used for departing traffic. Passage over these points is usually at or around 7000 ft. To get from the 7000 ft point at the edge of Edinburgh's airspace to a point at which they are aligned with the runway, ATC will provide the flight crew with instructions on how high to fly and in which direction to fly. This is known as vectoring.

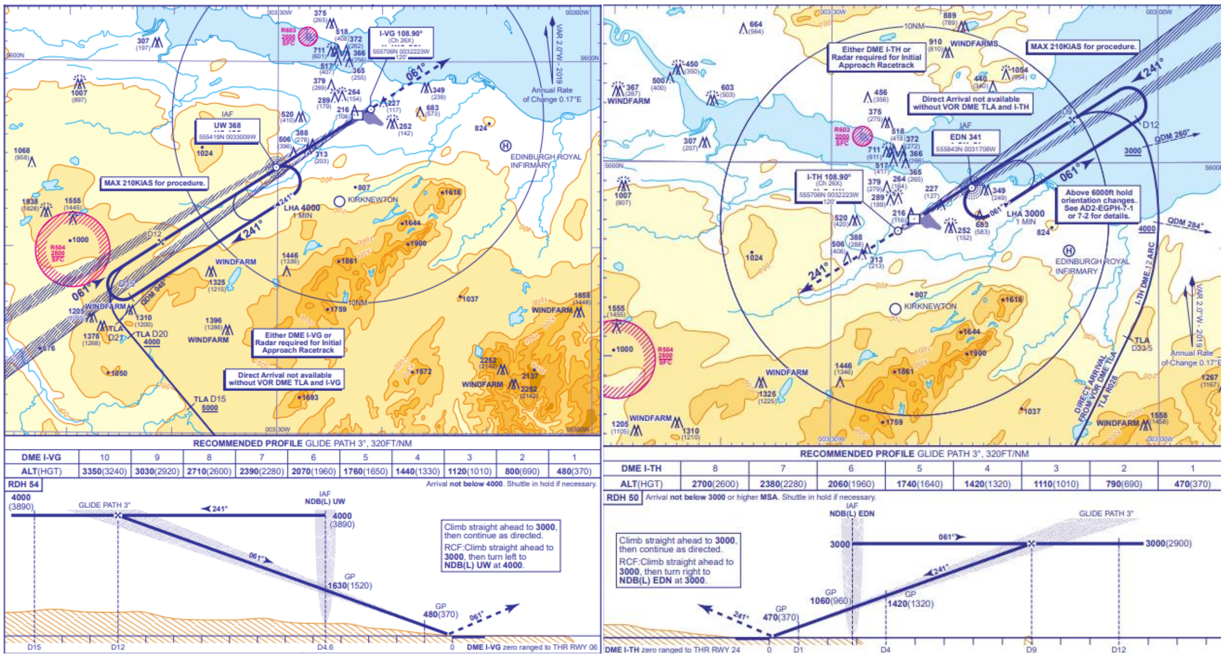
Should capacity not be available in the vectoring area or on final approach, ATC may instruct an aeroplane to enter the hold; EDI was two – one near GRICE known as STIRA and another near TALLA known as TARTN.



3.5.1 Do-nothing

The do-nothing option is to ‘translate’ the existing procedures, described above into RNAV ones by overlaying these new procedures over the existing ones.

In principle, the shortest line from the initial point (GRICE, GOSAM or TALLA) to the point 10 – 15 NM from the runway is preferred to be flown. Under vectoring, the aeroplane may line up somewhat further away from the runway or a little closer. Lining-up for final approach at a distance less than 7 NM, is not common. In addition, vectoring may be used to laterally separate traffic by having one aeroplane fly a longer route to the final approach. It is for this reason that the area shown above is so large.



Aircraft descend to the south of Edinburgh (runway 06) or over the Firth of Forth / Fife coast (runway 24) to an altitude of 3000 ft (runway 06) or 4000 ft (runway 24) before intercepting a radio beam that permits the aeroplane to descend at an angle of three degrees. Aeroplanes descend on the glide path in a straight line towards the runway on passing:

- runway 06 – a point between and to the south of Harthill and Withburn, West Lothian, and
- runway 24 – a point just northeast of Inckeith in the Firth of Forth.

Such a step meets the UK CAA's desire to implement RNAV-procedures in the United Kingdom. RNAV-procedures will permit greater navigational accuracy of flights into Edinburgh. It also has the effect of concentrating traffic into a smaller swathe as the route is flown to a greater degree of accuracy. It does not generate any additional capacity for the airport.

3.5.2 Three optimised routes

As with departures, the introduction of RNAV-procedures can be used to optimising the track of the arrival routes from the three exits points; GRICE, TALLA and GOSAM, so as reduce emissions between 7000 ft and 4000 ft and to minimise noise at altitudes from 4000 ft.

Such a step meets the UK CAA's desire to implement RNAV-procedures in the United Kingdom. RNAV-procedures will permit greater navigational accuracy of flights into Edinburgh such that 95% of all aeroplanes will operate within 1 NM of the imaginary line between two points on a straight line. There will also be less dispersal on turns. Under P-RNAV a T-Bar shaped approaches are considered as default set-up. As required due to airspace constraints, it may be necessary to substitute a T-bar shape for a Y-bar shape.

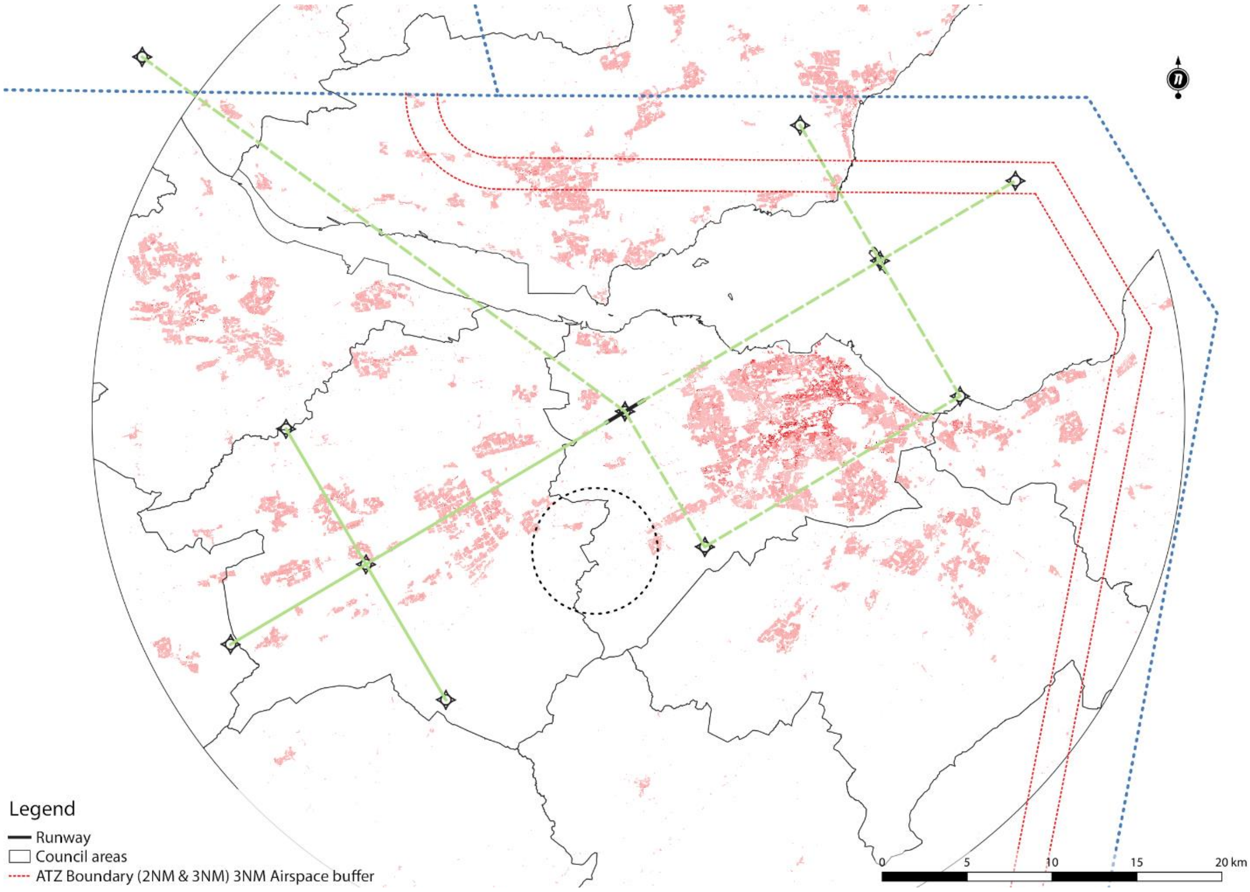


FIGURE: Generic T- and Y-bar for three points

3.5.3 Four optimised routes

If a fourth exit point is generated (see 3.4.3 above) it is logical to use this point for arrivals as well.

Such a step meets the UK CAA's desire to implement RNAV-procedures in the United Kingdom. RNAV-procedures will permit greater navigational accuracy of flights into Edinburgh. It also has the effect of concentrating traffic into a smaller swathe as the route is flown to a greater degree of accuracy. It does not generate any additional capacity for the airport.

The above text describes the do-nothing situation; this is what EDI'S airspace looks like today. As the CAA requires the modernisation of the airspace system, the first change that can be considered is overlaying the current system with a satellite based navigation system; P-RNAV. The application of such a system enables aeroplanes to fly the published routes very accurately. This results in a concentration of traffic such that 95% of all aeroplanes will operate within 1 NM of the imaginary line between two points on a straight line. There will also be less dispersal on turns.

Under P-RNAV a T-Bar shaped approaches are considered as default set-up. As required due to airspace constraints, it may be necessary to substitute a T-bar shape for a Y-bar shape.

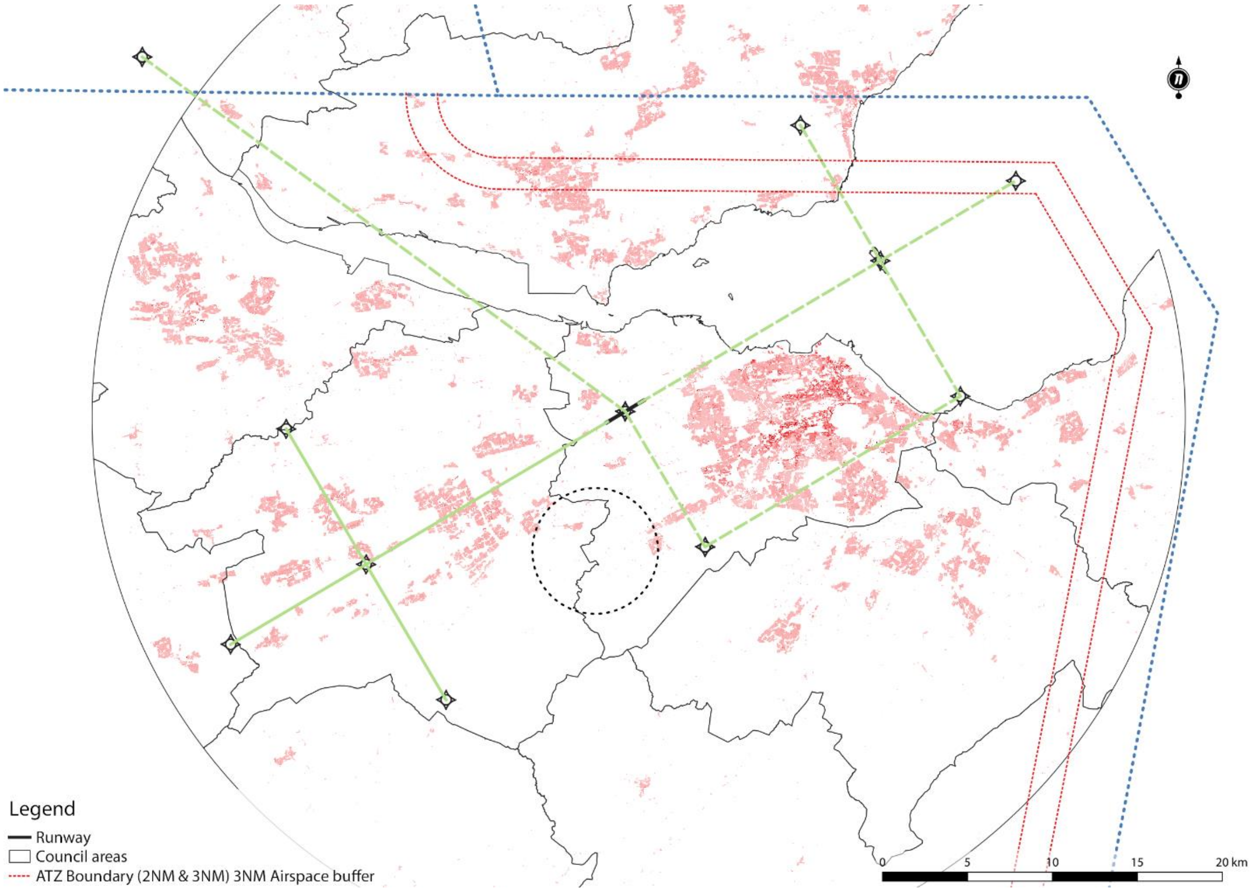


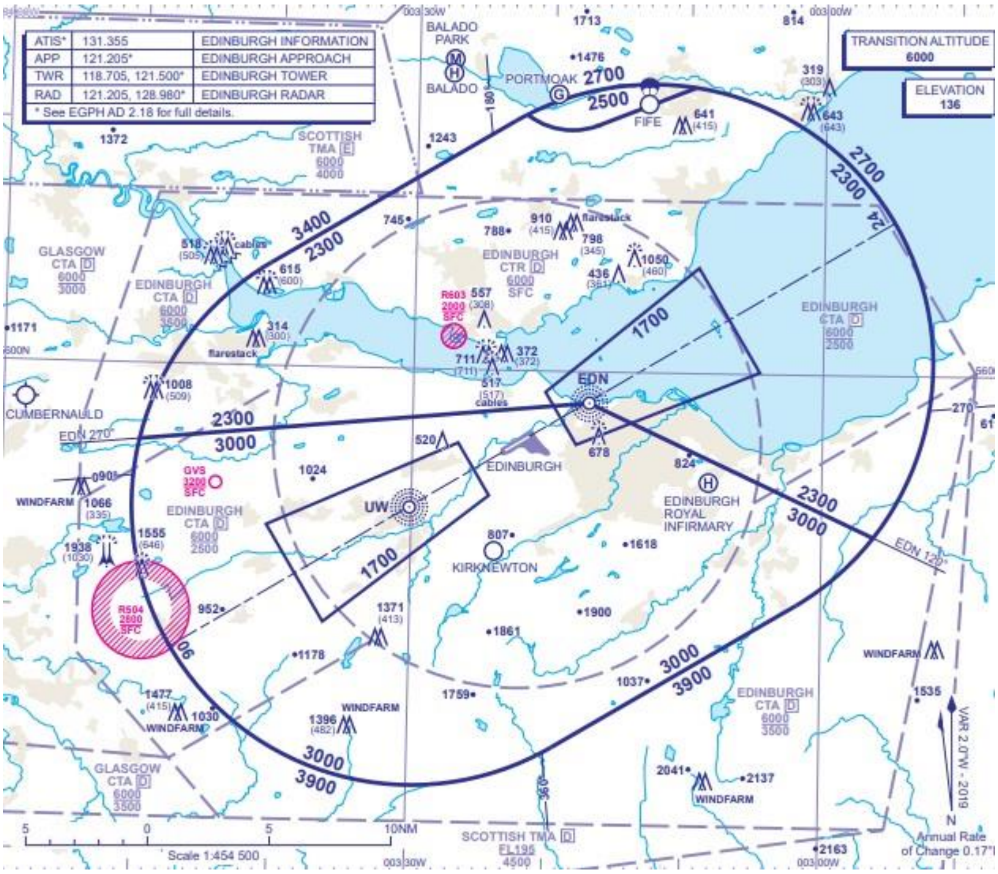
FIGURE: Generic T- and Y-bar for four points

3.5.4 Other possible arrivals modifications

Noise associated with descent – It is the airline's expectation that aeroplanes will be offered the shortest path, vertically and laterally to the runway. This uses the least fuel. The concept of continuous descent operations (see below). From the perspective of the airspace change, the noise at and below 4000 ft is of importance. In the current situation, aeroplanes using runway 06 – and descending over Mid-Lothian – do not normally descend below 4000 ft until they start on the three-degree glidepath. Aeroplanes descending towards runway 24 – over the Firth of Forth – start their final descent towards the runway at 3000 ft. When descending, aeroplanes engines are usually run at idle; making less noise than when under power. The moments when the aeroplane's configuration is changed – the extension of landing gear or flaps – will affect the noise produced. On the whole, much of this noise is related to air passing over the aeroplane that is no longer having a clean configuration. During the last minute or so of every flight, the engines are brought out of idle as a safety precaution. This means that, at around 1000 ft or, in good weather, just below, more engine noise is made. The safety precaution relates to the fact that should a missed approach be flown, the flight crew will want a speedy response from the engines and from idle this takes more time than is desirable. The concept is part of what is known as a stable approach and was developed during the 1990s as a response to a number of landing accidents. The procedure is embedded in air operating requirements.

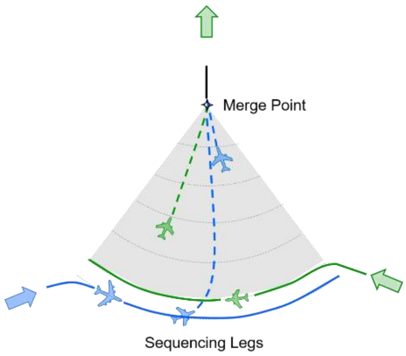
Relocate GOSAM – The relocation of GOSAM has the same effect on arrivals as it does for departures; see discussion in 3.4.4 above.

Radar Manoeuvring Area – The Radar Manoeuvring Area (RMA) is that part of Controlled Airspace within which aircraft can be radar vectored. At Edinburgh this is coincident with the ScTMA and is to the East of the Glasgow buffer zone. Aircraft that need to be vectored into this buffer zone may be vectored with coordination. Radar vectors are used to position arrivals onto final approach and allow them to complete an IFR landing, which may be an ILS, NDB or visual approach. In order to keep aircraft safe there are altitudes below which an aircraft cannot be vectored, and an aircraft will only be below these altitudes when on final approach to land or when flying an approved departure route (SID or NPR). This is because aircraft landing or taking off are subject to strict routes that have been assessed for obstacle clearance. These altitudes are detailed in the ATSMAC (Air traffic Control Surveillance Minimum Altitude Chart) which is published in the AIP (Aeronautical Information Publication).



Holding areas – It is normal to designate areas of medium level airspace – in EDI's case, above 7000 ft – as holding areas (hold or holds). During busy periods, air traffic control may introduce a delaying tactic whereby aeroplanes have to fly an oval shaped pattern, before the flight may commence its approach. At EDI, there are two holds defined; STIRA and TARTN. STIRA is located above Tullibody, Clackmannanshire and TARTN is located between Penicuik and Peebles, Borders. The holds are planned to be retained but the airspace changes proposed here may result in one or both of these holds being moved laterally by up to several miles. As the lowest altitude that the hold may be used is 7000 ft , the impact of this change on noise is negligible. The move may be required to align Edinburgh Airport's plans with those of NATS, who manage the airspace above 7000 ft.Lastly, a new hold will be proposed to the east of the planned new entry / exit point, "EAST". This is located over the North Sea at 7000 feet and above, Its inclusion in the proposals has no effect on noise or emissions in the area around EDI.

Point Merge – A systemised method for sequencing arrival flows developed by EUROCONTROL in 2006 following on from ICAO initiatives to support continuous descent operations.



It is designed to work in high traffic loads without radar vectoring. It is based on a specific P-RNAV route structure, consisting of a point (the merge point) and pre-defined legs (the sequencing legs) equidistant from this point. The sequencing is achieved with a "direct-to" instruction to the merge point at the appropriate time. The legs are only used to delay aircraft when necessary ("path stretching"); the length of the legs reflects the required delay absorption capacity.

From an Air Traffic Control perspective, Point Merge is expected to provide benefits in terms of capacity, safety and environment due to its ability to deliver more orderly flows of traffic with a better view of arrival sequences. From the ATCO's perspective, a reduction in workload, through a simplification of tasks and a reduction of communications, is envisaged.

It can require a considerable amount of airspace to be reserved. Using an example from Dublin[8], the triangular shape shown above encompasses an area of about 50 by 20 NM. It is airspace that is would perhaps be low enough above 3000 to 4000 ft.

Whilst Point Merge was considered at an early stage in the airspace change process, the concept has been rejected for use at Edinburgh Airport. The primary reason for this is the large amount of controlled airspace that Point Merge requires, often up 1000 NM^2 per runway end. This is an amount of airspace that Edinburgh Airport cannot claim from Glasgow Airport, military uses and general aviation users. Other reasons for its rejection include input from ATCOs who stated that the use of Point Merge would place air traffic above the SIDs and lead, potentially to a reduction of safety due to radar 'clutter' – too many overlapping symbols on the radar screen.

3.6 Relationship between arrivals and departures

As a rule of thumb, arriving aeroplanes descend in such a way that the departing traffic climbs over the arrivals. This is advantageous for noise and emissions as ATC strives to allow aeroplanes to descend with a minimum use of engine thrust.

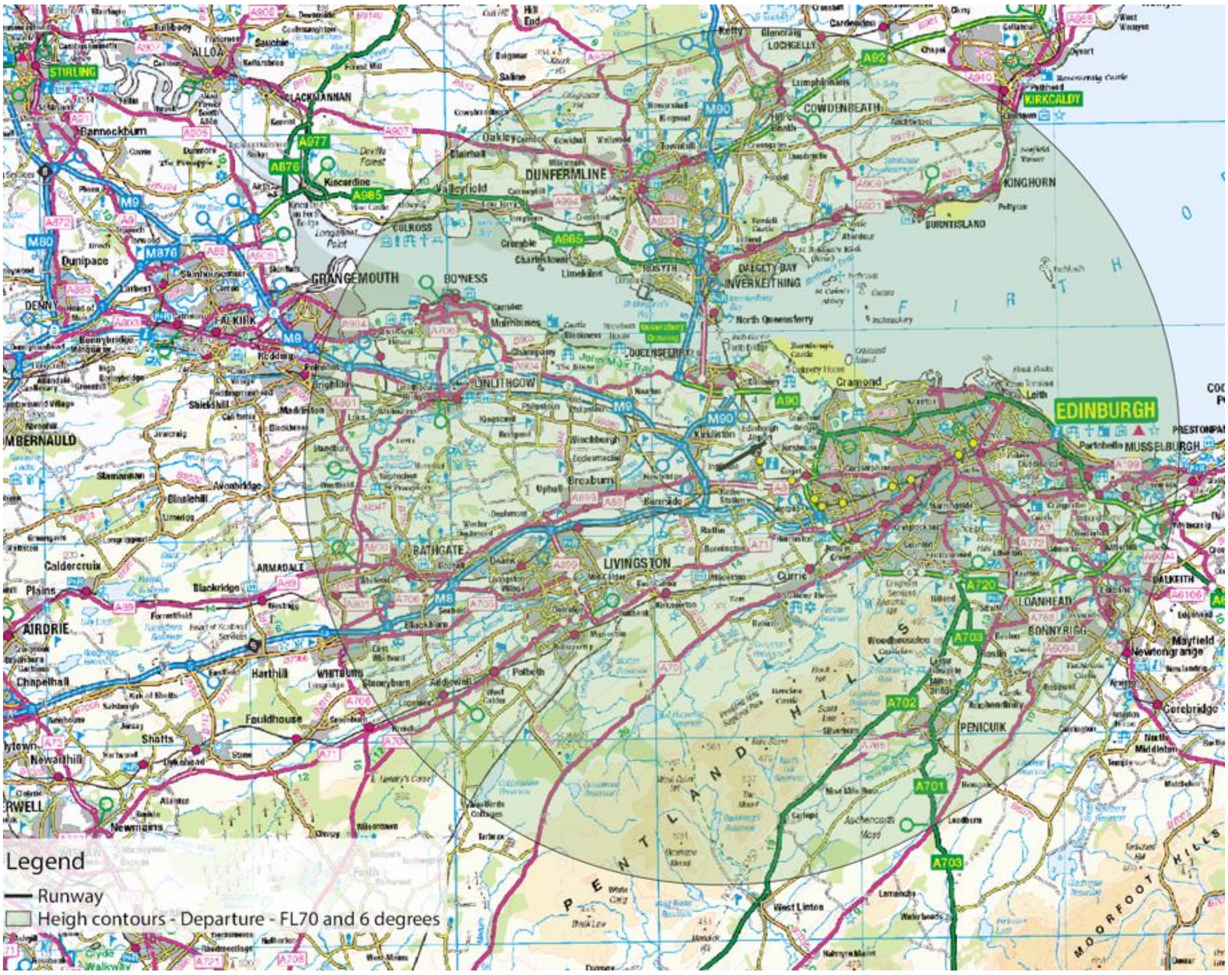
It was not considered that one runway would have four exits points and the other three. Whilst permissible in procedure design, in practice airlines rely on a balanced set of routes by distance so that fuel calculation from one runway remain valid should the runway in use change between preparing the flight and the actual departure.

3.7 Relationship with Glasgow Airport

We continue to work with GLA as part of the masterplan. FDP 4, 6 and 14.

Interdependencies are discussed in many workshops with GLA and NERL. With the possible truncation of GOSAM this makes interdependency much less likely . NERL wish to route more arrivals to the north and the STIRA hold may become more exclusively EDI's. Our departure profile for GOSAM show aircraft reaching 7000 feet before the GLA buffer zone so at the level or altitude of our ACP the interdependencies do not appear to exist but this will have to be examined further in Stage 3 when designs for flight paths are being finalised. There will be structural changes above 7000 feet which may affect flight paths below this level. Again we would need to liaise with NERL and GLA to contribute in the development of the structure of flightpaths and airspace above 7000 ft.

The diagram below shows where an aircraft that departed Edinburgh would be if it climbed at a rate of 6 degrees and flew in a straight line to 7000ft. It is highly unlikely that there would be interaction between Glasgow and Edinburgh traffic below 7000 feet however the network above may affect Edinburgh tracks below 7000 feet and we need to be aware of this possibility when designing our new flightpaths.



4 Design Principles

4.1 Design principles and metrics

Number	Design principle	Typical metrics
FDP1	The airspace design and its operation must be as safe or safer than it is today.	What regulations each option needs to meet? ICAO Doc 4444 and 9906 Technical workstream to be compliant with CAA requirements. Subject to SARG (Safety and Airspace regulation group) approval All newly designed turns, climbs and descents must be safe and flyable in accordance with IFP design guidance Simulator exercises must reflect the design Safety case / assurance before implementation Mats part 1 compliant (CAP493)

		Mats 2 approval Training plan approval **To measure safety this will always be a YES or a NO** **A points or RAG system is not suitable here**
FDP2	Flight paths must be flyable and technically supported by air traffic control and airport technical management systems.	Using IFP approved designers Quality assured All newly designed turns, climbs and descents must be safe and flyable in accordance with IFP design guidance Flight Simulator validated (more than one simulator for different aircraft types – CAA to advise when appropriate) Training programme Evidence of systemisation from ATC systems **To measure safety this will always be a YES or a NO** **A points or RAG system is not suitable here**
FDP3	Flight paths must be designed to allow modern aircraft to use performance-based navigation (PBN) in line with CAA's modernisation strategy	All the designs RNAV1 in order to comply with the CAA's modernisation strategy No dependence on ground-based aids IFP design approved Coding tables All newly designed turns, climbs and descents must be safe and flyable in accordance with IFP design guidance Remain inside Edinburgh's airspace and outside the Glasgow buffer zone. i.e. within at least 2 miles of the boundary of controlled airspace Flight Simulator validated (more than one simulator for different aircraft types – CAA to advise when appropriate) Align with CAP 1711 Airspace modernisation strategy
FDP4	Routes to/from Glasgow and Edinburgh airports must be procedurally deconflicted from the ground to a preferred level in coordination with NATS Prestwick.	Collaboration with NATS Ensure the design below 7000 feet does not conflict with Glasgow traffic. The routes will exit/enter at the relevant part of airspace. Regular correspondence with Glasgow and how their ACP interacts with ours Designed with vertical safety assurance. Silent handovers detailed and deconflicted. Remain inside Edinburgh's airspace and outside the Glasgow buffer zone. i.e. within at least 2 miles of the boundary of controlled airspace and within vertical parameters
FDP5	The predictability of flight tracks must be maximised for consistency of operations.	Aircraft need to fly the predictable flight paths for operational and safety reasons. Low drag low engine power More systemisation and less vectoring Increased capacity with no increase to ATCO workload Validated by ATC simulator Possible dispersal in the initial turn especially if more than a 180-degree turn Are they predictable enough? The distance measurement between the hold and T bar. CCO and CDA capability PIR needs to be thought about and validated appropriately
FDP6	Collaborate with other Scottish airports and NATS to ensure that the airspace design	Design to take into account Glasgow's proposed ACP and its possible effects on ours. Ensure connectivity to the route network routing SIDs to the points that NERL require.

	options are compatible with the wider programme of lower altitude and network airspace changes and accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it.	Ensure arrivals and transitions are also designed to the correct entry points and routes comply with the FDP's Ensure: • Regular engagement with Glasgow and NATS • Regular engagement with ACOG Qualitative at this stage but measured by successful and safe designs verified by ATC and flight simulator validation.
FDP7	Flight paths should be designed to minimise the total adverse effect on health and quality of life created by aircraft noise and emissions.	NOISE – qualitative • Population density/heat maps • Climb and descent profiles/power settings AIR QUALITY • Existing number of receptors to flightpaths – measure against increases or decreases • Total mass emissions (based on ICAO data – to be supplied). Current baseline is metric for all measurements TRANQUILLITY No. of tranquil designations overflown compared against each option
FDP8	For flightpaths at or above 4,000ft to below 7,000ft, 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 this would disproportionately increase CO_2 emissions.	NOISE – qualitative • Population density/heat maps for each height band (0-4000ft and 4000-7000ft) climb and descent profiles/power settings • 2018 LAeq summertime 16hr contour map and population tables based on our radar tracks have been provided to WSP these could be used to assist with flightpaths under 4000ft. • AIR QUALITY • Total mass emissions (based on ICAO data – to be supplied). Current baseline is metric for all measurements CARBON Length of flight path (more of less track miles) than other options
FDP9	Flight paths should be designed to minimise population overflown below 4,000ft and, between 4,000ft	NOISE – qualitative • Receptors maps identifying protected characteristics, as defined by the Equalities Act 2010 • 2018 LAeq summertime 16hr contour map and population tables based on our radar tracks have been provided to WSP these could be used to assist with flightpaths under 4000ft.

	and 7,000ft, taking into account any potential adverse impact, due to those overflown having protected characteristics, as defined by the Equalities Act 2010.	• Consider respite through no night flights over newly overflown areas? • Consider implementing no vectoring from the flight paths until 7000ft – thereby limiting the number outliers and dispersal of the tracks? AIR QUALITY • Existing number of receptors to flightpaths – measure against increases or decreases • Total mass emissions (based on ICAO data – to be supplied). Current baseline is metric for all measurements
FDP10	Flight paths should be designed to minimise overflying sensitive locations and noise-sensitive receptors (for example, the zoo, retirement complexes, green spaces, historic heritage sites, and others).	NOISE – qualitative Receptors maps identifying non-residential receptors produced at Stage 1B TRANQUILLITY – comparison of designated sites affected compared across options
FDP11	Flight paths should be designed to include track concentration and/or track dispersal options to provide noise respite.	NOISE – qualitative • Does the option offer the potential for scheduled respite? Flight tracking capabilities? Consider respite through no night flights over newly overflown areas? Consider implementing no vectoring from the flight paths until 7000ft – thereby limiting the number outliers and dispersal of the tracks?
FDP12	Flight paths should be designed with routes that minimise track miles and fuel burn.	AIR QUALITY • Existing number of receptors to flightpaths – measure against increases or decreases CARBON Comparison of track miles and fuel burn against each option – either longer or shorter
FDP13	Flight paths should be designed to ensure efficient and effective route management.	Looking at end to end distance. Efficient routes. Shortest distance Continuous Climb operations (CCO) and Continuous descent operations (CDA) Carbon reduction and fuel reduction are good metrics to use here. The routes must be designed to fit into the network and use the route effectively
FDP14	Requirements of airspace users should be taken into account	Other airspace users are: Non-compliant RNAV 1 aircraft, military, transit aircraft, and General Aviation.

	when designing flight paths.	(Para droppers, light aircraft, business jets, paragliders, microlights, gliders, non-radio aircraft hot air balloons Their requirements: Review the Classification of airspace Reduction or addition of airspace volume (e.g. the Dunfermline gap) Revision of LoA's and standing agreements Engagement with other airspace users (e.g. Cumbernauld) Kirknewton gliders. Can they be moved? Remain inside Edinburgh's airspace and outside the Glasgow buffer zone. i.e. within at least 2 miles of the boundary of controlled airspace
FDP15	Flight paths should be designed to minimise adverse local air quality impacts.	AIR QUALITY • Existing number of receptors to flightpaths – measure against increases or decreases Current baseline is metric for all measurements
FDP16	Airspace should be designed to maximise capacity in order to contribute economic benefits to Scotland, including tourism and trade.	Capacity is a driver for our ACP and we will look to achieve our goals with the design.

4.2 Evaluation method

The various options are evaluated against the design principles to see in how far that they are met.

Symbol	Meaning
Y	Design principle is met
N	Design principle is not met
-	Compliance with the design principle cannot be demonstrated by the swathe; detailed route options, in the design principle evaluation, will confirm whether or not the approach meets the design principles

4.3 Step 2A Options

The options for both departures and arrivals have been detailed in the engagement sessions and illustrated in the engagement presentation. These options contain departure route to exit points with NERL as described earlier in this document and combine possible early and late turns in order to give a variety of options to assess against the design principles. This process gives options of possible flight paths that will be taken forward to the full options appraisal carried out in Stage 3.

4.4 Initial Options Appraisal

The initial options appraisal is carried out in Stage 2B of the process and flightpaths will give us a solution against a meet environmental Design Principle Evaluation document contains all required information on our options for both arrivals and departures. Once the Design Principle evaluation is completed then an initial options appraisal is carried out on all of the options. The outcomes from these allows the sponsor to determine a short list of options to be taken forward to Stage 3 and a full options appraisal. This is where the quantitative approach and further analysis will lead to the analysis of actual flightpaths before moving to consultation.

The initial options appraisal should contain as a minimum, qualitative assessments of the different options. This highlights to change sponsors, stakeholders and the CAA the relative differences between the impacts, both positive and negative of each option. A do-nothing option, or baseline, needs to be taken forward in order to compare these changes to the current situation

4.5 The Baseline

<u>'Do Nothing Scenario' Baseline mapping</u>

It is important for Edinburgh Airport to have a detailed understanding of our current operations or Baseline, and their impact on the communities affected by our operation. This will enable us to understand any impacts, changes to our flight paths may have, and assess where we can reduce or limit the impact on our communities.

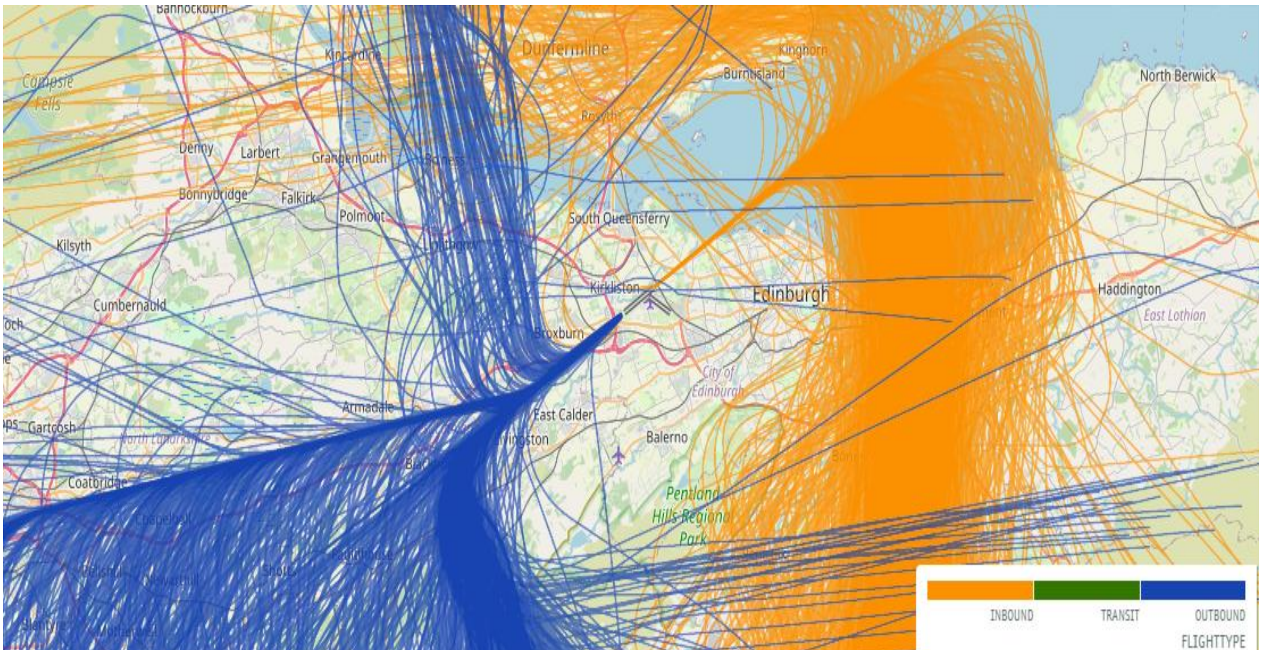
To provide a clear understanding of our current flight tracks and distribution, figures 1 and 2 below show the flight tracks for arriving and departing aircraft of Runways 24 and 06 (R24/R06)

Edinburgh Airport has one primary runway (Runway 06/24), which operates in two directions. When Runway 06 is in operation, aircraft arrive from the west and depart to the east. When Runway 24 is in operation, aircraft arrive from the east and depart to the west. On average the split of runway operations is 70% W / 30% E

The following images reflect a 1-week period from 01/07/2019 to 08/07/2019 inclusive detailing flight path tracks and density of operations of fixed wing aircraft. via Runway 06 / Runway 24 Departures and Arrivals. It should be noted that the tracks shown are for fixed wing aircraft only and includes all flight operations which took place during this period including Cargo and GA operations. Arrivals are depicted in Orange and Departures in Blue.

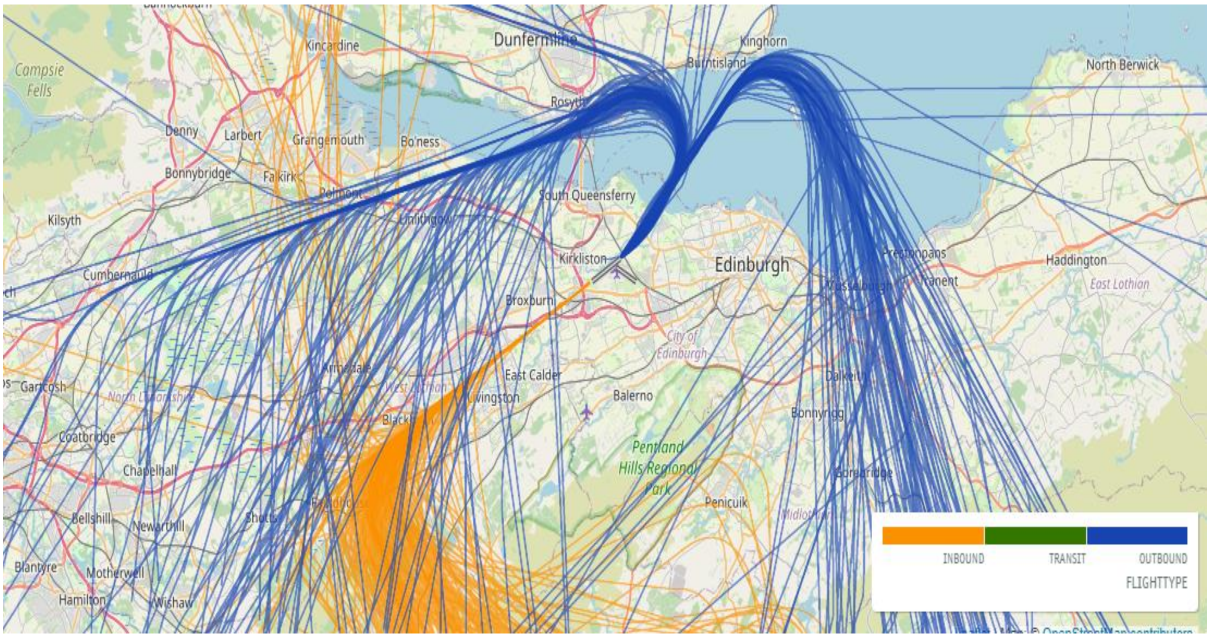
Further technical information on our current published operations may be found in our AIP, via the following link https://nats-uk.ead-it.com/cms-nats/opencms/en/Publications/AIP/Current-AIRAC/html/eAIP/EG-AD-2.EGPH-en-GB.html

Figure 1



Runway 24 (R24) Operations, Arrivals Orange, Departures Blue 01/07/2019 – 07/07/2019 inclusive

Figure 2



Runway 06 (R06) Operations, Arrivals Orange, Departures Blue 01/07/2019 – 07/07/2019 inclusive

Baseline noise contour mapping

To assist Edinburgh Airport in determining the impacts of our current operations referred to in CAP1616 as our Baseline, we commissioned Baseline noise contour analysis and mapping of our current operations by CAA Environmental Research Consultancy Department (ERCD),

The majority of this mapping will be used in Qualitative analysis during later stages of the CAP1616 process

A summary of the methodology used by ERCD is detailed below, however, a full and detailed modelling methodology is available to read with in document *'ERCD Technical Note: Edinburgh Airport ACP – Baseline Noise Contours Modelling Methodology produced 17/05/2022'* and *'EDI ACP Baseline Contours (CAP 2091) results letter – produced 17/05/2022'* both documents are provided with in ANNEXE BL1 of this submission

Traffic data was projected using 2019 data (which was the latest pre covid year) which was forecast to 2022 and 2032

Noise modelling local time periods are as follows:
16 hour Day – 07:00 – 23:00

8 hour Night – 23:00 – 07:00

Runway split:
Runway split data 2000 – 2021 was provided to ERCD in table format, this enabled them to determine the average runway split over 20 years as required in CAP 1616a Paragraph 1.15, a copy of the table provided is submitted within ANNEXE BL2 The average Runway split was determined to be 70% W / 30% E during the summer daytime 16 hour and 74% W / 26% E summer night-time 8 hour time periods

The following contours are provided for the baseline ('do-nothing') scenario:
LAeq contours

Noise exposure contours are similar to the contours on an ordinary map showing places at the same height however rather than showing height noise contours show noise levels within a set of closed lines on a map.

Each contour shows places where people get the same amounts of noise from aircraft, measured as LAeq.

LAeq is measured in a unit called dB which stands for 'decibel'.
The 'A' subscript means A-weighted (which matches the frequency response of the human ear) and the 'eq' subscript is an abbreviation of the word equivalent, i.e. LAeq is the equivalent continuous sound level.

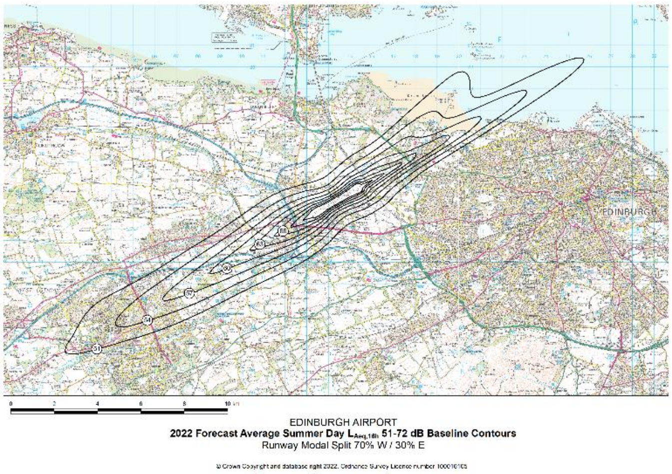
Noise exposure is generally used to indicate the noise environment averaged over a time interval. Research indicates that LAeq is a good predictor of a community's disturbance from aircraft noise and is commonly used in a variety of environmental noise measurements and noise legislation as an indicator of how a community will be affected by noise.

- 2022 average summer day LAeq,16h 70% W / 30% E
- 2022 average summer day LAeq,16h 100% W and 100% E
- 2022 average summer night LAeq,8h 74% W / 26% E
- 2022 average summer night LAeq,8h 100% W and 100% E
- 2032 average summer day LAeq,16h 70% W / 30% E
- 2032 average summer day LAeq,16h 100% W and 100% E
- 2032 average summer night LAeq,8h 74% W / 26% E
- 2032 average summer night LAeq,8h 100% W and 100% E

The summer day LAeq,16h contours have been plotted from 51-72 dB in 3 dB steps. The summer night LAeq,8h contours have been plotted from 45-72 dB in 3 dB steps in accordance with CAP1616a Airspace Change: Environmental requirements technical annex. Noise: standard metrics

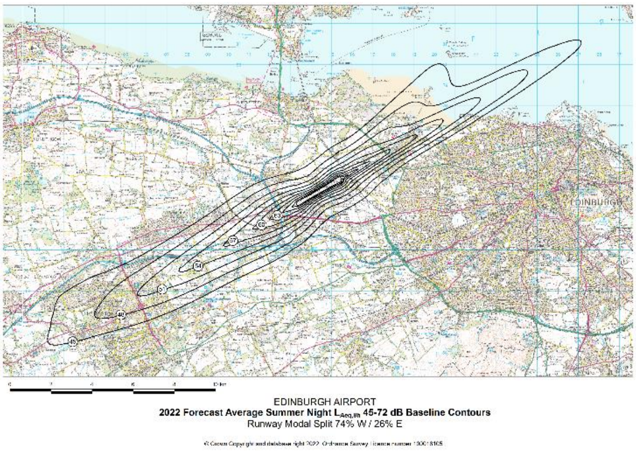
Figures 3 and 4 provide the average summer day LAeq,16h 70% W / 30% E and 2022 average summer night LAeq,8h 74% W / 26% E respectively, the remaining 70% W / 30% E summertime mapping may be found in Annexe BL3

Figure 3



2022 average summer day LAeq,16h 70% W / 30% E

Figure 4



2022 average summer night LAeq,8h 74% W / 26% E

Included within the above list of contour mapping are 100% Mode noise contours which are different from those which represent the 70/30% split usually depicted in summertime LAeq contour mapping, this is detailed and explained below and by section 1.27 of CAP1616a

<u>100% mode noise contours</u>

Average summer day contours reflect the direction of usage of an airport's runway(s) during the summer period.

For safety reasons aircraft take-off and land into wind, and therefore the runway direction in use will change depending on wind direction. While summer average day noise contours reflect noise exposure for an average summer day, because they represent an average of the two runway directions available, they do not represent the noise associated with a single runway direction. 100% mode noise contours address this by depicting the summer average day flight operations for a single operating mode.

Since a runway can be used in one of two directions, there are two 100% mode noise contours, one for each runway direction and for each year modelled

Figures 5 and 6 provide the average summer day LAeq,16h 100% W and 100% E
and 2022 average summer night LAeq,8h 100% W and 100% E respectively, the remaining
100% W and 100% E summertime mapping may be found in Annexe BL3

Figure 5

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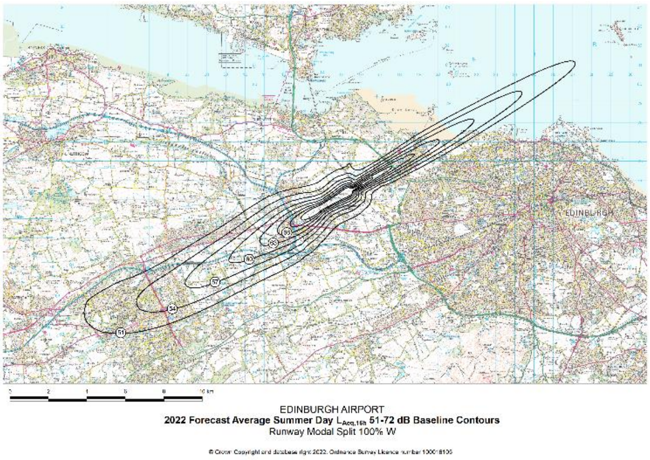
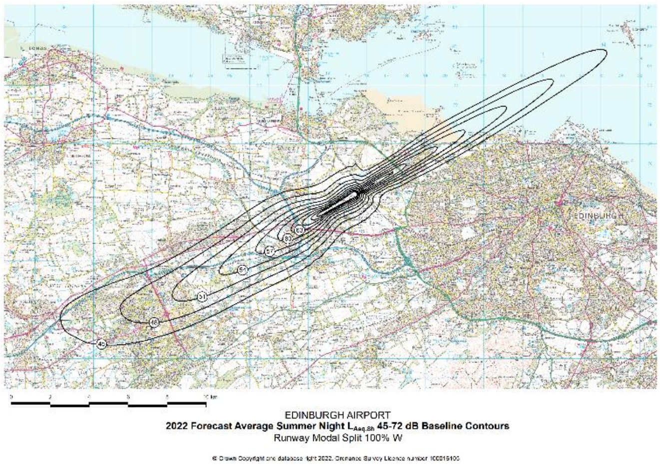


2022 average summer day LAeq,16h 100% W

Figure 6



2022 average summer night LAeq,8h 100% W

<u>N65/N60 contours</u>

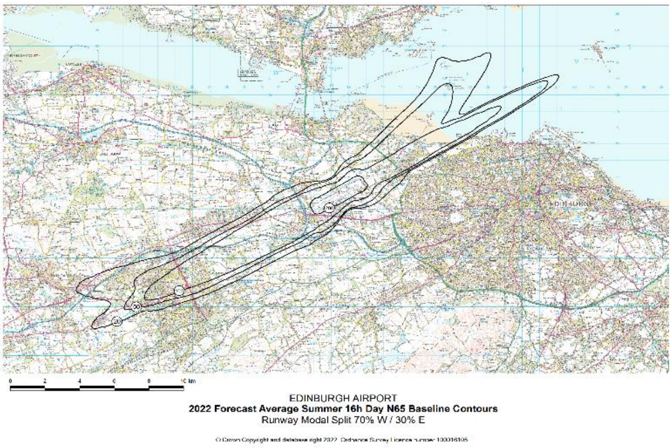
As with the above 100% Mode contours Nx Contours are provided to increase understanding and further clarity on how noise from our operations may affect communities in close proximity to our flight paths. Nx contours show the locations where the number of events which within this mapping is the number of flights exceeds a pre-determined noise level, expressed in dB LAmax. For example, N65 contours show the number of events where the noise level from those flights exceeds 65 dB LAmax. Within CAP1616 the levels of 65 dB LAmax for daytime flights and 60 dB LAmax (N60) for night-time flights were selected because they are specified in the Secretary of State's Air Navigation Guidance as supplementary metrics

- 2022 average summer 16h day N65 70% W / 30% E
- 2022 average summer 8h night N60 74% W / 26% E
- 2032 average summer 16h day N65 70% W / 30% E
- 2032 average summer 8h night N60 74% W / 26% E

The daytime N65 contours have been plotted at levels 20, 50, 100 and 200 events. The night-time N60 contours have been plotted at levels 10, 20 and 50 events.

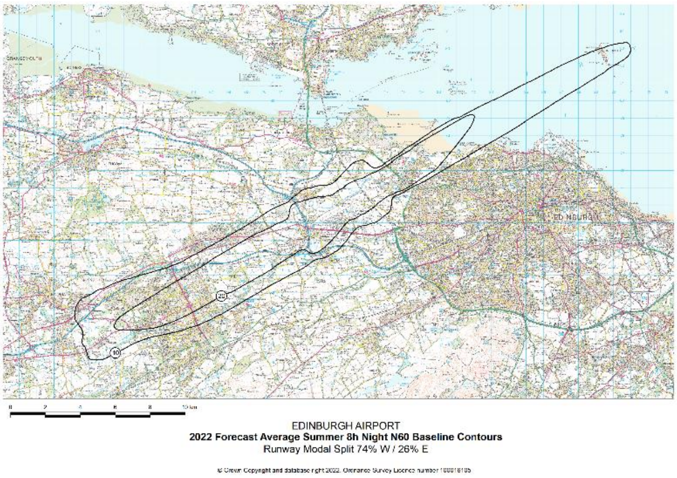
Figures 7 and 8 provide the 2022 average summer 16h day N65 70% W / 30% E 2022 average summer 8h night N60 74% W / 26% E respectively, the remaining NX summertime mapping may be found in Annexe BL3

Figure 7



2022 average summer 16h day N65 70% W / 30% E

Figure 8



2022 average summer 8h night N60 74% W / 26% E

Area, population, households

For each contour map analysis of the number of households and populations within each contour were estimated and provided in table format

Estimated areas, populations and households within the above contours are summarised in **Tables 1-16**.

Table 1 2022 average summer day $L_{Aeq,16h}$ 70% W / 30% E contours – estimated areas, populations and households

LAeq,16h (dB)	Area (km²)	Population	Households
> 51	64.0	40,000	17,600
> 54	37.1	13,300	6,000
> 57	21.0	4,800	2,200
> 60	11.6	3,000	1,400
> 63	6.2	500	200
> 66	3.4	300	200
> 69	1.8	< 100	< 100
> 72	1.0	0	0

Table 2 2022 average summer day $L_{Aeq,16h}$ 100% W contours – estimated areas, populations and households

LAeq,16h (dB)	Area (km^2)	Population	Households
> 51	64.9	50,100	22,000
> 54	38.1	15,500	6,900
> 57	21.5	4,200	2,000
> 60	11.8	3,300	1,500
> 63	6.4	1,100	500
> 66	3.6	400	200
> 69	1.9	< 100	< 100
> 72	1.0	0	0

Table 3 2022 average summer day $L_{Aeq,16h}$ 100% E contours – estimated areas, populations and households

LAeq,16h (dB)	Area (km^2)	Population	Households
> 51	57.0	23,300	10,300
> 54	34.6	13,700	6,100
> 57	20.0	2,900	1,300
> 60	11.3	600	300
> 63	6.2	500	300
> 66	3.4	200	100
> 69	1.9	< 100	< 100
> 72	1.0	< 100	< 100

Note: Population and household estimates are given to the nearest 100, and based on population data supplied by WSP.

Table 4 2022 average summer night $L_{Aeq,8h}$ 74% W / 26% E contours – estimated areas, populations and households

LAeq,8h (dB)	Area (km²)	Population	Households
> 45	77.6	51,200	22,500
> 48	45.9	22,300	9,800
> 51	26.5	6,100	2,800
> 54	14.9	3,500	1,700
> 57	8.1	1,900	900
> 60	4.3	400	200
> 63	2.3	100	< 100
> 66	1.2	< 100	< 100
> 69	0.7	0	0
> 72	0.5	0	0

Table 5 2022 average summer night $L_{Aeq,8h}$ 100% W contours – estimated areas, populations and households

LAeq,8h (dB)	Area (km²)	Population	Households
> 45	78.7	56,100	24,600
> 48	47.0	28,200	12,400
> 51	27.4	6,500	2,900
> 54	15.0	3,700	1,700
> 57	8.2	2,800	1,300
> 60	4.5	500	200
> 63	2.4	100	< 100
> 66	1.3	0	0
> 69	0.7	0	0
> 72	0.4	0	0

Table 6 2022 average summer night $L_{Aeq,8h}$ 100% E contours – estimated areas, populations and households

LAeq,8h (dB)	Area (km²)	Population	Households
> 45	67.4	27,900	12,400
> 48	41.4	18,400	8,200
> 51	24.9	5,800	2,600
> 54	14.0	800	400
> 57	8.0	600	300
> 60	4.4	300	100
> 63	2.4	100	< 100
> 66	1.3	< 100	< 100
> 69	0.7	0	0
> 72	0.4	0	0

Note: Population and household estimates are given to the nearest 100, and based on population data supplied by WSP.

Table 7 2032 average summer day $L_{Aeq,16h}$ 70% W / 30% E contours– estimated areas, populations and households

$L_{Aeq,16h}$ (dB)	Area (km^2)	Population	Households
> 51	75.3	48,800	21,400
> 54	44.1	20,400	9,100
> 57	25.2	5,800	2,700
> 60	14.0	3,400	1,600
> 63	7.6	1,000	500
> 66	4.1	400	200
> 69	2.2	100	< 100
> 72	1.2	< 100	< 100

Table 8 2032 average summer day $L_{Aeq,16h}$ 100% W contours –estimated areas, populations and households

$L_{Aeq,16h}$ (dB)	Area (km^2)	Population	Households
> 51	76.1	56,300	24,600
> 54	45.0	26,600	11,700
> 57	25.9	6,200	2,800
> 60	14.3	3,600	1,700
> 63	7.8	2,100	1,000
> 66	4.3	400	200
> 69	2.3	100	< 100
> 72	1.3	0	0

Table 9 2032 average summer day $L_{Aeq,16h}$ 100% E contours –estimated areas, populations and households

$L_{Aeq,16h}$ (dB)	Area (km^2)	Population	Households
> 51	66.4	27,100	12,000
> 54	40.5	17,500	7,800
> 57	24.0	5,000	2,300
> 60	13.4	700	300
> 63	7.5	600	300
> 66	4.1	200	100
> 69	2.3	100	< 100
> 72	1.3	< 100	< 100

Note: Population and household estimates are given to the nearest 100, and based on population data supplied by WSP.

Table 10 2032 average summer night $L_{Aeq,8h}$ 74% W / 26% E contours – estimated areas, populations and households

$L_{Aeq,8h}$ (dB)	Area (km^2)	Population	Households
> 45	92.5	57,900	25,400
> 48	55.0	32,500	14,300
> 51	32.2	8,700	4,000
> 54	18.1	3,900	1,800
> 57	10.0	2,900	1,400
> 60	5.3	500	200
> 63	2.9	300	100
> 66	1.5	< 100	< 100
> 69	0.9	0	0
> 72	0.5	0	0

Table 11 2032 average summer night $L_{Aeq,8h}$ 100% W contours – estimated areas, populations and households

$L_{Aeq,8h}$ (dB)	Area (km^2)	Population	Households
> 45	93.6	63,500	27,800
> 48	56.1	39,100	17,100
> 51	33.2	8,600	3,900
> 54	18.5	4,000	1,900
> 57	10.1	3,100	1,500
> 60	5.5	1,000	500
> 63	3.1	400	200
> 66	1.6	< 100	< 100
> 69	0.9	0	0
> 72	0.5	0	0

Table 12 2032 average summer night $L_{Aeq,8h}$ 100% E contours – estimated areas, populations and households

$L_{Aeq,8h}$ (dB)	Area (km^2)	Population	Households
> 45	80.1	32,800	14,500
> 48	49.1	20,700	9,200
> 51	29.9	9,700	4,300
> 54	17.0	2,000	900
> 57	9.8	600	300
> 60	5.4	400	200
> 63	3.0	200	100
> 66	1.6	< 100	< 100
> 69	0.9	0	0
> 72	0.5	0	0

Note: Population and household estimates are given to the nearest 100, and based on population data supplied by WSP.

Table 13 2022 average summer 16h day N65 70% W / 30% E contours – estimated areas, populations and households

N65	Area (km^2)	Population	Households
> 20	90.7	56,100	24,600
> 50	60.6	36,900	16,200
> 100	35.9	21,000	9,300
> 200	3.3	< 100	< 100

Table 14 2022 average summer 8h night N60 74% W / 26% E contours – estimated areas, populations and households

N60	Area (km^2)	Population	Households
> 10	99.5	62,200	27,300
> 20	43.6	32,000	14,100
> 50	0.0	0	0

Table 15 2032 average summer 16h day N65 70% W / 30% E contours – estimated areas, populations and households

N65	Area (km^2)	Population	Households
> 20	97.8	59,300	26,000
> 50	69.8	43,200	18,900
> 100	41.7	25,500	11,200
> 200	16.6	6,300	2,800

Table 16 2032 average summer 8h night N60 74% W / 26% E contours – estimated areas, populations and households

N60	Area (km^2)	Population	Households
> 10	116.3	78,000	34,200
> 20	69.5	44,200	19,400
> 50	2.7	100	< 100

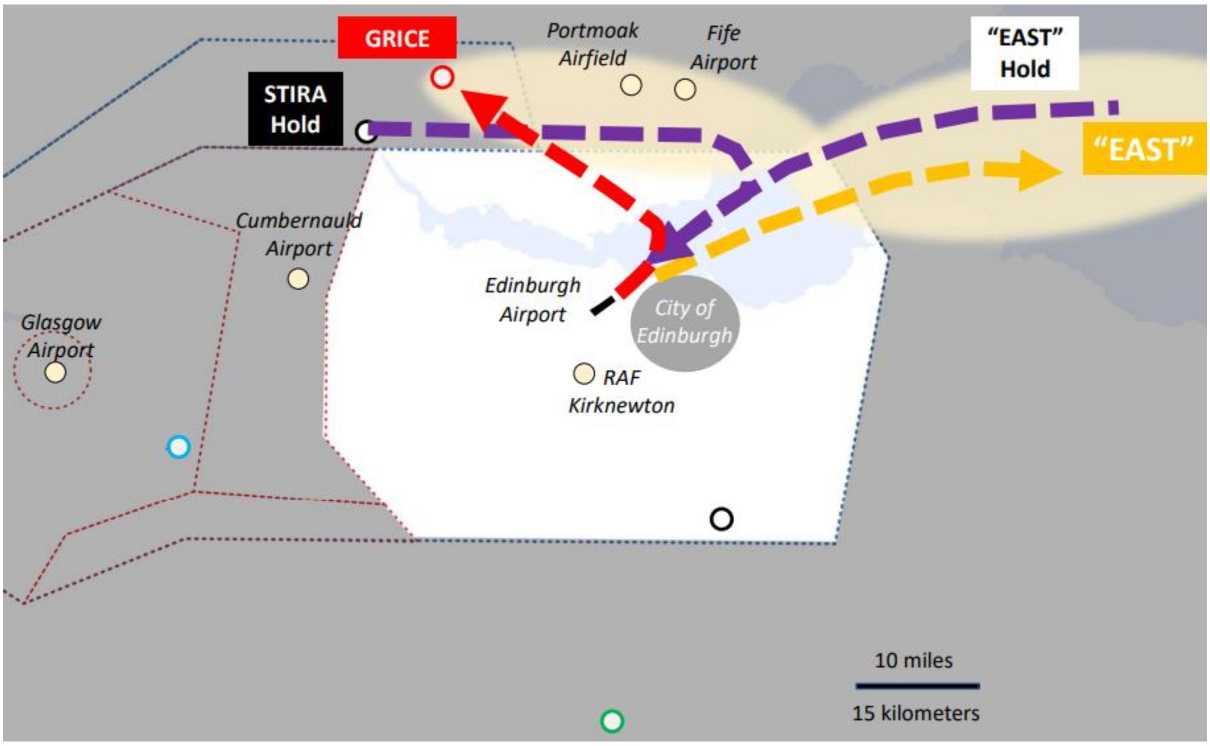
Note: Population and household estimates are given to the nearest 100, and based on population data supplied by WSP.

5. Additional Controlled Airspace

Some of the departure and arrival options described earlier may require additional controlled airspace to be establish. The three instances where additional airspace may be asked for are:

1) In order to straighten the SID towards GRICE from Runway 06.
2) In order to systemise arrivals from the STIRA hold to Rwy 24.
3) In order to establish an airway to facilitate arrivals to and fron the East across the North Sea.

These options are illustrated in the diagram below and have also been briefed in our engagement



Of course we would need to justify any or all of this before implementation. We are also aware of Design Principle 14 "Requirements of airspace users should be taken into account when designing flight paths".

6. CAP 2091 CAA policy on minimum standards for noise modelling

This document was published in January 2021 and Edinburgh Airport complies as a catgory C airport according to tables 4.1 and 4.2 contained within the document. We are undergoing improvements to our noise modelling system and these will include two more noise monitors placed in the most appropriate places to help with the requirements of the CAP1616 process and also with our Noise Action Plan.

This document is now concluded.

Further documents in this submission are:

Engagement

The Design Principle Evaluation

The Initial Options Appraisal

Stage 2 Glossary

Safety Appraisal