Glasgow Prestwick Airport RNAV1 Routes

Airspace Change Proposal

NATS Airspace Change Assurance Team/MK

Issue 2.0

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Document Control

Amendments to version 2.0:

- SUDBY 1L ICARD name updated

References

Reference 1: Glasgow Prestwick Airport Airspace Change Consultation Document

Reference 2: ERCD Glasgow Prestwick Airport ACP Noise Assessment

Reference 3: AIP current chart – RNAV5 STAR via TRN VOR

Reference 4: AIP current chart – NGY 1K, 1L SID

Reference 5: AIP current chart – TRN 1K, 1L SID

Reference 6: AIP current chart – STAR via Turnberry

Reference 7: AIP – EGPK Textual Data

Reference 8: CAA CAP725 – CAA Guidance on the Application of the Airspace Change Process

Reference 9: CAA CAP1385 – Performance-based Navigation, Enhanced Route Spacing Guidance

Reference 10: CAA CAP1498 – Definition of Overflight

Reference 11: DfT Guidance to the CAA on Environmental Objectives Relating to the Exercise of its Air Navigation Functions

Reference 12: Doc 8168 PANS-OPS Vol I Flight Procedures/ Vol II Construction of Procedures

Reference 13: Prestwick Flight / Simulator Validation Plan, High-Level Strategic Plan

Reference 14: Prestwick ACP PBN Approaches Report

Reference 15: Prestwick ACP PBN Departures Report

Reference 16: Glasgow Prestwick Safety Report

Reference 17: Design Workshop Notes, January 2017

Reference 18: Stakeholder Engagement Workshop Slides, January 2017

Reference 19: NATS Consultation Feedback Report

Reference 20: CAA CAP 778 Policy and Guidance for the Design and Operation of Departure Procedures in UK Airspace

Reference 21: Validation Report – B737 Session 1

Reference 22: Validation Report – B737 Session 2

Reference 23: Validation Report – B737 Session 3, Still Wind Runs

Reference 24: RNAV Coverage Report

Reference 25: Prestwick ACP Training Needs Analysis and Initial Plan

1 Introduction

Glasgow Prestwick Airport is undergoing an Airspace Change Proposal, through which we are proposing changes to the arrival and departure routes to and from Glasgow Prestwick Airport.

The proposal is to introduce a system of replicated and new RNAV1 Standard Instrument Departures (SIDs), RNP approaches, RNAV1 arrival transitions and omni-directional departures. This change is needed due to the removal of old navigational aids as part of a national replacement programme. The navigation aids that assist aircraft to fly in and out of Glasgow Prestwick Airport are due to be taken out of service in 2019. In preparation for this, the procedures at Glasgow Prestwick Airport need to be updated to be compatible with modern digital infrastructure, before the current equipment becomes defunct.

The proposed routes will take advantage of improved navigational capability; enabling more efficient use of the airspace as well as future-proofing to accommodate potential growth and development. Where conventional routes currently exist, our intention is to replicate them as closely as possible so that similar paths are flown. However, as these were designed decades before satellite-based navigation was available, some changes are required in order to meet modern design criteria. We are also looking to make some enhancements to the routes to minimise noise impact and support environmental efficiency.

We have completed a formal public consultation which ran from 14th June to 13th September 2017; through which we requested feedback on the proposed routes. The consultation document fully details the current and proposed routes alongside the justification behind the changes (Ref 1). This consultation received a total of 29 responses. The feedback received was analysed and summarised in the Feedback Report (Ref 19).

It should be noted that this Airspace Change Proposal covers changes to the Instrument Flight Procedures (IFPs) and ATC operations at Glasgow Prestwick Airport. Aircraft flying under Visual Flight Rules (VFR) will continue to operate in the same way they do today.

1.1 New RNAV1 SIDs and Arrival Transitions

This ACP proposes the introduction of:

- RNAV1 replication of the four existing conventional SIDs.
- Introduction of three new RNAV1 SIDs: one to the east and two to the west.
- Five new RNAV1 arrival transitions.
- “T-Bar” approaches to three runway ends. Omnidirectional departures will be introduced for those departing aircraft which are not RNAV1 compliant, and non-RNAV1 compliant arrivals will be vectored as per today.

The proposed departure, approach and arrival routes can be seen in the following two diagrams, Figures 1 and 2.

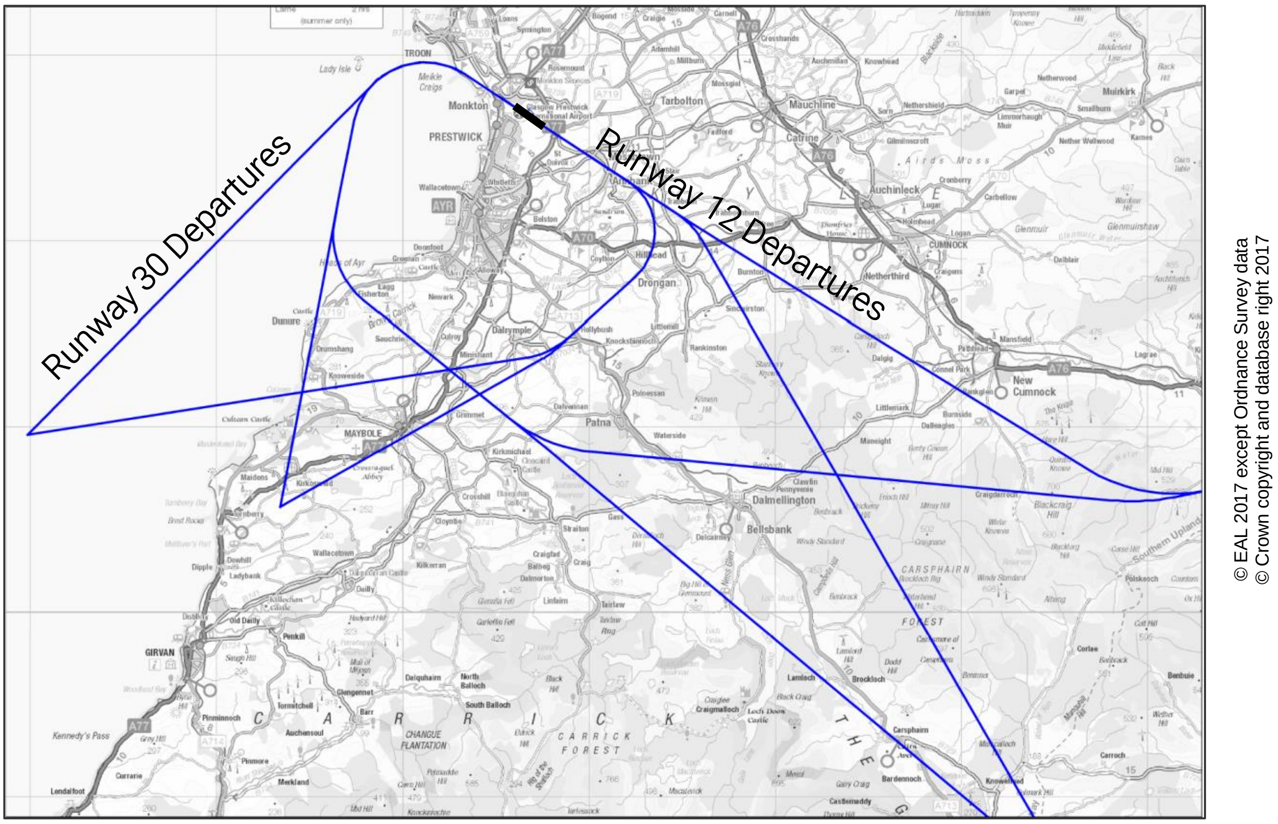

Figure 1: Proposed RNAV1 Departure Routes

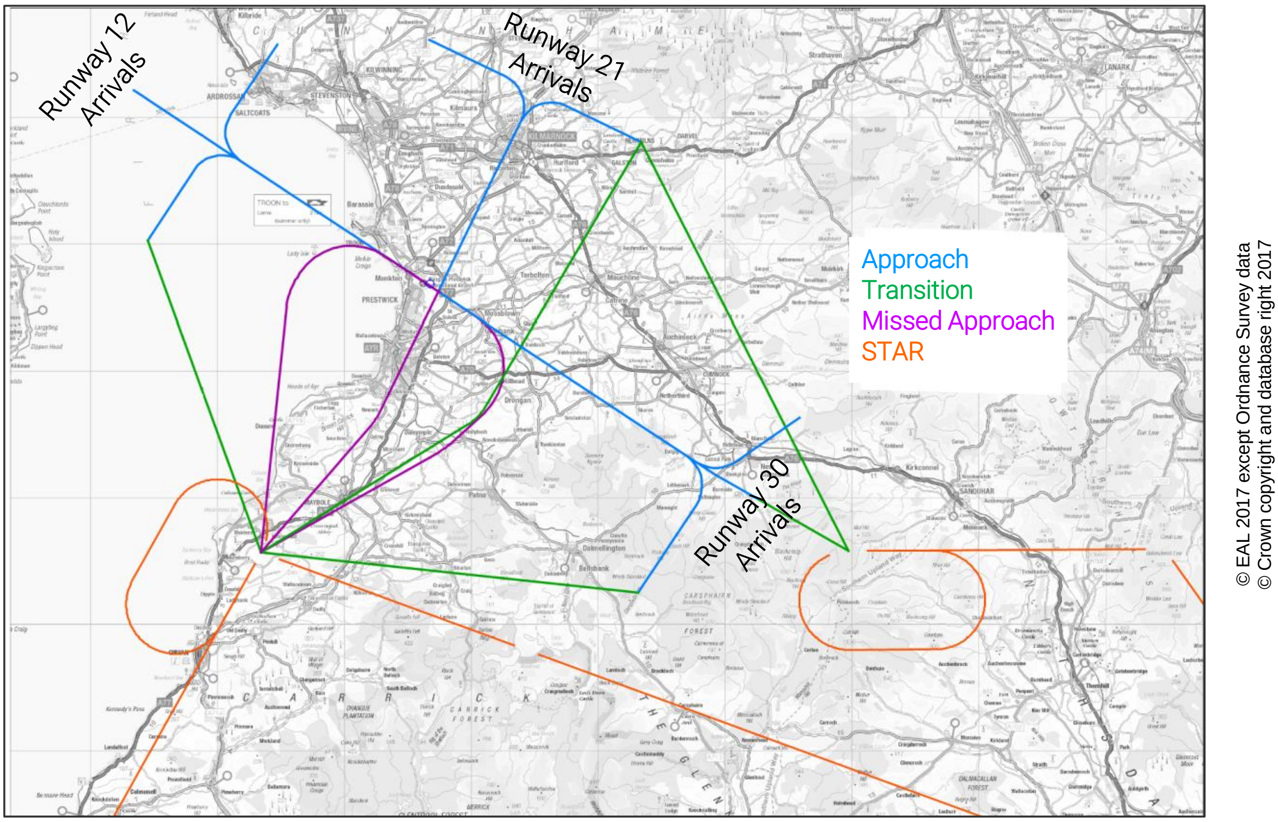

Figure 2: Proposed RNAV1 Approach and Arrival Routes

2 Justification and Objectives

2.1 Background and Justification

We are looking to upgrade and, where possible, improve the arrival and departure routes at Glasgow Prestwick Airport, by utilising the improved capabilities of PBN. This need for change has come from the CAA's approval to reduce the enroute navigation aid infrastructure which NATS En Route Limited (NERL) are currently undertaking through a "VOR rationalisation" project. This includes decommissioning the Turnberry (TRN) VOR and New Galloway (NGY) NDB in 2018; these are used for both departures and arrivals at Glasgow Prestwick Airport.

Modernising our airspace will allow us to:

- Minimise the impact of aircraft to people on the ground particularly from overflights below 4,000ft;
- Position aircraft more accurately on precise arrival and departures routes; consequently impacting fewer people;
- Make improvements to departure routes using RNAV1 capabilities to fly more direct routings;
- Make efficiency improvements to the arrival routes using RNAV1 capabilities and the addition of new "T-Bar" approaches;
- Accommodate growth and development at the airport through future-proofing the routes.

Our aim is to maximise the above benefits to Glasgow Prestwick Airport and the surrounding area and Scotland; whilst mitigating any negative impacts. This change is necessary to improve the airspace around Glasgow Prestwick Airport, with the intention to make it more efficient and at least as safe as extant.

Where we are proposing changes to a flight path, we are focussed on reducing the impact to those living under the route and the surrounding areas. Improved track keeping means that there will be less dispersal of aircraft either side of the route nominal centrelines. This would mean a reduction in the overall area regularly overflown but a corresponding increase in the concentration of over-flights in some areas.

2.2 Objectives

The objectives of the Airspace Change Proposal are as follows:

- Maintain or improve the level of safety for departures and arrivals to Glasgow Prestwick Airport;
- Minimise the noise impact on overflown population, particularly below 4,000ft;
- Increase the efficiency of departure and arrival routes to Glasgow Prestwick Airport, such as through enabling CDAs;
- Introduce PBN routes in accordance with CAA Future Airspace Strategy FAS recommendations;
- Improve the accuracy and predictability of tracks flown;
- Not to increase the overall volume of controlled airspace;
- Accord with the DfT environmental objectives relating to noise impact and CO_2 emissions;
- Minimise exposure of new populations to noise and visual impacts;
- Minimise low level over-flight of National Scenic Areas, National Parks and other tranquil areas;
- Minimise impact on military operations.

The final design will reflect a balanced approach between competing objectives and requirements.

2.3 Alignment with the CAA's Future Airspace Strategy (FAS) Principles

The Future Airspace Strategy (FAS) is focussed on upgrading the airspace throughout the UK and Ireland to increase capacity and efficiency, whilst maintaining safety. The introduction of RNAV1 SIDs and arrival transitions at Glasgow Prestwick Airport would improve systemisation and upgrade the navigation capability in accordance with the FAS recommendations.

3 Current Airspace

3.1 Current Aircraft Flight Paths

Glasgow Prestwick Airport has two Runways: the main Runway named 12/30 and the second Runway named 03/21. Runway 12/30 is just under 3,000m long and is used for passenger, cargo and military flights. Runway 03/21 is just over 1,900m long and is primarily used by small GA aircraft; or passenger aircraft when the main Runway is closed for maintenance. Helicopters can fly standard approaches to either runway, or a visual approach to the helicopter aiming point midway along Runway 12/30.

The direction of the wind affects the pattern of traffic as it is safest for aircraft to take off and land into a head wind; therefore determining which Runway is used daily. In the summer of 2016: Runway 12/30 was used for 90% of all movements, with only 6% using Runway 03/21 and 4% using the helipads.

There are currently four SIDs published at Glasgow Prestwick Airport which are primarily used by the commercial operators. The current SIDs take aircraft to the south-east and south-west; meaning aircraft flying to destinations such as Northern Europe initially fly away from their destination before turning back. In the summer of 2016, 25% of departures flew a SID whilst the remainder flew a visual departure.

Arrivals to Glasgow Prestwick Airport either arrive at a hold overhead the TRN VOR (14Nm south-west of the Airport) or are routed to a point called SUMIN (22Nm to the east of the airport). Currently aircraft are vectored from these locations by ATC to commence the final approach, which is typically conducted using the ILS.

Figures 3 to 5 on the subsequent pages illustrate the current day flight paths of aircraft arriving and departing to/from Runways 12 and 30, up to 7,000ft. These plots are generated from the radar data from 15 days in summer 2016 (04/07/16 – 18/07/17) and show the density of the flight paths. Red areas indicate the highest concentration of flight paths, with yellow/green less so and grey areas show where there are only occasional flights.

- Figure 3 shows all traffic (arrivals and departures) over the 15 day period when Runways 12/30 were in use.
- Figure 4 shows arrivals only over the 15 day period when Runways 12/30 were in use.
- Figure 5 shows departures only over the 15 day period when Runways 12/30 were in use.

The typical altitudes at points on the current day arrival and departure flight paths are indicated on Figures 4 and 5. ATC will always seek to climb departures as soon as possible and not to descend arrivals prematurely; this is better for noise levels and CO_2 and other emissions reduction. However our primary aim is maintaining safe separation between aircraft, and as a result this can affect the altitudes they can achieve.

3.2 Current Track Concentrations

Figures 3 to 5 show the current day spread of flight paths, up to 7,000ft.

These figures show the density of flight paths around Glasgow Prestwick Airport taken from 15 days of flight data in summer 2016. These give a good geographical indication of where the main concentrations of flights currently occur. The colour coding shows the number of overflights per day as an indication of concentration.

Where there is a spread of flight paths, this is a result of many factors including:

- The range of climb and descent performance of different aircraft types; typically slower aircraft will turn with tighter radii (e.g. turbo props) whereas larger aircraft fly faster and turn with wider radii (e.g. jets);
- ATC will tactically vector aircraft which may take them off defined arrival and departure routes, this can be seen by the dispersed nature of the tracks in Figures 3 to 5;
- Variation due to wind and different runway operations used. (note the runway in use is dictated by the wind direction)

For reference, the current conventional SID and STAR route definitions are included in Refs 3-6.

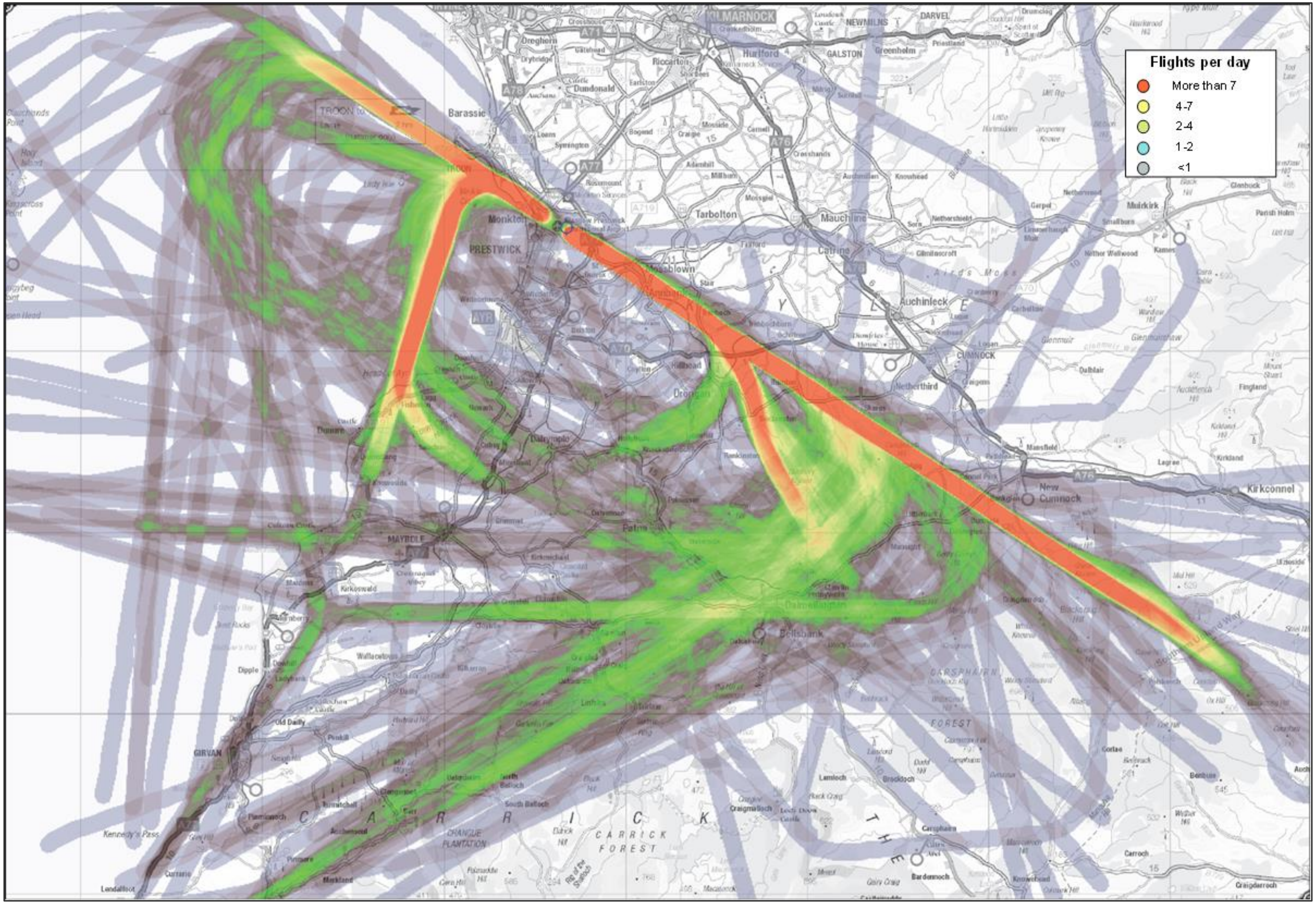

Figure 3: Current arrival and departure traffic patterns

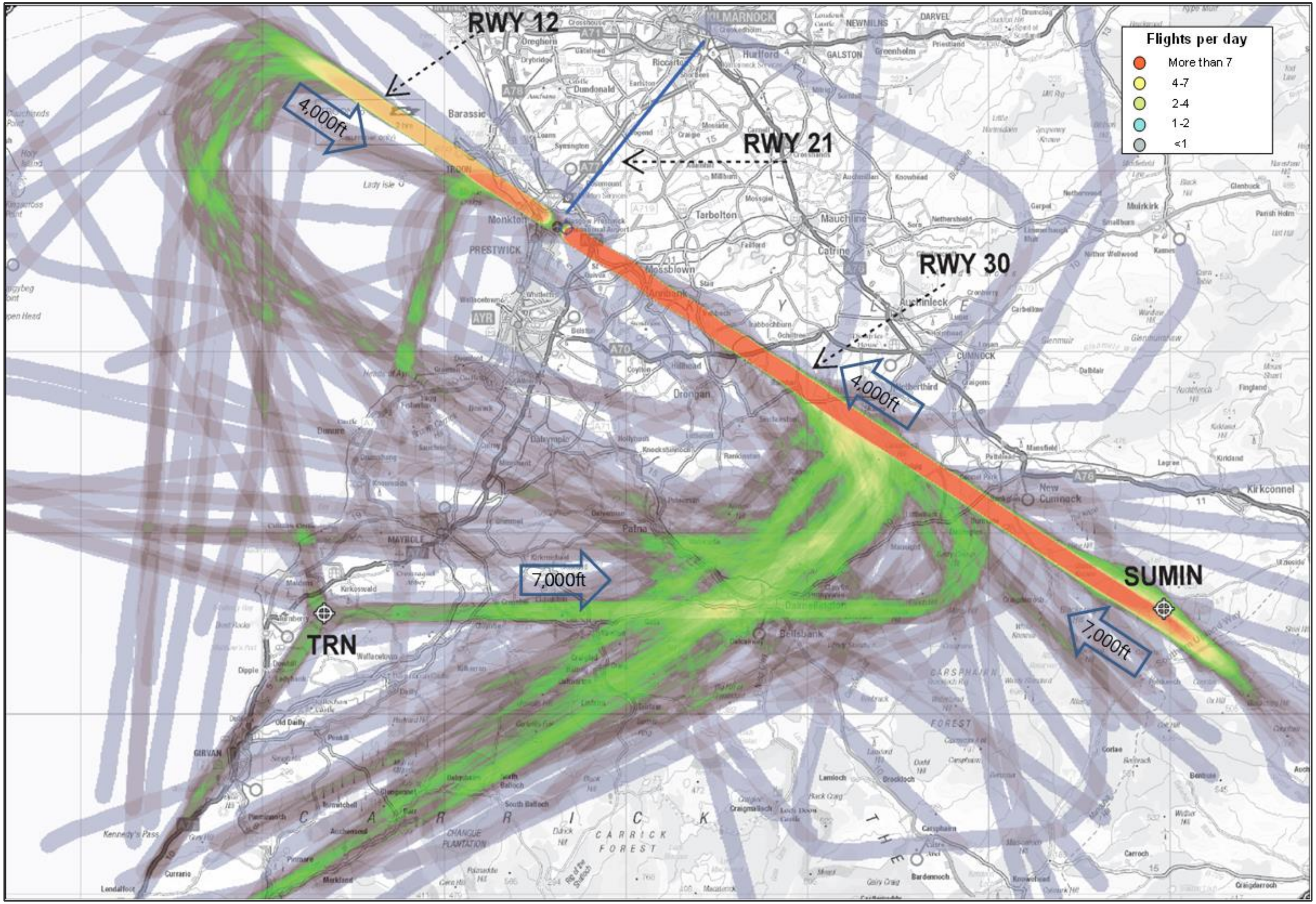

Figure 4: Current Arrival traffic pattern

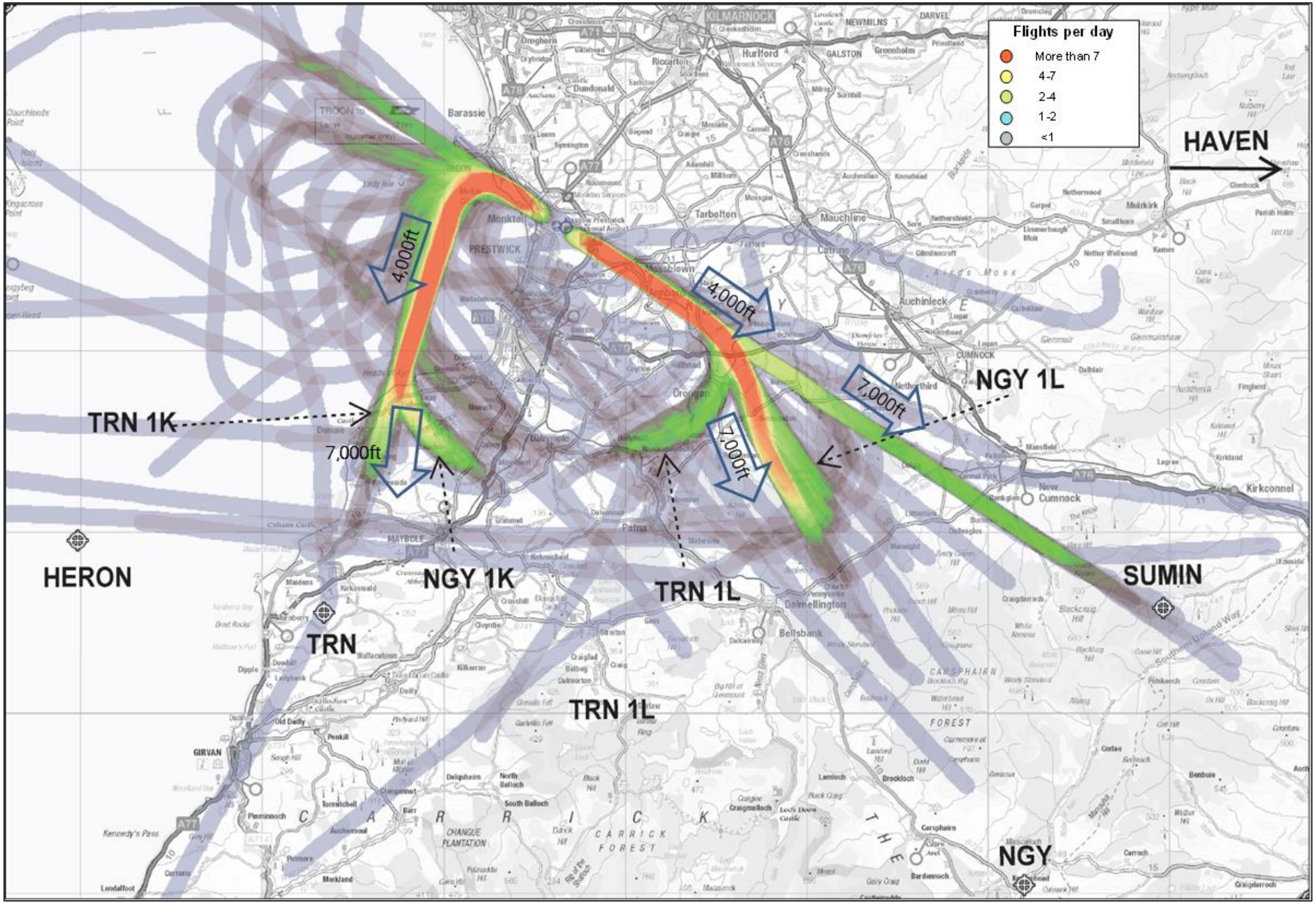

Figure 5: Current Departure traffic pattern

3.3 Current Traffic and Aircraft Type Figures (Summer 2016)

Table 1 below shows the average usage for each arrival and departure route at Glasgow Prestwick Airport. This is taken from the busy summer period between 16th June – 15th September 2016 (92 days in total).

Route	% (using the SID/ STAR)	Average Flights per Day
Arrivals		
TRN 1B	11%	2
TRN 1C	30%	4
TRN 2D	32%	4
Direct	20%	3
Unknown	7%	1
Departures		
NGY	68%	9
TRN	31%	4
Unknown	1%	1

Table 1: Current Average Daily Route Usage

NB: in the summer of 2016, 90% of all aircraft movements used Runway 12/30, 6% used Runway 03/21 and 4% used the helipads.

Table 2 below shows the mix of aircraft types departing from Glasgow Prestwick Airport between 16th June – 15th September 2016. This is for aircraft types making up at least 1.0% of the movements.

Type	Manufacturer	Name	Number
PA28 / C152 / DR46 / AA5 / EURO / C172 / C182	Piper PA-28 Cherokee Cessna 152 / 172 / 182 Robin DR400, etc.	2 – 5 seat single engine propeller	27.1%
B738	Boeing 737-800	184 passenger commercial jet	25.7%
S92	Sikorsky S-92	Coastguard Helicopter	4.8%
A320	Airbus A320	164 passenger commercial jet	3.4%
C130	Lockheed C-130 Hercules	4 engine turboprop medium military transport / cargo	2.7%
A319	Airbus A319	134 passenger commercial jet	2.5%
SC3	Short 330	2 engine turboprop medium	1.9%
HAWK	BAE Systems Hawk	Military trainer (e.g. Red Arrows)	1.4%
B206	Bell 206 JetRanger	7 seat helicopter	1.2%
DHC6	De Havilland Canada DHC 6 Twin Otter	2 engine turboprop 19 passenger	1.2%
B752	Boeing 757-200	200 passenger commercial jet	1.1%
DHC8	Bombardier Dash 8	2 engine turboprop 70 passengers	1.1%
B744	Boeing 747-400	Large 4 engine jet cargo	1.0%
B748	Boeing 747-800	Large 4 engine jet cargo	1.0%
Other			23.9%

Table 2: Current Aircraft Type Usage (by summer 2016 departures)

3.4 Operational Priorities

There are no specific operational issues in the current operation at Glasgow Prestwick Airport.

The airport has facilities, equipment and experience for a higher volume of aircraft movements (passenger and cargo) than are handled today. The airport is designed for up to 4 million passengers per annum and is operational 24 hours a day. Hence the airport infrastructure has ample spare capacity. Glasgow Prestwick Airport is working closely with its current passenger and cargo airline customers on the support of existing routes and the development of potential new routes.

3.5 Environmental Priorities

Glasgow Prestwick Airport recognises its responsibility to minimise and reduce the impact that a change in arrival and departure routes has on the environment, in relation to noise and pollution.

The main environmental consideration is the noise impact that aircraft in the airspace from the ground to 4,000ft has on people on the ground. As described in the consultation document (Ref 1), the main environmental priority for this ACP is to minimise the noise impact of aircraft overflying below 4,000ft and the number of people on the ground significantly affected by it. For aircraft flying between 4,000ft to 7,000ft there should be a balance between minimising the noise impact and aircraft emissions. Similarly, in the airspace above 7,000ft the priority should be to make the most efficient use of the airspace and minimise aircraft emissions.

An analysis of the environmental impact of the proposed new routes is given in Section 5.2. This includes a summary of impacts such as fuel burn, CO_2, noise and population overflown.

3.6 Safety

The proposed routes have not been designed with the intention to alleviate any specific safety issues in the current operation, as none exist. Ensuring the safety of proposed changes is a priority for Glasgow Prestwick Airport. Safety representatives from SARG have had oversight of the safety assurance process.

All proposed procedures have been designed in accordance with ICAO PANS-OPS RNAV procedure design criteria (Ref 12).

See Paragraph 5.11 for the safety assessment details of this proposal.

4 Proposed Routes

4.1 Requirements

In line with the justification and objectives listed in Section 2.2, the following requirements have particular relevance for the proposed route designs at Glasgow Prestwick Airport:

- Remove dependency on the TRN VOR and NGY NDB;
- Maintain or improve the level of safety for departures and arrivals to Glasgow Prestwick Airport;
- Minimise impact of aircraft noise on local population;
- No additional controlled airspace required for changes.

4.2 Proposed SIDs

The current conventional NGY and TRN departures will be replaced with modified RNAV1 SIDs:

- Runway 12 SUDBY 1L (south-east departures) - to replace NGY 1L
- Runway 12 TRN 2L (south-west departures) - to replace TRN 1L
- Runway 30 LUCCO 1K (east/ south-east departures)- to replace NGY 1K
- Runway 30 TRK 2K (south-west departures) - to replace TRN 1K

In order to improve departure routings, Glasgow Prestwick Airport has also decided to introduce the following SIDs from Runways 12 and 30:

- Runway 12 OKNOB 1L (west departures)
- Runway 12 SUMIN 1L (east departures)
- Runway 30 DAUNT 1K (west departures)

The new proposed SIDs will allow aircraft flying to destinations, such as Northern Europe, a more direct routing. Currently these departures are flown south-east or south-west away from their destination, before turning back on track. Overview diagrams of the proposed SIDs for Runways 12 and 30 are given in Figures 6 and 7 below. Details of the route usage and traffic allocation are given in Section 4.4. New links routes have been negotiated with Prestwick Centre which are shown in red on Figures 6 and 7. Link routes are detailed in Section 4.12.

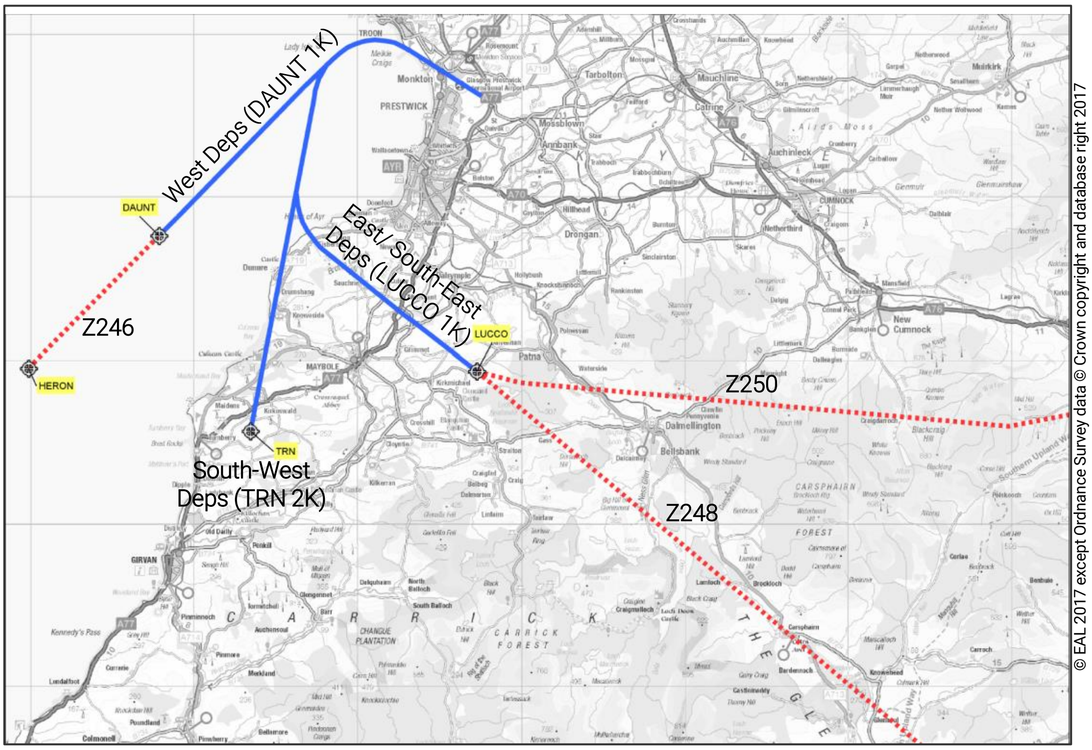

Figure 6: Proposed Runway 30 Departures

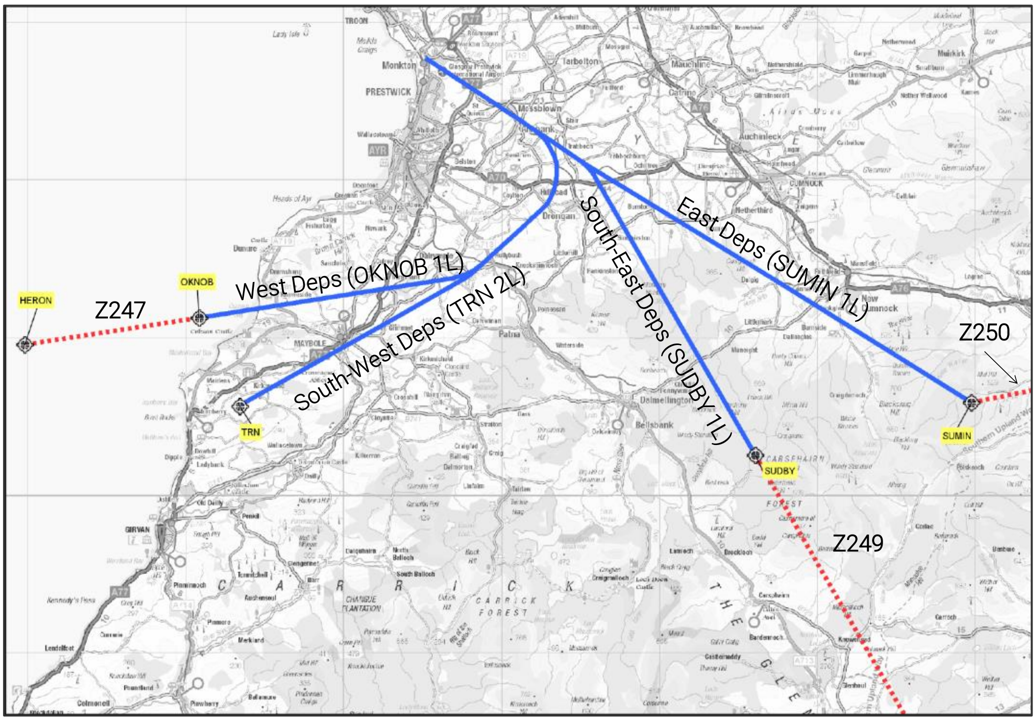

Figure 7: Proposed Runway 12 Departures

4.3 Proposed PBN Approach Procedures and Arrival Transitions

Glasgow Prestwick Airport has taken this opportunity to implement new RNAV (GNSS) approach procedures to Runways 12, 21 and 30. The procedures for Runways 12 and 30 will replicate the existing ILS approaches. The procedure for Runway 21 will replicate the existing SRA approach but the descent gradient will be reduced to comply with design criteria.

The five proposed RNAV1 arrival transitions and approach procedures can be seen in Figure 8 below. These routes will be used by aircraft arriving at the airport via one of the Standard Instrument Arrivals (STARs) for Runways 12, 30 and 21. These new procedures will allow the flight crew to manage descent planning better and enable continuous descent approaches more reliably.

Aircraft arriving via a standard STAR which are required to hold, will be instructed by ATC to hold at a point overhead the old TRN navigation aid, before picking up the transition route for the appropriate runway. Arrivals which don't need to hold will be sent to either the TRN or SUMIN point, before picking up the transition route for the appropriate runway.

The proposed approach procedures are, as far as practicable, each replications of the existing conventional procedures especially with regard to the parameters of the final approach segment. All of the RNAV (GNSS) approaches will be designed with additional "T-Bar" legs which facilitate arrivals without the need for ATC intervention, with the exception of the north leg for the Runway 30 which has been designed as a "Y-Bar" due to operational reasons. There is one proposed "T-Bar" leg for Runway 30 (south), three for Runway 12 (north, south and west) and two for Runway 21 (east and west). The procedures for Runway 12/ 30 will primarily be flown by training aircraft practicing the new procedure types, whilst the procedure for Runway 21 is likely to become the preferred approach.

Draft charts of the procedures are provided can be found in the design reports for approaches/ arrivals and departures, Refs 14 – 15.

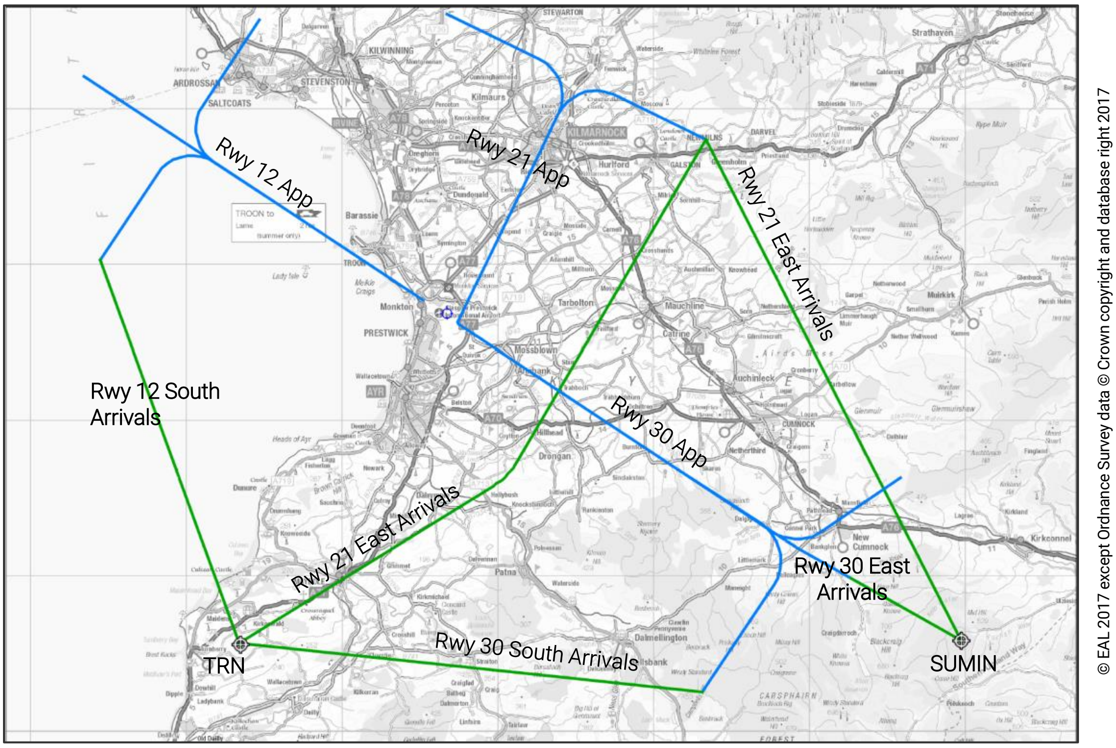

Figure 8: Proposed Arrival Transition and Approach Procedures

4.4 Proposed Changes Summary

This airspace change proposes 15 new RNAV1 instrument flight procedures as broken down below:

- 4 SIDs for Runway 12;
- 3 SIDs for Runway 30;
- 1 arrival transition for Runway 12;
- 2 arrival transitions for Runway 30;
- 2 arrival transitions for Runway 21;
- 3 approach procedures (one for each runway).

All routes will be operated H24, local time. Note that route names below are working names (the names have been reserved in iCARD but may be subject to change, as a normal part of the regulatory review). The proposed procedures have been summarised below:

Route (working name 5LNCs)	Description
RNAV1 SIDS from Runway 30	
Runway 30 TRN 2K (south-west departures)	New RNAV1 replacement for the current TRN 1K departure route. Destinations such as Scotland, Ireland, Southern Europe or Africa.
Runway 30 DAUNT 1K (west departures)	A new route to replace the situation where aircraft are tactically cleared to HERON. Destinations such as Iceland, North America or South America.
Runway 30 LUCCO 1K (east/ south-east departures)	New RNAV1 replacement for the current NGY 1K departure route. Two new link routes from the end of LUCCO 1K will exist: - A route for aircraft which fly the current NGY 1K route to destinations such as England, Wales, Central Europe or the Middle East. - A more direct routing for aircraft departing to destinations such as Northern Europe, Russia or the Far East. Aircraft currently depart on the south-east route before turning back north-east.
RNAV1 SIDS from Runway 12	
Runway 12 TRN 2L (south-west departures)	New RNAV1 replacement for the current TRN 1L departure route. Destinations such as Scotland, Ireland, Southern Europe or Africa.
Runway 12 OKNOB 1L (west departures)	A new route for aircraft departing to destinations such as Iceland, North America or South America. Aircraft are currently tactically cleared to HERON.
Runway 12 SUDBY 1L (south-east departures)	New RNAV1 replacement for the current NGY 1L departure route. Destinations such as England, Wales, Central Europe or the Middle East.
Runway 12 SUMIN 1L (east departures)	A new route for aircraft departing to destinations such as Northern Europe, Russia or the Far East.
New RNAV1 Arrival Transitions	
Runway 12 Arrivals from the south	To be used by aircraft arriving via a STAR that ends at TRN.
Runway 21 Arrivals from the east	To be used by aircraft arriving via a STAR that ends at SUMIN.
Runway 21 Arrivals from the south	To be used by aircraft arriving via a STAR that ends at TRN.
Runway 30 Arrivals from the east	To be used by aircraft arriving via a STAR that ends at SUMIN.
Runway 30 Arrivals from the south	To be used by aircraft arriving via a STAR that ends at TRN.
New RNP Approaches	
Runway 12 Approaches	A replication of the existing conventional approach procedure with three additional "T-Bar" legs which facilitate arrivals from the north, south and west.
Runway 21 Approaches	A replication of the existing conventional approach procedure with two additional "T-Bar" legs which facilitate arrivals from the east and west.
Runway 30 Approaches	A replication of the existing conventional approach procedure with one additional "T-Bar" leg and one "Y-Bar" leg which facilitate arrivals from the north and south.

Table 3: Proposed Route Usage

Figures 6 to 8 show an overview of the proposed routes and Table 3 above gives a summary of the different routes. Further details on usage are given in Section 4.8 – Route Usage and Traffic Forecasts.

4.5 Modernising Procedures

As outlined in the consultation document (Ref 1), Glasgow Prestwick Airport propose to replace the conventional departure, arrival transition and approach procedures with PBN procedures.

This change forms part of the CAA's Future Airspace Strategy (FAS) for the United Kingdom (2011 – 2030). This is focussed on upgrading the airspace throughout the UK and Ireland to increase capacity and efficiency. One way in which this can be attained is through designing upgraded routes which use modern technology such as PBN.

The navigation aids used by aircraft to fly in and out of Glasgow Prestwick Airport are due to be decommissioned in 2019 as part of the NATS VOR rationalisation programme. As such, the proposed changes to current procedures are targeted to be complete before the navigation aids listed in Table 4 below are withdrawn from service.

NDB/ VOR being decommissioned	Used by current EGPK conventional procedures	Deadline for procedures to be removed	Proposed date of decommissioning
New Galloway (NGY) NDB	NGY 1K SID, NGY 1L SID	Dec 2019	Feb 2019
Turnberry (TRN) VOR (TRN DME will remain in service)	TRN 1K SID, TRN 1L SID, TRN 1B STAR	Dec 2019	Feb 2019

Table 4: VOR Rationalisation – Procedures Affected

4.5.1 RNAV Equipage

Most commercial aircraft already have the ability to conform to RNAV1 and RNP APCH. The RNAV1 equipage rate for aircraft which operate from Glasgow Prestwick Airport is currently 86.9% as shown in the Table 5 below . Non-RNAV1 compliant aircraft are covered below in Section 4.11.

Airport	RNAV5	RNAV1	RNAV1 GNSS	RNP1	RNP1 GNSS	RNP APCH	with RF
Glasgow Prestwick	96.4%	86.9%	83.3%	83.9%	13.1%	83.9%	0.0%

Table 5: Performance Based Navigation Equipage Rate at Glasgow Prestwick Airport

The above was taken from the NATS PBN equipage survey Jan-Feb 2017; airframes of flights originating from Glasgow Prestwick Airport.

The proposed SIDs and Transitions for Glasgow Prestwick Airport have been designed using the RNAV1 navigation specification.

For non-RNAV1 capable aircraft, omnidirectional departures for each runway end have been designed (Section 4.10). These provide simple departure procedures for non-RNAV1 capable aircraft to ensure obstacle clearance on departure before aircraft can be vectored by ATC to join the enroute network.

The Approaches have been designed using the RNP APCH navigation specification. Conventional approach procedures will remain available for approaches in IMC from the PIK NDB.

4.6 Radar, Communications and Navaid coverage

There is no intention to propose any new controlled airspace or changes to existing controlled airspace boundaries as part of the Glasgow Prestwick Airport Airspace Change Proposal. All proposed routes are within existing CAS where radar and comms coverage are well proven.

RNAV1 Navaid coverage (DME/DME) is demonstrated in the coverage plots included as Ref 24. This assessment concludes that all proposed approaches, SIDs and arrival transitions are covered by full DME/ DME signal full redundancy in support of RNAV1.

The coverage assessment identifies Dundonald DME as a “critical” navaid for the SUDBY 1L and SUMIN 1L SIDs. This is operationally acceptable as the information for this DME is provided in the charts and assuming that Glasgow Prestwick Airport is notified of any outages.

4.7 Traffic Forecasts and Route Usage

Table 6 below shows the forecast average number of aircraft, of any type, which would fly each route per week over the first five years of operation. These figures do not include GA traffic.

	Route	2018	2019 (+24%)	2020 (+8%)	2021 (+3%)	2022 (+2%)	2023 (+3%)
Runway 12	South-west Deps	10	13	14	14	14	15
	West Deps	3	3	3	3	3	4
	East/ South-east Deps	23	29	31	32	33	34
	Total Flights	36	45	48	49	50	53
Runway 30	South-west Deps	18	22	24	25	25	26
	West Deps	5	7	7	7	7	8
	South-east Deps	52	65	70	72	74	76
	East Deps	3	4	4	4	5	5
	Total Flights	78	98	105	108	111	115
Runway 21	Runway 21 Flights	<1	<1	<1	<1	<1	<1

Table 6: Forecast Total Route Usage

Table 7 below shoes the forecast percentage use of each route, by runway, using the above figures (Table 6) over the first five years of operation. Runway 21 has not been included due to the low number of expected flights.

	Route	2018	2019 (+24%)	2020 (+8%)	2021 (+3%)	2022 (+2%)	2023 (+3%)
Runway 12	South-west Deps	27.8%	28.9%	29.2%	28.6%	28.0%	28.3%
	West Deps	8.3%	6.7%	6.2%	6.1%	6.0%	7.5%
	East/ South-east Deps	63.9%	64.4%	64.6%	65.3%	66.0%	64.2%
Runway 30	South-west Deps	23.1%	22.5%	22.8%	23.1%	22.5%	22.6%
	West Deps	6.4%	7.1%	6.7%	6.5%	6.3%	7.0%
	South-east Deps	66.7%	66.3%	66.7%	66.7%	66.7%	66.1%
	East Deps	3.8%	4.1%	3.8%	3.7%	4.5%	4.3%

Table 7: Forecast Percentage Route Usage

The traffic growth figures used for the above forecasts were taken from an update of the Glasgow Prestwick Airport Strategic Plan for passenger numbers. These traffic growth figures were applied to flight plan data from 2016 for Glasgow Prestwick Airport arrivals and departures.

4.8 Controlled Airspace

Glasgow Prestwick Airport is not requesting any changes to the boundaries of controlled airspace. The proposed new routes are contained within existing controlled airspace. There is no proposal in this ACP to release controlled airspace or raise the base of controlled airspace.

NATS Prestwick Centre (PC) implemented 3.0nm radar separation on the 2nd March 2017. As part of the wider Scottish airspace development project there may be work in the future to implement 3.0nm radar separation between the Scottish units. However this would be at a later date and completely independent of the ACP. Hence for the purposes of this ACP 5nm separation will continue to be used at the interface between EGPK and NATS Prestwick Centre. PC and the NATS airspace development team are aware of, and support, the proposed changes at Glasgow Prestwick Airport.

4.9 Omnidirectional Departures (ODD)

Omnidirectional departures have been designed for Runways 12, 21 and 30, from each runway end, in order to cater for non-RNAV capable aircraft. Omnidirectional departures are used as an alternative method to ensure obstacle clearance for IFR departing aircraft, which are unable to fly the new RNAV1 routes.

The intention is that only aircraft that are unable to fly the new departure routes would use the omnidirectional departure procedures. Once an aircraft has climbed above the designated altitude, ATC would then provide tactical instructions directing the aircraft along the appropriate route, before joining the enroute network. As such to an observer from the ground the flight path of an aircraft using the omni-directional departure will be similar to those using the RNAV1 routes.

As the omnidirectional departures don't define a specific track over the ground there is no route to consult on so they do not appear as a specific route in this consultation.

The omnidirectional departures will be described in the AIP Airport textual data (EGPK AD 2.22 Flight Procedures – Ref 7). Table 8 below shows the suggested text for the Glasgow Prestwick Airport Omnidirectional departures.

Omnidirectional Departures		
	Description	**Restriction**
Runway 12	Climb straight ahead MAG track 124° to 936ft then turn on track climbing to enroute safety altitude/ MSA. PDG 3.3%.	N/A
Runway 21	Climb straight ahead MAG track 207° to 1342ft then turn on track climbing to enroute safety altitude/ MSA.	PDG 3.7% to 1342ft then 3.3% after turn.
Runway 30	Climb straight ahead MAG track 304° to 566ft then turn on track climbing to enroute safety altitude/ MSA. PDG 3.3%.	N/A

Table 8: Omnidirectional Departures Summary

4.10 Link routes

The SIDs designed for Glasgow Prestwick Airport have been assessed to decide on the most appropriate and efficient termination point for flight planning and fuel usage purposes. Beyond the termination point, a distinction between the SID and an RNAV Departure Transition will link the end of each SID to the intended enroute airway structure. In considering the Prestwick SIDs we are looking to truncate, where possible, at a convenient location close to where the nominal aircraft can achieve 6,000ft.

For the purpose of the consultation and flight validation, the SIDs have been constructed to their full extent; ending in an enroute waypoint and assessed with departure criteria. This is for the purpose of the consultation and flight validation only.

A distinction between the SID and departure transition link routes has negotiated and agreed with Prestwick Centre, prior to Work Package 3. A full design package and charts will be included at Work Package 3. This ACP submission is therefore subject to this later activity taking place.

The SIDs will be terminated at the following positions with link routes connecting to the enroute network.

SID	Link route(s)	SID Enroute interface point	Route Designator
DAUNT 1K	DAUNT – HERON	HERON	Z246
OKNOB 1L	OKNOB - HERON	HERON	Z247
LUCCO 1K	LUCCO - OSMEG	OSMEG	Z248
SUDBY 1L	SUDBY – OSMEG	OSMEG	Z249
LUCCO 1K	LUCCO – SUMIN – HAVEN	HAVEN	Z250
SUMIN 1L	SUMIN – HAVEN	HAVEN	Z250
TRN 2K	N/A - not truncated	TRN	N/A
TRN 2L	N/A - not truncated	TRN	N/A

Table 9: SID Link Routes Summary

The above ICARD names have been requested for reservation from CAA SARG.

The above link routes have been designed to interface with the existing enroute structure and also in coordination with the NATS PLAS network. These routes have been agreed with NATS Prestwick Centre.

Figure 9 below shows the link routes, as coloured in Table 9 above.

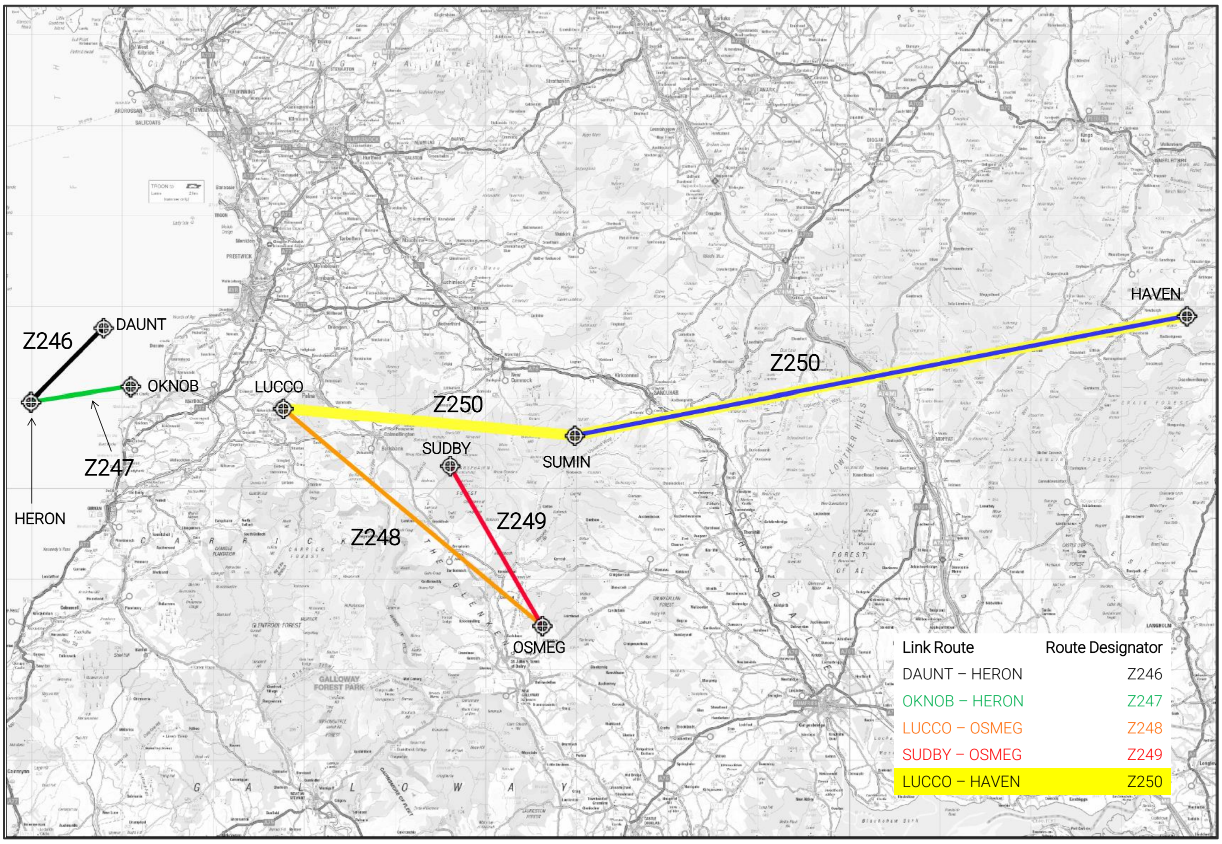

Figure 9: Proposed Link Routes

4.11 GNSS approaches

Glasgow Prestwick Airport has also taken this opportunity to introduce new RNAV (GNSS) approach procedures to Runways 12, 21 and 30. The procedures for Runways 12 and 30 will replicate the existing ILS approaches. The procedure for Runway 21 will replicate the existing SRA approach alignment with a reduced gradient.

Draft charts of the proposed GNSS approaches are available in the PBN Approaches Report, Ref 14.

5 Airspace Change Proposal Impacts

5.1 Airspace Change Proposal Impacts Summary

This section describes the airspace change impacts for the proposed routes, with the main changes summarised below:

Safety/ Complexity

- Increased predictability of flight paths and a reduction in complexity of ATC tasks.
- See Section 5.11.

Fuel Efficiency/ CO_2

- Small annual increase of 23.2 tonnes fuel and 73.9 tonnes CO_2.
- See Section 5.7.

Noise

- Leq contours
  - No initial effect on the number of people within the Leq contours.
  - Increase by 2023 (due to the forecast increase in traffic).
- SEL footprints
  - No change for arrival footprints.
  - Negligible change for B737 departure footprints on Runways 30 & 12 (most common aircraft).
  - Increase for B747 Runway 30 departures (noisiest aircraft).
  - Decrease for B747 Runway 12 departures (noisiest aircraft).
- See Section 5.2.

Other Airspace Users

- Minimal impact, no changes to CAS volumes.
- See Sections 5.9 to 5.13.

There are no significant changes forecast on capacity, delay, tranquillity, biodiversity or local air quality.

5.2 Noise and population impacted

The ERCD Prestwick ACP Noise Assessment (Ref 2) summarises the noise modelling work carried out by the CAA ERCD for the Glasgow Prestwick ACP. The following noise contours were produced, showing the current routes and impact of the proposed routes:

- 51-72 dBA Leq contours showing the **current** SIDs and arrival routes in **2018**;
- 51-72 dBA Leq contours showing **proposed** SIDs and arrival routes in **2018**;
- 51-72 dBA Leq contours showing the **proposed** SIDs and arrival routes for the forecast year **2023**;
- 80 and 90 dBA SEL footprints for the most frequent and noisiest aircraft types currently operating at night.

Overall noise impact – Leq Analysis

Leq (equivalent continuous sound level) contours are used as a metric to demonstrate the degree of daytime noise impact across geographical areas. The affected area, populations and households for the current routes in 2018, proposed routes in 2018 and proposed routes in 2023 were calculated from the Leq noise contours.

The Leq contours for Glasgow Prestwick Airport were based on summer 2016 traffic (92-day period) with forecast figures applied for 2018 and 2023. The population data was a 2016 update of the 2011 Census supplied by CACI Ltd. These can be seen below in Figures 10–11.

The estimated area, populations and households captured within the Leq contours, and split by noise level, is summarised in Table 10 below.

Leq (dBA)	2018 - Current Routes			2018 - Proposed Routes			2023 - Proposed Routes		
	Area (km^2)	Population	Households	Area (km^2)	Population	Households	Area (km^2)	Population	Households
> 51	13.9	2,100	900	14.1	2,100	900	19.1	3,000	1,300
> 54	7.7	400	200	7.7	400	200	10.6	1,100	500
> 57	4.3	100	< 100	4.3	100	< 100	5.9	100	100
> 60	2.5	100	< 100	2.5	100	< 100	3.4	100	< 100
> 63	1.4	0	0	1.5	0	0	1.9	< 100	< 100
> 66	0.9	0	0	0.9	0	0	1.2	0	0
> 69	0.6	0	0	0.6	0	0	0.7	0	0
> 72	0.4	0	0	0.4	0	0	0.5	0	0

Table 10: Summary of Leq contour population data

The above shows that the proposed routes would not initially have any effect on the number of people within the Leq contours. By 2023 the forecast traffic growth results in the size of the contours increasing and hence an increase of population count within the 51dBA and 54dBA Leq contours. There is a negligible change of population count within the 57dBA and higher Leq contours.

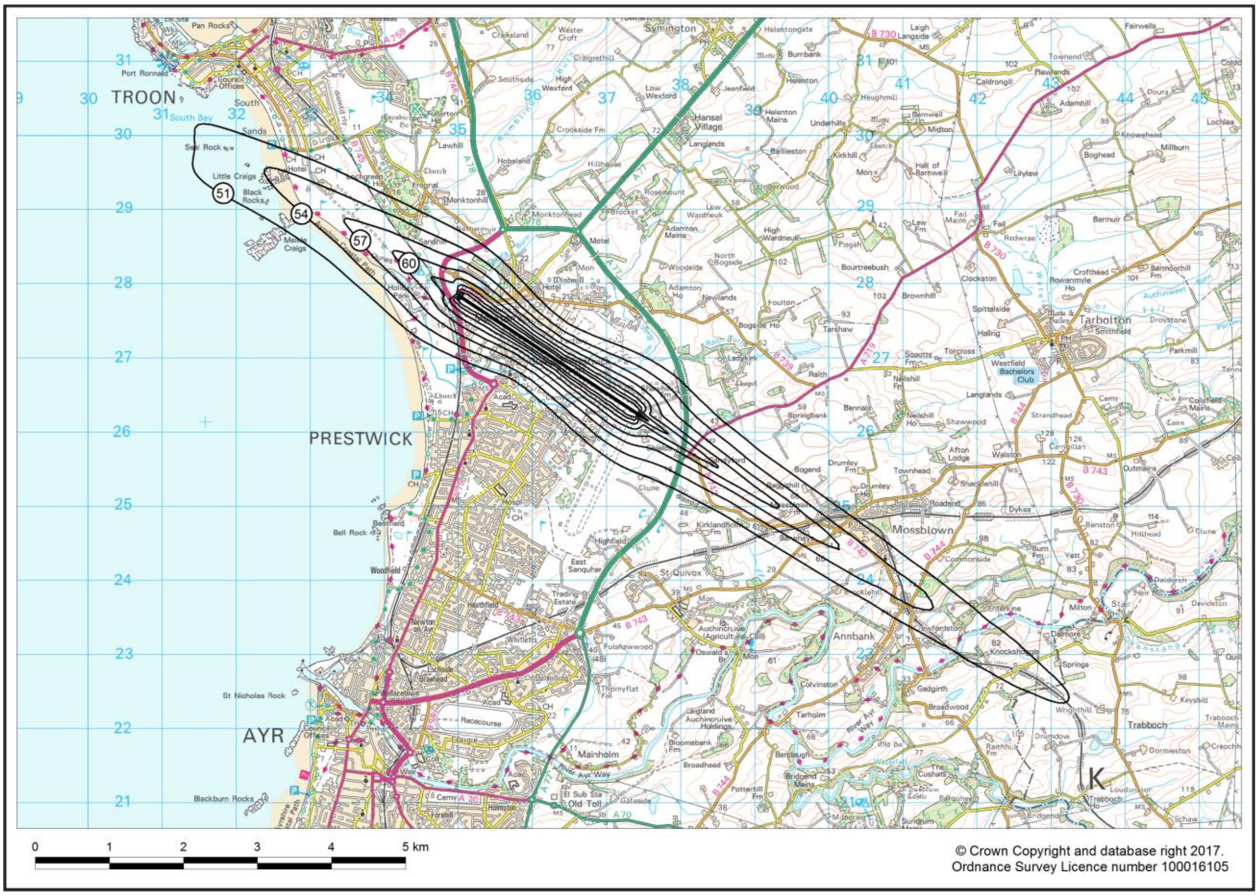

Figure 10: Glasgow Prestwick 2018 average summer day (68% W / 32% E) 51-72 dBA Leq noise contours – with proposed changes

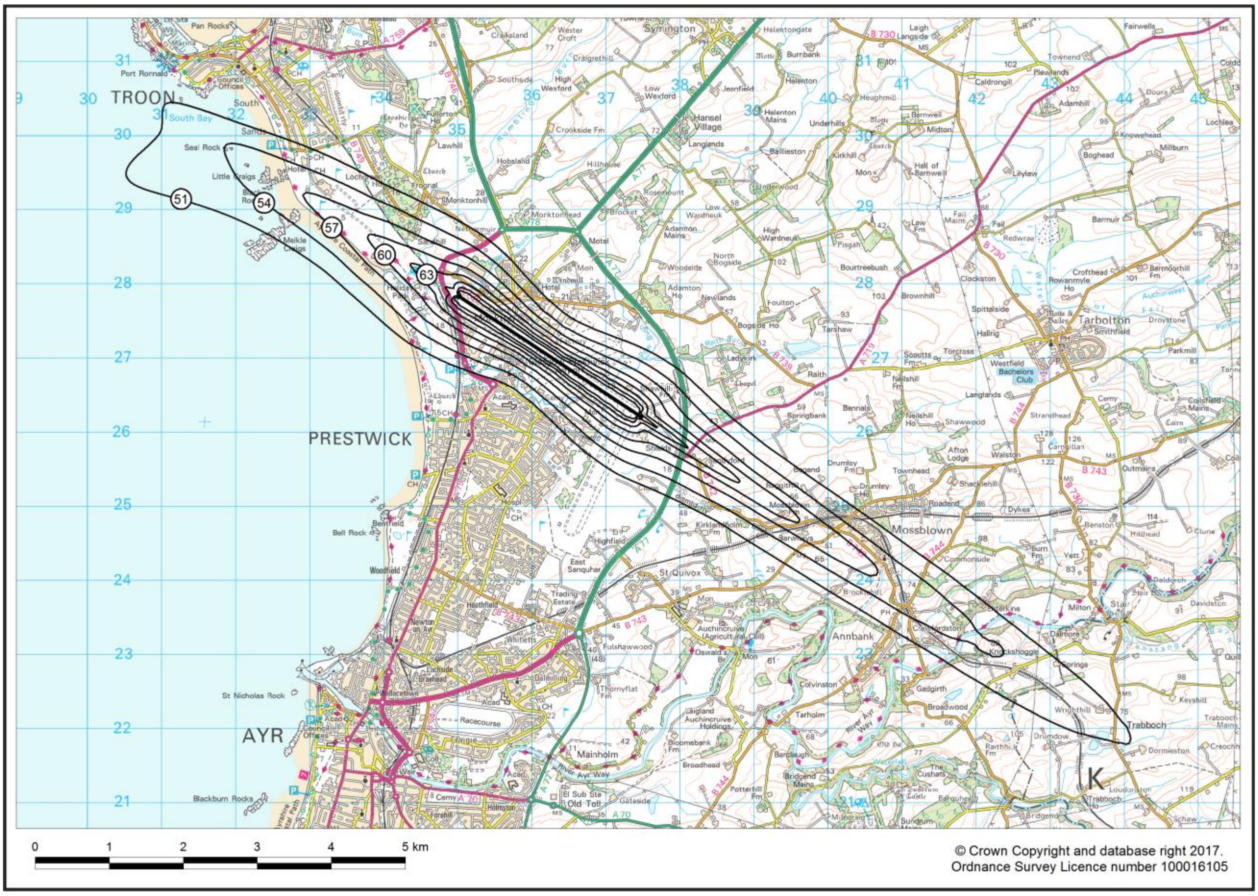

Figure 11: Glasgow Prestwick 2023 average summer day (68% W / 32% E) 51-72 dBA Leq noise contours – with proposed changes

Night Noise Impact

As an indicator of the night noise impact from the proposed routes, SEL footprints were produced for the most frequent (Boeing B738) and noisiest (Boeing B748) aircraft types that operated at night (2300-0700 local time). As for the Leq contours, this was based on the summer 2016 period at Glasgow Prestwick Airport. The SEL footprints relate to a single overflight occurrence and show the area, population and total households within the 80 and 90dBA contours. These are generated for the current and proposed routes. The ERCD noise assessment technical report can be found in Ref 2.

Table 11 below summarises the area, population and households within the 80 and 90dBA contours for the most frequent aircraft type (Boeing 737-800 (B738)). The Boeing 737/Airbus A320 family of aircraft is representative of approximately 26% of the aircraft movements at Glasgow Prestwick Airport. This is the second most common aircraft type found after single engine propeller aircraft.

Table 12 below summarises the area, population and households within the 80 and 90dBA contours for the noisiest aircraft type (Boeing 747-800 (B748)) . This gives the worst-case in terms of noise exposure. The B748 accounts for approximately 1% of the aircraft movements at Glasgow Prestwick Airport.

Route	Runway	SEL (dBA)	Area (km²)	Population	Households
Existing Routes					
NGY 1L (south-east Deps)	12	> 80	27.2	5,500	2,600
		> 90	4.6	100	< 100
TRN 1L (south-west Deps)	12	> 80	27.4	5,500	2,600
		> 90	4.6	100	< 100
Arrivals 12	12	> 80	11.0	1,000	500
		> 90	0.7	0	0
NGY 1K (south-east Deps)	30	> 80	25.4	3,300	1,600
		> 90	4.5	100	100
TRN 1K (south-west Deps)	30	> 80	25.4	3,300	1,600
		> 90	4.5	100	100
Arrivals 30	30	> 80	11.9	1,500	700
		> 90	0.9	< 100	< 100
Proposed Routes					
SUDBY 1L (south-east Deps)	12	> 80	27.3	5,500	2,600
		> 90	4.6	100	< 100
TRN 2L (south-west Deps)	12	> 80	26.9	5,500	2,600
		> 90	4.6	100	< 100
SUMIN 1L (east Deps)	12	> 80	27.3	5,500	2,600
		> 90	4.6	100	< 100
OKNOB 1L (west Deps)	12	> 80	26.9	5,500	2,600
		> 90	4.6	100	< 100
Arrivals 12 via TRN	12	> 80	11.0	1,000	500
		> 90	0.7	0	0
LUCCO 1K (east/ south-east Deps)	30	> 80	25.6	3,600	1,800
		> 90	4.4	100	100
TRN 2K (south-west Deps)	30	> 80	25.6	3,600	1,800
		> 90	4.4	100	100
DAUNT 1K (west Deps)	30	> 80	25.5	3,600	1800
		> 90	4.4	100	100
Arrivals 30 via SUMIN	30	> 80	11.9	1,500	700
		> 90	0.9	< 100	< 100
Arrivals 30 via TRN	30	> 80	11.9	1,500	700
		> 90	0.9	< 100	< 100

Table 11: Boeing 737-800 (B738) SEL footprints – area, population and household estimates

Where the proposed departure routes replicate existing routes, these are shown by matching colours.

For Runway 12 operations (NGY 1L, TRN 1L and arrivals) and Runway 30 arrivals the proposed replication routes show no difference in the overflown population. For Runway 30 departures (NGY 1K and TRN 1K) the proposed routes result in an 9% (3,300 to 3,600) increase of population within the SEL 80dBA contour for the B738.

There is no change in overflown population for the louder 90dBA contours.

Route	Runway	SEL (dBA)	Area (km²)	Population	Households
Existing Routes					
NGY 1L (south-east Deps)	12	> 80	55.9	7,100	3,100
		> 90	6.3	1,400	600
TRN 1L (south-west Deps)	12	> 80	52.1	8,400	3,700
		> 90	6.3	1,400	600
Arrivals 12 (straight in)	12	> 80	39.8	5,500	2,800
		> 90	5.3	500	200
Arrivals 12 (vectored)	12	> 80	40.0	5,500	2,800
		> 90	5.3	500	200
NGY 1K (south-east Deps)	30	> 80	51.9	2,300	1,000
		> 90	5.9	100	< 100
TRN 1K (south-west Deps)	30	> 80	50.7	2,400	1,000
		> 90	5.9	100	< 100
Arrival 30 (straight in)	30	> 80	45.4	4,200	1,900
		> 90	6.1	600	300
Arrival 30 (vectored)	30	> 80	48.6	4,200	1,900
		> 90	6.1	600	300
Proposed Routes					
SUDBY 1L (south-east Deps)	12	> 80	55.6	5,300	2,300
		> 90	6.3	1,400	600
TRN 2L (south-west Deps)	12	> 80	50.9	6,700	2,900
		> 90	6.4	1,400	600
SUMIN 1L (east Deps)	12	> 80	54.9	5,300	2,300
		> 90	6.3	1,400	600
OKNOB 1L (west Deps)	12	> 80	51.0	6,700	2,900
		> 90	6.4	1,400	600
Arrivals 12 via TRN	12	> 80	40.0	5,500	2,800
		> 90	5.3	500	200
LUCCO 1K (east/ south-east Deps)	30	> 80	48.9	4,200	1,900
		> 90	5.8	100	< 100
TRN 2K (south-west Deps)	30	> 80	48.4	4,200	1,900
		> 90	5.8	100	< 100
DAUNT 1K (west Deps)	30	> 80	48.3	4,200	1,900
		> 90	5.8	100	< 100
Arrivals 30 via SUMIN	30	> 80	45.5	4,200	1,900
		> 90	6.1	600	300
Arrivals 30 via TRN	30	> 80	46.0	4,200	1,900
		> 90	6.1	600	300

Table 12: Boeing 747-800 (B748) SEL footprints – area, population and household estimates

Where the proposed departure routes replicate existing routes, these are shown by matching colours.

For Runways 12 and 30 arrivals, the proposed replication routes show no difference in the overflown population.

The proposed, replicated departure routes for Runway 12 both showed a reduction in the overflown population within the SEL 80dBA contour for the B748:

- A 25% reduction for the south-east SUDBY 1L departure (replacing NGY 1L) - shown in red.
- A 20% reduction for the south-west TRN 2L departure (replacing TRN 1L) – shown in orange.

The proposed, replicated departure routes for Runway 30 both showed an increase in the overflown population within the SEL 80dBA contour for the B748:

- An 83% increase for the south-east LUCCO 1K departure (replacing NGY 1K) – shown in blue.

- A 75% increase for the south-west TRN 2K departure (replacing TRN 1K) – shown in purple.

This large increase in overflown population has arisen from a change in design criteria which the proposed replicated routes have had to adhere to. Previously these departure routes flew straight ahead for approximately 1,500m before turning southeast or southwest. Current design criteria stipulates that this turn cannot be any closer than 1,950m from the runway end. This has led to the SEL contours increasing in size across the sea and further towards Troon which has led to the increase in overflown population.

There is no change in overflown population for the louder 90dBA contours.

The population figures in Tables 11 and 12 above, use population data provided by CACI Ltd. This is a 2016 update of the 2011 Census. This includes Local Authority Mid-Year Estimates, LSOA (lower-level data-zones) Population Mid-Year Estimates, Local Authority Population Projections and Principal National Population Projections for Scotland. Population and households are given to the nearest 100.

5.3 Concentration of traffic

With the aid of modern navigation systems aircraft are able to fly more accurately and consistently than using legacy “conventional” navigation aids. Use of more accurate navigation systems will result in a reduction in the overall area overflown, but a corresponding increase in the concentration of flights close to the route centrelines.

When designing the routes we have positioned them to, where possible, over-fly the lowest number of people, e.g. when design criteria permit. This is in accordance with DfT guidelines (Ref 11).

5.4 Ground Holding

There is not expected to be a change in ground holding times between the current and proposed operations. Ground holding times and departure intervals are not currently an issue at Glasgow Prestwick Airport.

5.5 Biodiversity

The proposed routes do not overfly any National Parks or National Scenic Areas (NSAs). There are also no direct impacts anticipated on flora, fauna or biodiversity due to the proposed changes.

There has been no additional biodiversity analysis undertaken.

5.6 Local Air Quality

CAA Guidance (Ref 8) determines that if changes alter flight paths below 1,000ft, local air quality analysis is required. Above 1,000ft, due to atmospheric mixing, there is no significant effect on local air quality at ground level.

There is a small change to the first turn point for the Runway 30 departures, which may fall below 1,000ft for slow climbers. Under proposed changes the turn point would be moved 427m further from the end of the runway in order to comply with design criteria (Ref 20). This moves the track further out to sea with aircraft still maintaining the current Noise Preferential Route intention to turn away from Troon at the earliest opportunity. Therefore, the only change to the turn point would be seen over the sea where most aircraft would be expected to be well over 1,000ft anyway. The number of slow climbers is likely to be very small.

There are no changes below 1,000ft to any of the other departure, arrival or transition routes at Glasgow Prestwick Airport. There are also no proposed changes to aircraft taxiing or hold times. It is also worth noting that there are no Air Quality Management Areas (AQMA) in the vicinity of Glasgow Prestwick Airport.

It is therefore concluded that further, detailed local air quality assessment is not required as part of this submission.

5.7 CO_2 emissions & fuel burn

The NATS Analytics, Environmental team have completed analysis on the CO_2 emissions and fuel burn change that the proposed routes at Glasgow Prestwick Airport would have.

This analysis forecasts that the proposed changes would result in an increase in fuel burn and CO_2 emissions per annum as summarised in Table 13 below.

Runway	Current Route	Proposed Route	Track Mileage Count (NM)	2018 Flight Count	Fuel Difference per Flight (kgs)	Annual Fuel Difference (T)	Annual CO^2 Difference (T)
30	TRN 1K	South-west – TRN 2K	+1.2	924	+12.1*	+11.2*	+35.5 *
30	TRN 1K	West – DAUNT 1K	-2.4	276	-38.9	-10.7	-34.1
30	NGY 1K	South-east – LUCCO 1K (via Z248)	+1.7	2700	+17.7*	+47.9*	+152.2 *
30	NGY 1K	East – LUCCO 1K (via Z250)	-3.0	168	-39.2	-6.6	-20.9
12	TRN 1L	South-west – TRN 2L	-1.2	520	-13.0	-6.8	-21.5
12	TRN 1L	West – OKNOB 1L	-2.2	132	-24.7	-3.3	-10.4
12	NGY 1L	South-east – SUDBY 1L	-0.1	1116	-0.6	-0.7	-2.1
12	NGY 1L	East – SUMIN 1L	-7.4	84	-92.9	-7.8	-24.8
					TOTAL	**+23.2**	**+73.9**

Table 13: Annual Fuel and CO^2 Differences

This concludes that there would be an increase of 23.2 tonnes of fuel and 73.9 tonnes of CO_2 over approximately 6,000 flights per year. This equates to a small increase of around 4Kg of fuel and 12Kg of CO_2 per flight.

* The south-east LUCCO 1K route from Runway 30 (replication of extant route NGY 1K) has the biggest effect on the increase in these fuel and CO_2 figures. This is due to PANS OPS requirements for RNAV1 which result in an extension of the current departure route before turning southwest, (in order to comply with PANS OPS design criteria of how far a turn point can be placed from the end of a runway). The same applies to the south-west route from Runway 30, although this has a less pronounced effect. These increases in the track mileage are a direct result of maintaining compliance with ICAO PANS OPS criteria.

The LUCCO 1K SID has been split out into traffic which flies south-east, which accounts for the vast majority of traffic, and east. The two sets of traffic will split across two different link routes: Z248 for south-east traffic and Z250 for east traffic. The link routes have all been agreed with Prestwick Centre and are described in full in Section 4.10.

5.8 Tranquillity and Visual Intrusion

The proposed routes do not overfly any National Parks or National Scenic Areas (NSAs). As such, no additional analysis into the tranquillity and visual intrusion of the proposed routes has been commissioned.

5.9 Military airspace users

Military or search and rescue helicopter flights operate regularly from the helipads situated to the north of Runway 12/ 30. This will not change with the proposed changes.

The following Letters of Agreement already exist and will not change following an introduction of RNAV procedures:

- **Swanwick Military** –D&D cell to monitor the DF facilities and their serviceability
- **RAF Lossiemouth** – QRA diversion requirements
- **5 Regiment Army Air Corps Belfast Aldergrove** – procedures for Gazelle helicopters who have no means of conventional approaches, other than an SRA.

5.10 General Aviation (GA) airspace users

General Aviation aircraft and helicopters that are certified to the navigation specifications of the proposed routes will be able to fly the new departure, arrival and approach procedures. For aircraft and helicopters that don't meet the navigation specifications, they will be able to depart in IMC using the omnidirectional departures, see Section 4.11. General Aviation aircraft and helicopters will still be able to arrive and depart visually to/ from both runways and the helipads.

There are no changes proposed to controlled airspace which would affect General Aviation users of Glasgow Prestwick Airport.

The following Letters of Agreement already exist and will not change following an introduction of RNAV procedures:

- **Advanced Aerial Media** – drone operations.
- **Burns Country Flyers** – model aircraft flying in the Control Zone.
- **Jubilee Airways** - operate from Glasgow Prestwick Airport as tenants.
- **Prestwick Flying Club** - operate from Glasgow Prestwick Airport as tenants.
- **Prestwick Flight Club** - operate from Glasgow Prestwick Airport as tenants
- **Warrix Flying Group** - model aircraft flying in the Control Zone

5.11 Other ATC Units Affected by the Proposal

The Glasgow Prestwick Airport arrival and departure procedures will interface with Scottish enroute airspace controlled by NATS/ NERL. They must also be appropriately separated from Glasgow Airport airspace and procedures and take into account development of the Scottish TMA Airspace. As such, NATS Prestwick Centre (PC) and Glasgow Airport were identified as key stakeholders in the proposed changes.

A Design Workshop was held in January 2017 between Glasgow Prestwick Airport ATC and NATS (PC PLAS, design team, project management and airspace change representatives were all present). This was focussed on the ATC requirements for the proposed route changes, broken down by departures, arrivals and runways. Constraints on the various routes were also discussed, such as known interactions. The output from this workshop was a full list of design criteria for the various proposed departure and arrival routes (Ref 17).

The following Letters of Agreement already exist and will not change following an introduction of RNAV procedures:

- **HM Coastguard SAR Flight** – operate from Glasgow Prestwick Airport as tenants.
- **RVL Group** – maritime agency based at Glasgow Prestwick Airport as tenants.

5.11.1 NATS

As mentioned above, NATS PC contributed to a Glasgow Prestwick Airport design workshop to ensure that the proposed routes do not have a detrimental impact on the network and wider airspace.

NATS provided a detailed response to consultation; expressing full support for the proposed changes on the proviso that a number of comments were addressed. Most of these relate to the existing interfaces between Glasgow Prestwick Airport and Glasgow Airport/ NATS PC. Glasgow Prestwick was clear when responding that Glasgow Airport and NATS PC have been involved from the start of this airspace change project; having been identified as key stakeholders. All extant agreements and procedures will be updated to reflect route changes.

The feedback received from NATS and the response sent back can be found in the feedback report (Ref 19).

5.11.2 Glasgow Airport

Glasgow Airport was fully supportive of the modernisation of routes at Glasgow Prestwick Airport and in the level of engagement throughout. They did stress the importance of the extant procedures between Glasgow Airport, Prestwick ATC Centre and Glasgow Prestwick Airport. The preservation of these procedures is fundamental to the success of the proposed routes which Glasgow Prestwick Airport is ensuring. Engagement between Glasgow Prestwick Airport and Glasgow Airport will continue up until implementation.

Glasgow Airport did express concern over Runway 12 easterly departures regarding possible interaction with the LANAK hold. The LANAK hold is currently under consideration as part of the wider Scottish Airspace Change Project however this is completely out of the scope of this ACP. NATS PC have confirmed this.

Glasgow Airport also presented a preference of the "Alternative 1" route for the Runway 21 approach. The design team has concluded that this option does not provide adequate obstacle clearance as well overflying more people, some of whom are not currently overflown. This was fed back to Glasgow Airport as part of the response (Ref 19) which they accepted on the grounds that the usage of this route is not planned to increase.

The feedback received from Glasgow Airport and the response sent back can be found in the feedback report (Ref 19).

5.12 Commercial Air Transport Impact & Consultation

A Stakeholder Engagement Workshop was held in January 2017 to give stakeholders the opportunity to provide input to guide the design process. This gave an overview of the Airspace Change Proposal for Glasgow Prestwick Airport including rationale, timelines and a description of the proposed routes. This was attended by the following stakeholders:

- Ryanair,
- Bristow,
- Prestwick Local Flying Club.

The stakeholders were all supportive of the proposed changes at Glasgow Prestwick Airport. The slides used for this workshop can be viewed, Ref 18.

Cargolux and Ryanair are supporting the Airspace Change Proposal by providing flight simulation facilities and crew to assess the proposed procedures as part of the flyability validation programme. In addition to evaluating the flyability, this will provide a detailed assessment of crew workload and charting of the proposed routes. This ACP submission is therefore subject to these flyability validations taking place.

Ryanair also responded to the consultation in support of the proposed changes. Particular positive reference was made to the new proposed Runway 12 and 30 west departure routes due to the significant operational improvement they will provide. Cargolux had no issues with the proposed routes. However, Cargolux did suggest a few changes to the airspace in the future; namely an additional departure route to the north and a change to the airspace bottom limit. However, these and all airspace structure changes are outside the scope of this ACP; this was communicated to Cargolux.

The following airlines and operator companies responded in support of the proposed changes at Glasgow Prestwick Airport:

- Air France,
- Cargolux,
- Ryanair,
- Prestwick Flight Centre.

NATMAC stakeholders representing commercial air transport were also involved in the consultation.

5.13 Impact on Aviation Safety

Glasgow Prestwick Airport considers the safety of proposed changes as a priority. The following safety analyses have been completed in support of this Airspace Change Proposal:

- Safety Assessment Report – design and implementation of RNAV based arrival/ departure procedures (Ref 16):
  - Part I includes all safety requirements,
  - Part II includes system operation and maintenance arrangements, and system assurance.

5.14 Economic Impact

Glasgow Prestwick Airport offers a diverse range of services including passenger, cargo, military and general aviation services. It has the longest commercial runway and parallel taxiway in Scotland. Glasgow Prestwick Airport contributes over £61 million annually to the UK economy and supports in excess of 4,500 jobs.

The airport is looking to build on its contribution to increase employment opportunities, trade and tourism. It already has a passenger terminal capacity for up to four million passengers annually, although currently handles around 625k passengers each year (2016).

The benefits of improving and modernising the departure and arrival routes will support the changeover from analogue to digital infrastructure. It will also help to future-proof Glasgow Prestwick Airport, ensuring it will accommodate growth and development efficiently.

No analysis has been undertaken to quantify the economic benefit of the proposed changes.

5.15 Sponsoring Unit Training Requirements

See Ref 25 for the initial training needs analysis report.

5.16 Procedure Flight Validation (Flyability)

The Flight Validation Reports detail the planned flight validation scenarios to be tested (Ref 21 – 23). These contain the flight simulator objectives, schedule conditions, procedures to be tested and all of the charts and coding tables.

Additionally we are also validating the LPV element for each of the three GNSS approach procedures. This will be using Flight Calibration Services Ltd to test fly the proposed approaches.

The results from all fixed base and live flight simulators will be provided as soon as available. There are no issues expected with any of the simulations or procedures. This ACP submission is therefore subject to this later activity taking place.

5.17 Resilience to Bad Weather

The ability of aircraft to fly the proposed procedures in varying wind conditions will be included as part of the flight validation simulations for the approach procedures, SIDs and arrival transitions. The different scenarios which will be tested are the following:

- Varying wind direction - these will be made unfavourable for each route dependent on the route direction.
- Strong wind - 30kts surface wind.
- Still wind.

A full description of each of the procedures to be tested can be found in the flight validation reports (Ref 21 – 23).

There have been no design objectives or requirements relating to the ATC system's resilience to bad weather.

The occurrence and impact of the following conditions are not expected to change as part of the proposed changes; these conditions have also not been simulated or assessed:

- Disruptive weather events,
- Extreme weather conditions,
- Icing conditions,
- Unusually high/low pressure.

6 Analysis of options

6.1 Introduction

The flight procedures design process for Glasgow Prestwick Airport began with numerous design principles which were developed into design envelopes and finally specific design options for each arrival, approach and departure route.

Glasgow Prestwick Airport carried out a formal public consultation period from 14th June to 13th September 2017. The aim of the consultation period was to provide information on the proposed design changes to relevant stakeholders and persons; and seek to receive feedback on the designs which might influence the final design.

A consultation document was produced which described the current airspace, proposed design options, the preferred option for each route and rationale behind the changes and options (Ref 1). We made significant efforts to encourage responses such as through public announcements, roadshows and writing to stakeholders on two different occasions.

This consultation period received a total of 29 responses. A summary of all responses from the consultation can be found in the Feedback Summary Report (Ref 19). The feedback from the consultation was used as an input to the design process and has influenced the final design, as described in Section 6.3 below. The final design is as proposed herein.

6.2 Design Principles and Options

The proposed routes were designed by considering how closely they could be aligned to current routes whilst adhering to present design criteria and also looking for opportunities to improve the noise and emissions impact of the routes. The design considerations, design principles and the design envelopes for each route were explained in the consultation document (Ref 1), pages 20 – 76.

The proposed approach, departure and transition routes have been designed in accordance with ICAO Doc 8168 PANS-OPS Volume II (Ref 12); except where UK differences, CAA criteria or policy modify this.

6.2.1 Do nothing (rejected)

The NATS DVOR rationalisation programme is removing a number of enroute navigation aids used by Glasgow Prestwick Airport instrument flight procedures. These include the Turnberry (TRN) VOR and New Galloway (NGY) NDB which will be removed from service in 2019. The EGPK current conventional routes will need to be replaced by equivalent PBN procedures or have their dependencies on these navigation aids removed by this time .

As such, “doing nothing” is not a feasible option.

6.2.2 Replicate the current conventional routes (rejected)

The first design option assessed was whether the current routes could be replicated using PBN procedures, whilst also complying with the current design criteria (Ref 12 and Ref 20). Strict replication would constrain the design and hence limit the ability to incorporate improvements which could be made; such as lessening the ground noise impact and reducing emissions through more direct routings. These improvements could not be made if current routes were merely replicated.

As such, replicating the current conventional routes is not a feasible option.

6.3 Route Options

The following criteria have been adhered to as closely as possible:

- ICAO Doc 8168 PANS-OPS – Volume II – 6th Edition Amendment 7 (Ref 12).
- UK CAA Policy Statement: *Use and Allocation of RNAV Waypoints, (Oct 2008).*

The design options considered for each route are described in detail in the consultation document (Ref 1, Section 6). No significant changes have been made to these routes since consultation .

Draft charts of the proposed SIDs and arrival transitions are available in the PBN Approaches and Departures Reports (Ref 14 – 15). Below is a description of the design for each route. Note that route names below are working names.

6.3.1 Runway 30 Departures (south-west) – TRN 2K

This route is a replacement for the existing TRN 1K departure route.

The four design envelope options considered and consulted upon for this route were described in the consultation document (Ref 1), Pages 20-24. The preferred option is the chosen route on balance for this airspace change.

Particular factors influencing the design choice:

- PANS OPS design criteria e.g. turn point required to be further from the runway end;
- Position turn to minimise noise impact on Troon;
- Preferred route uses a "fly-over" turn which minimises dispersal.

6.3.2 Runway 30 Departures (west) – DAUNT 1K

This is a new route providing a more efficient departure for aircraft departing to the west (e.g. Iceland, North America) currently tactically cleared to a point called HERON.

The three design envelope options considered and consulted upon for this route were described in the consultation document (Ref 1), Pages 24-28. The preferred option is the chosen route on balance for this airspace change.

Particular factors influencing the design choice:

- PANS OPS design criteria e.g. turn point required to be further from the runway end;
- Position turn to minimise noise impact on Troon;
- Preferred route uses a "fly-over" turn which minimises dispersal.

6.3.3 Runway 30 Departures (south-east) – LUCCO 1K via OSMEG (Z248)

This route is a replacement for the existing NGY 1K departure route. Aircraft flying south-east will continue onto the Z248 link route which has been agreed with Prestwick Centre.

The four design envelope options considered and consulted upon for this route were described in the consultation document (Ref 1), Pages 28-32. The preferred option is the chosen route on balance for this airspace change.

Particular factors influencing the design choice:

- PANS OPS design criteria e.g. turn point required to be further from the runway end;
- Position turn to minimise noise impact on Troon;
- Preferred route uses a "fly-over" turn which minimises dispersal;
- Preferred route to end at OSMEG to improve traffic integration.

6.3.4 Runway 30 Departures (east) – LUCCO 1K via HAVEN (Z250)

This is a new ATS link route, following on from the LUCCO 1K SID, providing a more efficient departure for aircraft which currently depart on the south-east route before turning back to the north-east.

The four design envelope options considered and consulted upon for this route were described in the consultation document (Ref 1), Pages 32-36. The preferred option is the chosen route on balance for this airspace change.

Particular factors influencing the design choice:

- PANS OPS design criteria e.g. turn point required to be further from the runway end;
- Position turn to minimise noise impact on Troon;
- Preferred route uses a "fly-over" turn which minimises dispersal.

6.3.5 Runway 12 Departures (south-west) – TRN 2L

This route is a replacement for the existing TRN 1L departure route.

The four design envelope options considered and consulted upon for this route were described in the consultation document (Ref 1), Pages 36-40. The preferred option is the chosen route on balance for this airspace change.

Particular factors influencing the design choice:

- Minimise overflight noise impact on several surrounding communities;
- Re-position the path and turn point to reduce noise impact.

6.3.6 Runway 12 Departures (west) – OKNOB 1L

This is a new route providing a more efficient departure for aircraft currently tactically cleared to a point called HERON.

The four design envelope options considered and consulted upon for this route were described in the consultation document (Ref 1), Pages 41-45. The preferred option is the chosen route on balance for this airspace change.

Particular factors influencing the design choice:

- Minimise overflight noise impact on several surrounding communities;
- Re-position the centreline and turn point to reduce noise impact.

6.3.7 Runway 12 Departures (south-east) – SUDBY 1L

This route is a replacement for the existing NGY 1L departure route.

The four design envelope options considered and consulted upon for this route were described in the consultation document (Ref 1), Pages 45-49. The preferred option is the chosen route on balance for this airspace change.

Particular factors influencing the design choice:

- Minimise overflight noise impact on several surrounding communities;
- Re-position the centreline to reduce noise impact;
- Preferred route to end at OSMEG to improve traffic integration.

6.3.8 Runway 12 Departures (east) – SUMIN 1L

This is a new route providing a more efficient departure for aircraft departing to destinations such as Northern Europe, Russia or the Far East.

The four design envelope options considered and consulted upon for this route were described in the consultation document (Ref 1), Pages 50-54. The preferred option is the chosen route on balance for this airspace change.

Particular factors influencing the design choice:

- Minimise overflight noise impact on several surrounding communities.

6.3.9 Runway 30 Arrivals (south)

This route will be used by aircraft which arrive via one of the STARs that end at a point over the TRN navigation aid. It will deliver them to the start of the Runway 30 approach procedure.

The preferred design option considered and consulted upon for this route was described in the consultation document (Ref 1), Pages 54-56.

Particular factors influencing the design choice:

- Main priority has been to minimise emissions. This has been achieved through a direct design which takes aircraft straight from TRN to the approach procedure entry.

6.3.10 Runway 30 Arrivals (east)

This route will be used by aircraft which arrive via one of the STARs that end at a point called SUMIN. It will deliver them to the start of the Runway 30 approach procedure.

The preferred design option considered and consulted upon for this route was described in the consultation document (Ref 1), Pages 56-58.

Particular factors influencing the design choice:

- Main priority has been to minimise emissions. This has been achieved through a direct design which takes aircraft straight from SUMIN to the approach procedure entry.

6.3.11 Runway 12 Arrivals (south)

This route will be used by aircraft which arrive via one of the STARs that end at a point over the TRN navigation aid. It will deliver them to the start of the Runway 12 approach procedure.

The preferred design option considered and consulted upon for this route was described in the consultation document (Ref 1), Pages 58-60.

Particular factors influencing the design choice:

- Main priority has been to minimise emissions. This has been achieved through a direct design which takes aircraft straight from TRN to the approach procedure entry.

6.3.12 Runway 21 Arrivals (south)

This route will be used by aircraft which arrive via one of the STARs that end at a point over the TRN navigation aid. It will deliver them to the start of the Runway 21 approach procedure.

The preferred design option considered and consulted upon for this route was described in the consultation document (Ref 1), Pages 60-62.

Particular factors influencing the design choice:

- Main priority has been to minimise emissions. This has been achieved through a direct design which takes aircraft from TRN to the approach procedure entry.

6.3.13 Runway 21 Arrivals (east)

This route will be used by aircraft which arrive via one of the STARs that end at a point called SUMIN. It will deliver them to the start of the Runway 21 approach procedure.

The preferred design option considered and consulted upon for this route was described in the consultation document (Ref 1), Pages 62-64.

Particular factors influencing the design choice:

- Main priority has been to minimise emissions. This has been achieved through a direct design which takes aircraft straight from SUMIN to the approach procedure entry.

6.3.14 Runway 30 Approaches

This is a replication of the existing conventional Runway 30 approach procedure with one additional "T-Bar" and one additional "Y-Bar" leg which enable arrivals from the north and south; with minimal ATC intervention.

The three design envelope options considered and consulted upon for this route were described in the consultation document (Ref 1), Pages 64-68. The preferred option is the chosen route on balance for this airspace change.

Particular factors influencing the design choice:

- Dimensions of controlled airspace to the east of the airport;
- Maximise available distance for aircraft to descend, to facilitate more efficient CDAs;
- Missed approach to place aircraft in an optimal location and minimise distance flown.

6.3.15 Runway 12 Approaches

This is a replication of the existing conventional Runway 12 approach procedure with three additional "T-Bar" legs which enable arrivals from the north, south and west; with minimal ATC intervention.

The three design envelope options considered and consulted upon for this route were described in the consultation document (Ref 1), Pages 69-73. The preferred option is the chosen route on balance for this airspace change.

Particular factors influencing the design choice:

- Limited amount of controlled airspace to the west of the airport;
- Missed approach to place aircraft in an optimal location and minimise distance flown.

6.3.16 Runway 21 Approaches

This is a replication of the existing conventional Runway 21 approach procedure with two additional "T-Bar" legs which enable arrivals from the east and west; with minimal ATC intervention.

The three design envelope options considered and consulted upon for this route were described in the consultation document (Ref 1), Pages 73-76. The preferred option is the chosen route on balance for this airspace change.

Particular factors influencing the design choice:

- Current design criteria e.g. requires the route to be aligned with the runway;
- Close proximity of Glasgow International Airport;
- Closely replicate the current route and avoid overflying Kilmarnock;
- Missed approach to place aircraft in an optimal location and minimise distance flown.

6.4 Proposed RNAV1 Arrival Transitions

The following RNAV1 arrival transitions are proposed:

- TRN 1X to Runway 12,
- TRN 1Z to Runway 30,
- SUMIN 1Z to Runway 30,
- TRN 1Y to Runway 21,
- SUMIN 1Y to Runway 21.

The arrivals transitions proposed herein are unchanged from those presented in the consultation. Draft charts of the arrival transitions are provided in the PBN Approaches Report (Ref 14).

These proposed routes can be seen in Figure 12 below, against the arrival routes shown in green.

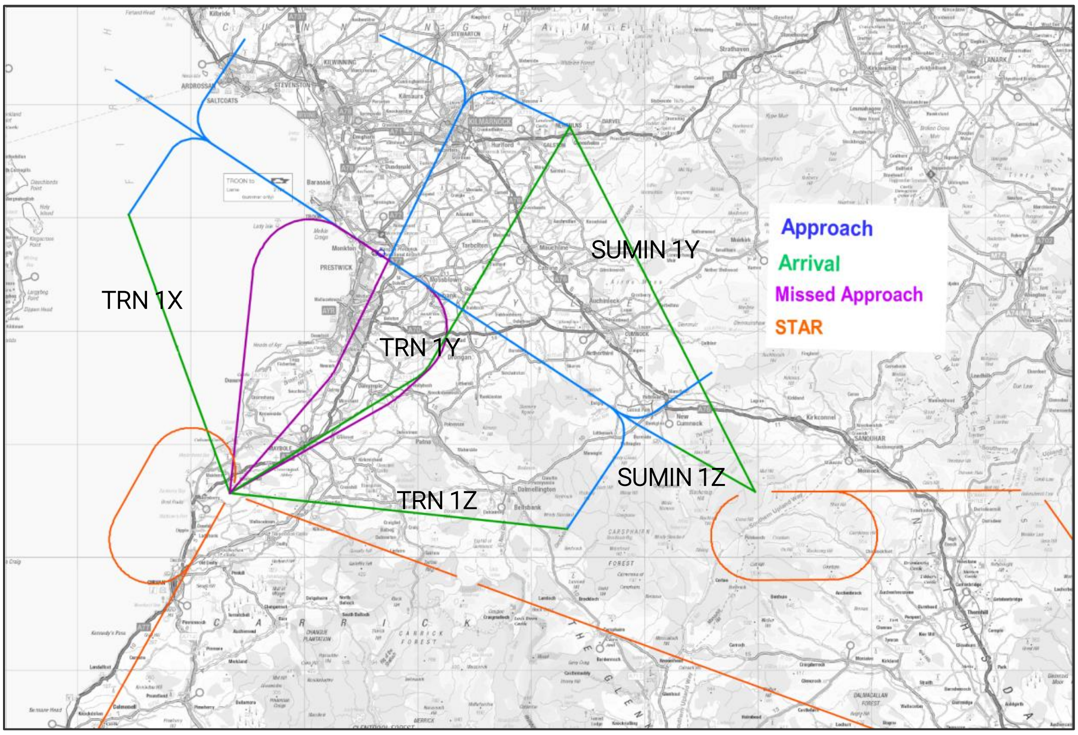

Figure 92: Proposed RNAV1 Arrival Transitions

Note that the above transition names are working names for termination 5LNCs and link route designators.

7 Airspace Description Requirement

CAP 725 Appendix A Paragraph A5 provides a list of requirements for a proposed airspace description. These are listed below:

	CAA CAP725, Appendix A paragraph 5 Requirement. "The proposal should provide a full description of the proposed change including the following:"	**Description for this Proposal**
a	The type of route or structure; e.g. Airway, UAR, Conditional Route, Advisory Route, CTR, SIDs/STARs, Holding Patterns, etc;	See Section 4.
b	The hours of operation of the airspace and any seasonal variations;	See Section 4.
c	Interaction with domestic and international enroute structures, TMAs or CTAs with an explanation of how connectivity is to be achieved. Connectivity to aerodromes not connected to CAS should be covered;	See Section 4.10.
d	Airspace buffer requirements (if any);	N/A
e	Supporting information on traffic data including statistics and forecasts for the various categories of aircraft movements (Passenger, Freight, Test and Training, Aero Club, Other) and Terminal Passenger numbers;	See Section 3.3 and Section 4.7.
f	Analysis of the impact of the traffic mix on complexity and workload of operations;	See Section 4.4 and 5.13, Ref 16.
g	Evidence of relevant draft Letters of Agreement, including any arising out of consultation and/or Airspace Management requirements;	See Sections 5.9 to 5.12. (LoAs will be updated pre-implementation, presuming approval)
h	Evidence that the Airspace Design is compliant with ICAO Standards and Recommended Practices (SARPs) and any other UK Policy or filed differences, and UK policy on the Flexible Use of Airspace (or evidence of mitigation where it is not);	CAP1385 applied, with supporting evidence, also CAS containment evidence. See Section 5.13 and Refs 8, 9, 12, 14-15 (draft charts) and 16.
i	The proposed airspace classification with justification for that classification;	No change to extant airspace classification.
j	Demonstration of commitment to provide airspace users equitable access to the airspace as per the classification and where necessary indicate resources to be applied or a commitment to provide them in-line with forecast traffic growth. 'Management by exclusion' would not be acceptable;	The classification of the airspace volumes would be honoured as per AIP ENR 1.4.
k	Details of and justification for any delegation of ATS.	No change to delegation of ATS.

8 Supporting Infrastructure & Resources

CAA CAP725 Appendix A Paragraph A6 provides a list of requirements for supporting infrastructure/resources. These are listed below:

	CAA CAP725, Appendix A Paragraph 6, general Requirements	Proposal
a	Evidence to support RNAV and conventional navigation as appropriate with details of planned availability and contingency procedures.	See Section 4.6 and Ref 24.
b	Evidence to support primary and secondary surveillance radar (SSR) with details of planned availability and contingency procedures.	No change, demonstrably adequate for purpose.
c	Evidence of communications infrastructure including R/T coverage, with availability and contingency procedures.	No change, demonstrably adequate for purpose.
d	The effects of failure of equipment, procedures and/or personnel with respect to the overall management of the airspace must be considered.	Failure modes will be analysed and appropriate contingency procedures established.
e	The Proposal must provide effective responses to the failure modes that will enable the functions associated with airspace to be carried out including details of navigation aid coverage, unit personnel levels, separation standards and the design of the airspace in respect of existing international standards or guidance material.	Failure modes will be analysed and appropriate contingency procedures established.
f	A clear statement on SSR code assignment requirements is also required.	No change to SSR code allocation.
g	Evidence of sufficient numbers of suitably qualified staff required to provide air traffic services following the implementation of a change.	Suitably trained staff will be in place before implementation (see Draft Training Plan Ref 25).

9 Operational Impact

CAA CAP725 Appendix A Paragraph A7 provides a list of requirements for operational impact. These are listed below:

	CAA CAP725, Appendix A paragraph A7 requirements. "An analysis of the impact of the change on all airspace users, airfields and traffic levels must be provided, and include an outline concept of operations describing how operations within the new airspace will be managed. Specifically, consideration should be given to:"	**Evidence of Compliance/Proposed Mitigation**
a	Impact on IFR General Air Traffic and Operational Air Traffic or on VFR General Aviation (GA) traffic flow in or through the area;	See Section 5.
b	Impact on VFR operations (including VFR Routes where applicable);	See Section 5.10.
c	Consequential effects on procedures and capacity, i.e. on SIDs, STARs, and/or holding patterns. Details of existing or planned routes and holds;	See Section 4, Refs 14-15 (draft SIDs, arrivals transitions, routes and link routes).
d	Impact on aerodromes and other specific activities within or adjacent to the proposed airspace;	See Section 5. No change to operation or use of danger areas, TRAs etc.
e	Any flight planning restrictions and/or route requirements.	See Sections 4 and 6.3.

10 Airspace & Infrastructure Requirements

CAA CAP725 Appendix A Paragraphs A11-A14 provide a list of requirements for airspace and infrastructure. These are listed below:

	CAA CAP725, Appendix A paragraph A11: General Requirements	Evidence of Compliance/Proposed Mitigation
a	The airspace structure must be of sufficient dimensions with regard to expected aircraft navigation performance and manoeuvrability to fully contain horizontal and vertical flight activity in both radar and non-radar environments;.	See Section 4.8.
b	Where an additional airspace structure is required for radar control purposes, the dimensions shall be such that radar control manoeuvres can be contained within the structure, allowing a safety buffer. This safety buffer shall be in accordance with agreed parameters as set down in SARG Policy Statement 'Special Use Airspace - Safety Buffer Policy for Airspace Design Purposes';	No new CAS is proposed.
c	The Air Traffic Management (ATM) system must be adequate to ensure that prescribed separation can be maintained between aircraft within the airspace structure and safe management of interfaces with other airspace structures;	The ATM system is currently adequate for maintaining separations within the airspace and safe management of the interfaces. The proposed systemised route structure will maintain the safe management of the airspace. See Sections 4.8 and 5.13, and Refs 8 and 9.
d	Air Traffic Control (ATC) procedures are to ensure required separation between traffic inside a new airspace structure and traffic within existing adjacent or other new airspace structures;	ATC procedures will ensure this. See Sections 4.8 and 5.13, and Refs 8 and 9.
e	Within the constraints of safety and efficiency, the airspace classification should permit access to as many classes of user as practicable;	No change to airspace volume or classification proposed.
f	There must be assurance, as far as practicable, against unauthorised incursions. This is usually done through the classification and promulgation.	Airspace classification will be unchanged. Route changes will be promulgated via AIRAC cycle.
g	Pilots shall be notified of any failure of navigational facilities and of any suitable alternative facilities available and the method of identifying failure and notification should be specified;	Should such a failure occur, pilots will be notified by NOTAM and advised of appropriate measures required to be taken.
h	The notification of the implementation of new airspace structures or withdrawal of redundant airspace structures shall be adequate to allow interested parties sufficient time to comply with user requirements. This is normally done through the AIRAC cycle;	This will be promulgated via AIRAC cycle.
i	There must be sufficient R/T coverage to support the ATM system within the totality of proposed controlled airspace.	No change from today's CAS. R/T coverage demonstrably adequate as per current day. See Section 4.6.
j	If the new structure lies close to another airspace structure or overlaps an associated airspace structure, the need for operating agreements shall be considered;	See Section 5.11 (LoAs will be updated pre-implementation, presuming approval).
k	Should there be any other aviation activity (low flying, gliding, parachuting, microlight site, etc.) in the vicinity of the new airspace structure and no suitable operating agreements or ATC Procedures can be devised, the Change Sponsor shall act to resolve any conflicting interests;	There are no known aviation activities requiring additional operating agreements. Should such a conflict occur, the sponsor will act to resolve it.

	CAA CAP725, Appendix A paragraph A12: ATS Route Requirements	Evidence of Compliance/Proposed Mitigation
a	There must be sufficient accurate navigational guidance based on in-line VOR/DME or NDB or by approved RNAV derived sources, to contain the aircraft within the route to the published RNP value in accordance with ICAO/EuroControl Standards;	See Report on RNAV1 coverage (Ref 24). (Note most aircraft do not rely on DME/DME for RNAV1.)
b	Where ATS routes adjoin Terminal Airspace there shall be suitable link routes as necessary for the ATM task;	Appropriate link routes are part of this proposal. See Section 4.10 and 6.4, Refs 14-15.
c	All new routes should be designed to accommodate P-RNAV navigational requirements.	New routes will be RNAV1.

	CAA CAP725, Appendix A paragraph A13: Terminal Airspace Requirements	Evidence of Compliance/Proposed Mitigation
a	The airspace structure shall be of sufficient dimensions to contain appropriate procedures, holding patterns and their associated protected areas;	The extant airspace is of sufficient dimensions to contain the proposed procedures. . See Paragraph 4.5 and Refs 14-15.
b	There shall be effective integration of departure and arrival routes associated with the airspace structure and linking to designated runways and published IAPs;	See Paragraph 4.5 and Refs 14-15.
c	Where possible, there shall be suitable linking routes between the proposed terminal airspace and existing enroute airspace structure;	See Paragraph 4.5 and Refs 14-15.
d	The airspace structure shall be designed to ensure that adequate and appropriate terrain clearance can be readily applied within and adjacent to the proposed airspace;	No terrain clearance issues for this proposal. See Refs 14-15
e	Suitable arrangements for the control of all classes of aircraft (including transits) operating within or adjacent to the airspace in question, in all meteorological conditions and under all flight rules, shall be in place or will be put into effect by Change Sponsors upon implementation of the change in question (if these do not already exist);.	Suitable arrangements for control of all classes of aircraft exist in the airspace. These will be applied appropriately according to the proposed classification of the airspace.
f	Change Sponsors shall ensure that sufficient VRPs are established within or adjacent to the subject airspace to facilitate the effective integration of VFR arrivals, departures and transits of the airspace with IFR traffic;	No additional VRPs required for this proposal.
g	There shall be suitable availability of radar control facilities;	Radar control will be provided as extant. See Section 4.6.
h	Change Sponsors shall, upon implementation of any airspace change, devise the means of gathering (if these do not already exist) and of maintaining statistics on the number of aircraft transiting the airspace in question. Similarly, Change Sponsors shall maintain records on the numbers of aircraft refused permission to transit the airspace in question, and the reasons why. Change Sponsors should note that such records would enable ATS Managers to plan staffing requirements necessary to effectively manage the airspace under their control;	No change to existing procedure
i	All new procedures should, wherever possible, incorporate Continuous Descent Approach (CDA) profiles after aircraft leave the holding facility associated with that procedure.	See Section 4.3.

	CAA CAP725, Appendix A paragraph A14: Off Route Airspace Requirements	Evidence of Compliance/Proposed Mitigation
	There are no proposed changes to off route airspace structures.	

11 Environmental Requirements

This section details the required elements of an Environmental Assessment for ACP development, based upon CAP725 Appendix B.

The requirements in this section are grouped by the degree of compliance expected from airspace change sponsors. In following this guidance:

Must – change sponsors are to meet the requirements in full when this term is used.

Should – change sponsors are to meet these requirements unless there is sufficient reason which must be agreed in writing with the SARG case officer and the circumstances recorded in the formal airspace change documentation.

May – change sponsors decide whether this guidance is appropriate to the circumstances of the airspace change.

	Requirement		**Ref.**	**Page**	
1	In order to ensure that the various areas for environmental assessment by SARG are addressed, Change Sponsors should submit the documentation with the following clearly defined sections: Description of the airspace change; Traffic forecasts; An assessment of the effects on noise; An assessment of the change in fuel burn/CO2; An assessment of the effect on local air quality; and An economic valuation of environmental impact, if appropriate.	General	Para 2	B-1	See Section 4 for description. This change would not influence the growth of traffic, but a forecast is provided in Section 4.7. See Section 5 for assessments of changed impacts on noise, fuel burn/CO_2, and local air quality. No economic valuation of environmental impact has been performed.
2	It is considered unlikely that airspace changes will have a direct impact on animals, livestock and biodiversity. However, Change Sponsors should remain alert to the possibility and may be required to include these topics in their environmental assessment.	General	Para 18	B-4	No change in impact. See Section 5.5.
3	Environmental assessment should set out the base case or current situation so that changes can be clearly identified.	General	Para 19	B-4	See Sections 3.5 and 5.7.
4	Environmental assessment should follow the Basic Principles listed in CAP 725.	General	Para 20	B-4	CAP725 Basic Principles have been followed.
5	A technical document containing a comprehensive and complete description of the airspace change including the environmental impact will be required and must be produced for all airspace changes.	General	Para 25	B-6	See Sections 3 and 5, and Ref 2.
6	It may be appropriate for Change Sponsors to produce a more general description of the airspace change and the rationale for its proposal in an easy-to-read style for public consumption. If such an additional separate document is produced, it must contain details of the environmental impact of the proposal.	General	Para 25	B-6	See feedback report Ref 19.
7	The environmental assessment must include a high quality paper diagram of the airspace change in its entirety as well as supplementary diagrams Illustrating different parts of the change. This diagram must show the extent of the airspace change in relation to known geographical features and centres of population	Airspace Design	Para 28	B-7	See Refs 14 - 15.
8	The proposal should consider and assess more than one option, then demonstrate why the selected option meets safety and operational requirements and will generate an overall environmental benefit or, if not, why it is being proposed.	Airspace Design	Para 29	B-7	See Section 6.

9	The Change Sponsor must provide SARG with a complete set of coordinates describing the proposed change in electronic format using World Geodetic System 1984 (WGS 84). In addition, the Sponsor must supply these locations in the form of Ordnance Survey (OS) national grid coordinates.	Airspace Design	Para 30	B-7	See Refs 14 - 15.
10	This electronic version must provide a full description of the horizontal and vertical extent of the zones and areas contained within the airspace change. It must also include coordinates in both WGS 84 and OS national grid formats that define the centre lines of routes including airways, standard instrument departures (SID), standard arrival routes (STAR), noise preferential routes (NPR) or any other arrangement that has the effect of concentrating traffic over a particular geographical area.	Airspace Design	Para 30	B-7	See Refs 14 - 15.
11	Change Sponsors should provide indications of the likely lateral dispersion of traffic about the centre line of each route. This should take the form of a statistical measure of variation such as the standard deviation of lateral distance from the centre line for given distances along track in circumstances where the dispersion is variable.	Airspace Design	Para 31	B-7	See Ref 16 –for CAP1385 compliance.
12	Sponsors may supply the outputs from simulation to demonstrate the lateral dispersion of traffic within the proposed airspace change or bring forward evidence based on actual performance on a similar kind of route. It may be appropriate for Sponsors to explain different aspects of dispersion e.g. dispersion within NPRs when following a departure routeing and when vectoring – where the aircraft will go and their likely frequency	Airspace Design	Para 31	B-7	See Section 3.2 and 5.3.
13	Change Sponsors must provide a description of the vertical distribution of traffic in airways, SIDs, STARs, NPRs and other arrangements that have the effect of concentrating traffic over a particular geographical area	Airspace Design	Para 32	B-7	Same as current operations
14	For departing traffic, sponsors should produce profiles of the most frequent type(s) of aircraft operating within the airspace. They should show vertical profiles for the maximum, typical and minimum climb rates achievable by those aircraft.	Airspace Design	Para 32	B-7	See Ref 1 Section 6.
15	A vertical profile for the slowest climbing aircraft likely to use the airspace should also be produced.	Airspace Design	Para 32	B-8	See Ref 1 Section 6.
16	All profiles should be shown graphically and the underlying data provided in a spread sheet with all planning assumptions clearly documented.	Airspace Design	Para 32	B-8	See Ref 1 Section 6.
17	Change Sponsors should explain how consideration of CDA and LPLD is taken into account within their proposals	Airspace Design	Para 33	B-8	Introduction of RNAV1 arrival transitions will improve pilot descent planning capability, and hence enhance the ability of IFR traffic to perform CDAs & LPLD.
18	In planning changes to airspace arrangements, sponsors may have conducted real and/or fast time simulations of air traffic for a number of options.	Traffic Forecasts	Para 34	B-8	Not Applicable.
19	Change Sponsors must include traffic forecasts in their environmental assessment.	Traffic Forecasts	Para 35	B-8	See Section 4.7.
20	Information on air traffic must include the current level of traffic using the present airspace arrangement and a forecast. The forecast will need to indicate the traffic growth on the different routes contained within the airspace change volume.	Traffic Forecasts	Para 35	B-8	See Section 4.7.
21	The sources used for the forecast must be documented.	Traffic Forecasts	Para 35	B-8	See Section 4.7.

22	Typically, forecasts should be for five years from the planned implementation date of the airspace change. There may be good reasons for varying this – for example, to use data that has already been made available to the general public at planning inquiries, in airport master plans or other business plans	Traffic Forecasts	Para 36	B-8	See Section 4.7.
23	It may also be appropriate to provide forecasts further into the future than five years: examples are extensive airspace changes or where traffic is forecast to grow slowly in the five-year period but faster thereafter.	Traffic Forecasts	Para 36	B-8	Not Applicable.
24	It may be appropriate for Change Sponsors to outline the key factors [affecting traffic forecasts] and their likely impact. In these circumstances, Sponsors should consider generating a range of forecasts based on several scenarios that reflect those uncertainties – this would help prevent iterations in the assessment process.	Traffic Forecasts	Para 37	B-8	Not Applicable.
25	Traffic forecasts should contain not only numbers but also types of aircraft. Change Sponsors should provide this information by runway (for arrivals/departures) and/or by route with information on vertical distribution by height/altitude/flight level as appropriate.	Traffic Forecasts	Para 38	B-9	See Section 3.3.
26	Types of aircraft may be given by aircraft type/engine fit using ICAO type designators. If this is not a straightforward exercise, then designation by the UK Aircraft Noise Contour Model (ANCON) types or by seat size categories would be acceptable	Traffic Forecasts	Para 38	B-9	See Section 3.3.
27	Change Sponsors must produce Leq, 16 hours noise exposure contours for airports where the proposed option entails changes to departure and arrival routes for traffic below 4,000 feet agl based on the published minimum departure and arrival gradients. Under these circumstances, at least three sets of contours must be produced: Current situation – these may already be available as part of the airport's regular environmental reporting or as part of the airport master plan; Situation immediately following the airspace change; and Situation after traffic has increased under the new arrangements (typically five years after implementation although this should be discussed with the SARG Project Leader).	Noise	Para 44	B-11	See Section 5.2 and Ref 2.
28	The contours should be produced using either the UK Aircraft Noise Contour Model (ANCON) or the US Integrated Noise Model (INM) but ANCON must be used when it is currently in use at the airport for other purposes.	Noise	Para 46	B-12	See Section 5.2 and Ref 2.
29	Terrain adjustments should be included in the calculation process (i.e. the height of the air routes relative to the ground are accounted for).	Noise	Para 47	B-12	See Ref 2.
30	Contours must be portrayed from 57 dBA Leq, 16 hours at 3 dB intervals.	Noise	Para 48	B-12	See Section 5.2 and Ref 2.
31	Contours should not be produced at levels below 54 dBA Leq, 16 hours because this corresponds to generally low disturbance to most people.	Noise	Para 48	B-12	Contours to 51dBA have been produced.
32	Change Sponsors may include the 54 dBA Leq, 16 hours contour as a sensitivity analysis but this level has no particular relevance in policy making.	Noise	Para 48	B-12	Contours to 51dBA have been produced.
33	A table should be produced showing the following data for each 3 dB contour interval: Area (km^2); and Population (thousands) – rounded to the nearest hundred.	Noise	Para 49	B-12	See Section 5.2 and Ref 2.

34	It is sometimes useful to include the number of households within each contour, especially if issues of mitigation and compensation are relevant: This table should show cumulative totals for areas/populations/households. For example, the population for 57 dBA will include residents living in all higher contours. The source and date of population data used should be noted adjacent to the table. Population data should be based on the latest available national census as a minimum but more recent updated population data is preferred. The areas calculated should be cumulative and specify total area within each contour including that within the airport perimeter.	Noise	Para 50	B-12	See Section 5.2 and Ref 2.
35	Contours for assessment should be provided to SARG in both of the following formats: Electronic files in the form of a comma delimited ASC2 text file containing three fields as an ordered set (i.e. coordinates should be in the order that describes the closed curve) defining the contours in Ordnance Survey National Grid in metres: Field Name Units 1 Level dB 2 Easting six figure easting OS national grid reference (metres) 3 Northing six figure northing OS national grid reference (metres) Paper version overlaid on a good quality 1:50 000 Ordnance Survey map. However, it may be more appropriate to present contours on 1:25 000 or 1:10 000 Ordnance Survey maps.	Noise	Para 51	B-13	KMZ format files of contours provided.
36	Contours for a general audience may be provided overlaid on a more convenient map (e.g. an ordinary road map with a more suitable scale for publication in documents). The underlying map and contours should be sufficiently clear for an affected resident to be able to identify the extent of the contours in relation to their home and other geographical features. Hence, the underlying map must show key geographical features, e.g. street, rail lines and rivers.	Noise	Para 53	B-13	See Section 5.2 and Ref 2.
37	SEL footprints must be used when the proposed airspace includes changes to the distribution of flights at night below 7,000 feet agl and within 25 km of a runway. Night is defined here as the period between 2300 and 0700 local time. If the noisiest and most frequent night operations are different, then footprints should be calculated for both of them. A separate footprint for each of these types should be calculated for each arrival and departure route. If SEL footprints are provided, they should be calculated at both 90 dBA SEL and 80 dBA SEL.	Noise	Para 56	B-13	See Section 5.2 and Ref 2.
38	SEL footprints may be used when the airspace change is relevant to daytime only operations. If SEL footprints are provided, they should be calculated at both 90 dBA SEL and 80 dBA SEL.	Noise	Para 56	B-14	See Section 5.2 and Ref 2.
39	SEL footprints for assessment should be provided to SARG in both of the following formats: Electronic files in the form of a comma delimited ASC2 text file containing three fields as an ordered set (i.e. coordinates should be in the order that describes the closed curve) defining the footprints in Ordnance Survey National Grid in metres: Field Name Units 1 Level dB 2 Easting six figure easting OS national grid reference (metres) 3 Northing six figure northing OS national grid reference (metres) Paper version overlaid on a good quality 1:50 000 Ordnance Survey map. However, it may be more appropriate to present footprints on 1:25 000 or 1:10 000 Ordnance Survey maps.	Noise	Para 57	B-14	KMZ format files of SEL footprints provided.

40	SEL footprints for a general audience may be provided overlaid on a more convenient map (e.g. an ordinary road map with a more suitable scale for publication in documents). The underlying map and footprints should be sufficiently clear for an affected resident to identify the extent of the footprints in relation to their home or other geographical features. Hence, this underlying map must show key geographical features, e.g. streets, rail lines and rivers. Calculations should include terrain adjustments as described in the section on Leq contours	Noise	Para 58	B-14	See Ref 2.
41	Change Sponsors may use the percentage highly annoyed measure in the assessment of options in terminal airspace to supplement Leq. If they choose to use this method, then the guidance on population data for noise exposure contours set out should be followed. Sponsors should use the expression and associated results in calculating the number of those highly annoyed. If they wish to use a variant method, then this would need to be supported by appropriate research references.	Noise	Para 65	B-15	Not Applicable.
42	Change Sponsors may use the LDEN metric but, if they choose to do so, they must still produce the standard Leq, 16 hours contours as previously described. If airspace change sponsors wish to use the LDEN metric they must do so in a way that is compliant with the technical aspects of the Directive and any supplementary instructions issued by DEFRA. Sponsors should note the requirement for noise levels to be calculated as received at 4 metres above ground level. In particular, the guidance on how contours are to be portrayed, as described in the section dealing with Leq contours applies. Calculations should include terrain adjustments as described in the section on Leq contours. An exception regarding LDEN contours is the production of a table showing numerical data on area, population and households which should be presented by band (e.g. 55 dBA to 60 dBA) rather than cumulatively as for UK Leq contours (e.g. >55 dBA). Change Sponsors should make it clear where areas/counts are by band or cumulative.	Noise	Para 67 & 69 & 70	B-15 & B-16	Not Applicable.
43	Change Sponsors may use the L_{Night} metric within their environmental assessment and consultation. If they do so, SEL footprints must also be produced. Calculations should include terrain adjustments as described in the section on Leq contours.	Noise	Para 73	B-16	See Ref 2. SEL footprints have been produced. Lnight contours have not.
44	Change Sponsors may use difference contours if it is considered that redistribution of noise impact is a potentially important issue.	Noise	Para 78	B-17	Not Applicable.
45	Change Sponsors may use PEI as a supplementary assessment metric.	Noise	Para 85	B-19	Not Applicable.
46	Change Sponsors may use the AIE metric as a supplementary assessment metric. If the sponsor uses PEI as a supplementary metric then AIE should also be calculated as both metrics are complementary.	Noise	Para 87	B-19	Not Applicable.
47	Change Sponsors may vary the information displayed in Operations Diagrams providing that the diagram is a fair and accurate representation of the situation portrayed.	Noise	Para 88	B-20	Not Applicable.
48	Change Sponsors may use maximum sound levels (Lmax) in presenting aircraft noise footprints for public consumption if they think that this would be helpful. This does not replace the obligation to comply with the requirement to produce sound exposure level (SEL) footprints, where applicable.	Noise	Para 95	B-21	Lmax footprints have not been produced. See Ref 2 for SEL footprints..
49	Change Sponsors may produce diagrams portraying maximum sound event levels (Lmax) for specific aircraft types at a number of locations at ground level beneath the airspace under consideration. This may be helpful in describing the impact on individuals. It is usual to include a table showing the sound levels of typical phenomenon e.g. a motor vehicle travelling at 30 mph at a distance of 50 metres.	Noise	Para 96	B-21	Lmax footprints have not been produced. See Ref 2.

50	Change Sponsors must demonstrate how the design and operation of airspace will impact on emissions. The kinds of questions that need to be answered by the sponsor are: Are there options which reduce fuel burn in the vertical dimension, particularly when fuel burn is high e.g. initial climb? Are there options that produce more direct routeing of aircraft, so that fuel burn is minimised? Are there arrangements that ensure that aircraft in cruise operate at their most fuel-efficient altitude, possibly with step-climbs or cruise climbs?	Climate Change	Para 102	B-22	See Section 5.
51	Change Sponsors should estimate the total annual fuel burn/mass of carbon dioxide in metric tonnes emitted for the current situation, the situation immediately following the airspace change and the situation after traffic has increased under the new arrangements – typically five years after implementation. Sponsors should produce estimates for each airspace option considered.	Climate Change	Para 106	B-23	See Section 5.7.
52	Change Sponsors should provide the input data for their calculations including any modelling assumptions made. They should state details of the aircraft performance model used including the version numbers of software employed.	Climate Change	Para 107	B-23	See Section 5.7.
53	Where the need to provide additional airspace capacity, reduce delays or mitigate other environmental impact results in an increase in the total annual fuel burn/ mass of carbon dioxide in metric tonnes between the current situation and the situation following the airspace change, Sponsors should provide justification.	Climate Change	Para 108	B-23	See Section 5.7.
54	Change Sponsors must produce information on local air quality only where there is the possibility of pollutants breaching legal limits following the implementation of an airspace change. The requirement for local air quality modelling will be determined on a case by case basis as discussed with the SARG Project Leader and ERCD. This discussion will include recommendations of the appropriate local air quality model to be used. Concentrations should be portrayed in microgrammes per cubic metre (μg.m-3). They should include concentrations from all sources whether related to aviation and the airport or not. Three sets of concentration contours should be produced: Current situation – these may already be available as part of the airport's regular environmental reporting or as part of the airport master plan; Situation immediately following the airspace change; and Situation after traffic has increased under the new arrangements – typically five years after implementation although this should be discussed with the SARG Project Leader.	Local Air Quality	Para 115	B-25	See Section 5.6.
55	Contours for assessment should be provided to SARG in similar formats to those used for noise exposure contours. Where Change Sponsors are required to produce concentration contours they should also produce a table showing the following data for concentrations at 10 μ.m-3 intervals: Area (km2); and Population (thousands) – rounded to the nearest hundred.	Local Air Quality	Para 116	B-25	Not applicable.
56	The source and date of population data used should be noted adjacent to the table. Population data should be based on the latest available national census as a minimum but more recent updated population data is preferred.	Local Air Quality	Para 117	B-25	Not applicable.

57	Change Sponsors may wish to conduct an economic appraisal of the environmental impact of the airspace change, assessing the economic benefits generated by the change. If undertaken, this should be conducted in accordance with the guidance from HM Treasury in the Green Book (HM Treasury, 2003). If Change Sponsors include a calculation of NPV then they must show financial discount rates, cash flows and their timings and any other assumptions employed. The discount rate must include that recommended in the Green Book currently set at 3.5%. Additionally, other discount rates may be used in a sensitivity analysis or because they are representative of realistic commercial considerations	Economic Valuation	Para 124 & 126	B-27	No such appraisal has been undertaken. See Section 5.14.

12 Appendix A: List of Proposed Amendments to the AIP

- ENR 3.3 – new link routes and interactions with existing routes.
- ENR 4.4 - new name-code designators.
- ENR 6.3.1.2 – update lower ATS routes chart
- AD-2-EGPK-1 - updates to ‘Noise Abatement Procedures’ and ‘Flight Procedures’ sections
- AD-2-EGPK-6-1 to AD-2-EGPH-7-2 - all 4 charts will be superseded and replaced by charts detailing the RNAV1 SIDs and STARs.
- 3 new GNSS instrument approach charts
- 5 new arrival transition charts
- Other - SRD and RAD to be updated.

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