

Redesign of Gatwick Route 4 RNAV SIDs

Initial Options Appraisal

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Glossary of Terms

Acronym	Definition
ACP	Airspace Change Proposal
agl	Above Ground Level
AIP	Aeronautical Information Publication
amsl	Above Mean Sea Level
ANG	Air Navigation Guidance
ANSP	Air Navigation Service Provider
AONB	Area of Outstanding Natural Beauty
AQMA	Air Quality Management Area
ATC	Air Traffic Control
CAA	(UK) Civil Aviation Authority
CAP	Civil Aviation Publication
dB	Decibel
DET	Detling (VOR Waypoint)
DfT	(UK) Department for Transport
DPE	Design Principle Evaluation
DVOR	Doppler VHF Omni-directional Range (Ground-based beacon)
ERCD	Environmental Research and Consultancy Department
FASI	Future Airspace Strategy Implementation
GA	General Aviation
GAL	Gatwick Airport Limited
HARP	Hazard and Risk Assessment Procedure
IFP	Instrument Flight Procedure
IOA	Initial Options Appraisal
LAM	Lambourne (VOR Waypoint)

Acronym	Definition
NO2	Nitrogen Dioxide
NP	National Park
PBN	Performance Based Navigation
PIR	Post Implementation Review
RNAV	Area Navigation
SID	Standard Instrument Departure
SUNAV	SUNAV (Waypoint)
TAG	Transport Analysis Guidance
TMA	Terminal Manoeuvring Area
VFR	Visual Flight Rules
VHF	Very High Frequency

Table 1 Glossary of Terms

1 Introduction

1.1 Regulatory Requirement for Change

London Gatwick Airport is the UK's second largest airport and prior to COVID-19, was handling over 100k metric tons of cargo and 46 million passengers annually. Destinations serviced by Gatwick Airport include other UK regions, Europe, Canada, the Americas, Africa and the Far East.

Route 4 is a set of Standard Instrument Departure (SID) routes for aircraft taking off in a westerly direction from Runway 26 and then turning approximately 180°, through north, to track in an easterly direction just to the south of Reigate and Redhill in Surrey.

The introduction of RNAV SIDs (Area Navigation Standard Instrument Departure) for Route 4 has been subject to regulatory and legal challenge since its original approval in 2013, when the CAA approved, and GAL implemented, RNAV procedures on all nine Gatwick Airport departure routes. In 2015, the CAA conducted a Post Implementation Review (PIR) (CAP 1912) and approved most of the routes for continued use but found that Route 4 had not delivered the objective of the airspace change. This required the route to be modified. This work was completed, and Gatwick Airport Limited (GAL) submitted an amended Route 4 proposal which was ratified by the CAA.

Subsequently, the community group 'Plane Justice' sought a judicial review to challenge the CAA's PIR decision. Following a further detailed investigation, the CAA asked the court to quash their previous decision. As a result, Route 4 RNAV SIDs assumed a temporary status.

The purpose of this project is to submit a new application for RNAV1 performance-based navigation (PBN) SID Procedures for Route 4 departures at Gatwick Airport under the guidance and requirements of the CAA's Airspace Change Process, defined in Civil Aviation Publication (CAP) 1616.

The objectives of this Airspace Change Proposal (ACP) are to design and implement new RNAV SIDs for Route 4 that:

- Improve further, where practicable, aircraft and passenger safety.
- Limit and seek to reduce, where possible, the environmental impact on local communities in the vicinity of the Route 4 SIDs.
- Enable further improvements in safety and noise reduction through the application of more efficient FASI-South¹ operating procedures and opportunities.
- Provide long term predictability of flight paths.

¹ FASI-South is the umbrella name for the programme to modernise the airspace structure and route network in Southern England. The programme is a collaborative initiative between 17 airports, and NATS as the UK's en route air navigation services provider (ANSP).

1.2 Document Scope and Structure

The overall purpose of this document is to provide a narrative, explaining the steps, rationale, and outcomes of Step 2B, the Initial Options Appraisal (IOA). It must be highlighted that this document does not contain a detailed IOA analysis of each option. Full analysis can be found in the IOA Full Analysis Table, alongside this document on the CAA Airspace Change Portal, available via the link below.

<https://airspacechange.caa.co.uk/PublicProposalArea?pID=111>

This document includes the methodology, baseline definition and results summary of the detailed IOA analysis, along with supporting Appendices, and is structured as follows:

1. Introduction (this section)
2. Guidance and Methodology for Options Appraisal
3. Baseline Definition
4. Initial Options Appraisal Results
5. Qualitative Safety Assessment
6. Design Options Shortlist
7. Initial Options Appraisal Full Table Analysis (Appendix A1)

Please note, it is highly recommended that readers review this document either before or alongside the IOA Full Analysis Table (Appendix A1) to provide additional context, clarification, and rationale. In addition, it must be clarified that all altitudes referred to within this document are based on height Above Mean Sea Level (amsl) rather than Above Ground Level (agl).

1.2.1 Submission 2

Submission 2 of the IOA (this document) forms part of the overall second submission by GAL to the CAA as part of Stage 2 of the CAP 1616 process. The first submission was completed in February 2020 but was subsequently deemed by the CAA to not meet the requirements of passing the Stage 2 gateway. Therefore, Submission 2 of the IOA (this document) supersedes the previous IOA submission and considers additional events and factors which were not evident during the previous submission. The main changes between the first submission and the second submission (this document) are:

- Amended baseline scenario.
- Changes to the analysis based on the amended baseline scenario.
- Updated option descriptors (in line with all other Submission 2 documentation).
- Additional consideration with regards to the removal of ground-based navigation aids.
- Three additional assessment criteria added (in line with CAP 1616 requirements).
- Updated design options shortlist (including a preferred option) based on updated analysis.

As a result of the changes outlined above, the IOA methodology in this document is subtly different to the methodology used within the previous submission.

1.3 CAP 1616 Airspace Change Process

The implementation of any changes to UK airspace is subject to the guidance contained in CAP 1616. CAP 1616 is a seven-stage process published by the CAA that provides guidance on the process to follow when seeking to change the way airspace is used. The seven stages of the process are as follows:

- Stage 1 – Define
- **Stage 2 – Develop and Assess**
- Stage 3 – Consultation
- Stage 4 – Update and Submit
- Stage 5 – Decide
- Stage 6 – Implement
- Stage 7 – Post-Implementation Review

GAL are currently at Stage 2 (the CAA, at the first Develop and Assess Gateway on 28 February 2020, concluded that further clarification was required in a number of areas) which requires the development of options that seek to meet the approved Statement of Need. The options are required to align, where practicable, with the Design Principles generated in Stage 1. These options are then assessed to understand the positive/negative impacts before progressing to the Stage 2 Gateway.

1.4 Stage 1 Summary

In December 2018, GAL submitted their Statement of Need to the CAA. This is the formal explanation as to why the airport wishes to change the airspace. The CAA indicated that an airspace change was an appropriate mechanism to achieve the objectives in GALs Statement of Need. A copy of the Statement of Need and other associated documentation can be viewed at:

<https://airspacechange.caa.co.uk/PublicProposalArea?pid=111>

On 27 September 2019, the first stage in the change process was successfully completed when the Airport's submission passed through the Stage 1 DEFINE Gateway.

The work undertaken during Stage 1 established a shortlist of Design Principles to act as a framework against which Design Options have been designed. The list of Design Principles can be found in the documents uploaded at Stage 1B on the CAA airspace change portal; the link can be found here:

<https://airspacechange.caa.co.uk/PublicProposalArea?pid=111>

1.5 Step 2A – Options Development Summary

During Step 2A, GAL developed a list of design options for the new procedures

In order to develop the options, the Instrument Flight Procedure (IFP) designers considered the fixed constraints identified during Stage 1A and the Design Principles established in Stage 1B. The initial list of all possible options was tested with the stakeholders as detailed in the Design Engagement Document, before GAL subsequently applied high-level criteria, derived from the Design Principles, in order to refine the comprehensive list of options carried forward for initial appraisal in Step 2B (this document).

A detailed explanation of how the constraints, design principles high-level criteria and learning from the first Gateway 2 were applied to the options development can be found in GAL Design Principle Evaluation (DPE) that is uploaded to the portal in Step 2A. That document can be found on the [CAA Airspace Change Portal](#).

1.6 Step 2B – Initial Options Appraisal

The DPE document explains how the Comprehensive List of all possible options was reduced to the Comprehensive List of Viable Options, together with an explanation of the necessary changes to the option identification and descriptions due to engagement and CAA guidance. The Comprehensive List of options is shown below in Table 2. This Comprehensive List was tested against the criteria contained in CAP 1616, Appendix E, Table E2 with the addition of a Qualitative Safety Assessment and a Qualitative Noise Assessment as required for a Level 1 change at this stage.

Option	Description
Baseline [Current]	Current 2021 Conventional Baseline
Do Minimum Baseline [Baseline – future]	RNAV Substitution of the current 2021 Conventional following the guidance set out in CAP1781 ²
0	Current 2021 Conventional 6M,6V RNAV Replication RNAV procedure which follows the path over ground of the nominal track of the existing conventional procedure as closely as possible, for the purposes of this evaluation, it is equivalent to the Do Minimum Baseline [Baseline – future]
1	Fly-by Fly-by LAM1X Turn by KKW04 not below 2500ft
2	Fly-over Fly-by (LAM 2X) Direct SUNAV As per LAM2X but DIRECT SUNAV and no southerly track adjustment
3	Fly-by Fly-by (Apparent Dispersion Late in Turn) Fly-by, Fly-by at multiple waypoints for dispersion
4	Fly-over Fly-by (Multiple Initial Turn Points) Multiple turn points with dispersion in the turn

² Do nothing is not an option, a substitution of the conventional SID is the Do Minimum Option, that will also serve as the baseline against which all the future options are compared, projected forward to the point of implementation and at implementation plus ten years. A single comparison will be made between the Baseline and the Do Minimum Baseline, but it is anticipated that there will be no differences.

Option	Description
5	Fly-by Fly-by (Lower Speed Vs Option 1) 2 x 90° turns, similar track across the ground as Option 1 but with a lower speed
6	Fly-over Fly-by (Multiple Initial and Turn Points) Multiple turn points with apparent dispersion in the turn
7	New Constant Radius to Fix (Tracks Concentrated) 'final'
8	Fly-over Fly-by (Was LAM 2X) This option is the historical LAM 2X Standard Instrument Departure (SID) as published in the UK AIP 2016, which was subsequently withdrawn through CAP1912 in 2019.

Table 2 – Options Identification

The methodology used for the Initial Options Appraisal is discussed in Section 2.

The Initial Options Appraisal itself is detailed in Section 4. The resultant shortlist of options to be taken forward to Stage 3 for detailed technical design and consultation is contained in Section 6.

2 Guidance and Methodology for Options Appraisal

CAP 1616 requires sponsors to complete a formal Options Appraisal process that assesses the benefits of the various options compared to a baseline. At the Initial Options Appraisal, the requirement is only to determine the high-level criteria and then conduct a qualitative assessment against each option. This Initial Options Appraisal serves as the foundation for a more quantitative assessment later in the process.

2.1 CAP 1616 Options Appraisal Requirements

The Options Appraisal process is carried out in accordance with the guidance in CAP 1616, and in conjunction with The Green Book³ and the Department for Transport's Transport Analysis Guidance (TAG)⁴, which constitute best practice in options appraisal.

Options Appraisal is used as a tool throughout the CAP 1616 process to help refine the options from the comprehensive list of viable options, down to a short list and finally a set of preferred options. The process is iterative with an Initial Options Appraisal (this document) being used to whittle down the longlist in Stage 2B, a Full Options Appraisal of the shortlist taking place in Stage 3 for consultation, and the Final Options Appraisal supporting the submission of the ACP application to the CAA.

The Options Appraisal consists of the following elements:

- High-level objective and assessment criteria.
- Baseline definition – current operations.
- Comprehensive list of viable options (including a do-nothing/minimum option).
- Shortlist of options.
- Preferred or final option(s).

The options appraisal requirement of CAP 1616 evolves through three iterations with the CAA reviewing at each phase as follows:

1. 'Initial' appraisal (this document) at Step 2B with the CAA review at the 'Develop and assess' gateway.
2. 'Full' appraisal at Step 3A with the CAA review at Step 3B and the subsequent 'Consult' gateway.
3. 'Final' appraisal at Step 4A, with the CAA review after the formal submission of the airspace change proposal at the end of Stage 4.

Iteration 1, Initial Options Appraisal, is the subject of this document to be submitted to the CAA as part of Step 2B. The remainder of this section of the document focusses on the

³ The Green Book: Appraisal and Evaluation in Central Government:
<https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government>

⁴ DfT transport analysis guidance (TAG):
<https://www.gov.uk/guidance/transport-analysis-guidance-webtag>

definition of the ‘high-level objective and assessment criteria’ and the assessment methodology.

2.2 High Level Objectives and Assessment Criteria

For an airspace change, the criteria against which appraisal options are assessed is defined within CAP 1616, Appendix E, Table E2. These criteria are described in Table 3 below. Additionally, Safety Assessment, Tranquillity and Biodiversity (as defined in CAP 1616, Appendix B) have been added at the bottom. It is worth stressing that the IOA provides a qualitative assessment only, therefore no numerical, statistical or noise contour analysis has been conducted at this stage. This approach has been chosen because of the relatively small scale of the proposed change compared to other in progress ACPs, and it is therefore deemed proportionate. The change sponsor will be conducting more detailed quantitative analysis in the Full/Final Options Appraisal as part of subsequent stages of the process.

Affected Group	Impact	Description
Communities	Noise impact on health and quality of life	Requires consideration of noise impact on communities including residents, schools, hospitals, parks and other sensitive areas.
Communities	Air Quality	Any change in air quality is to be considered.
Wider Society	Greenhouse Gas impact	Assessment of changes in greenhouse gas levels in accordance with TAG is required.
Wider Society	Capacity and resilience	A qualitative assessment of the impact on overall UK airspace structure.
General Aviation	Access	A qualitative assessment of the effect of the proposal on the access to airspace for GA users.
General Aviation / commercial airlines	Economic impact from increased effective capacity	Forecast increase in air transport movements and estimated passenger numbers or cargo tonnage carried.
General Aviation / commercial airlines	Fuel burn	The change sponsor must assess fuel costs based on its assumptions of the fleets in operation.
Commercial airlines	Training costs	An assessment of the need for training associated with the proposal.
Commercial airlines	Other costs	Where there are likely to be other costs imposed on commercial aviation, these should be described.
Airport / Air navigation service provider	Infrastructure costs	Where a proposal requires a change in infrastructure, the associated costs should be assessed.

Affected Group	Impact	Description
Airport / Air navigation service provider	Operational costs	Where a proposal would lead to a change in operational costs, these should be assessed.
Airport / Air navigation service provider	Deployment costs	Where a proposal would lead to a requirement for retraining and other deployment, the costs of these should be assessed.
Safety Assessment	Safety Assessment	CAP 1616 requires a safety assessment of the proposal to be undertaken in accordance with CAP760.
Wider Society	Tranquillity	The impact upon tranquillity need only be considered with specific reference to Areas of Outstanding Natural Beauty (AONB) and National Parks (NPs) unless other areas for consideration are identified through community engagement.
	Biodiversity	The variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Table 3 – Assessment Criteria for Level 1 Change

2.3 Method

2.3.1 Overview

The Initial Options Appraisal was carried out by comparing all the options side by side against the CAP 1616 (Appendix E) costs and benefits criteria in tabular form. The Appraisal also included the results of a Qualitative Safety Assessment as described in Section 5, and the noise impact for communities was supported by a qualitative noise assessment as described in Appendix A1 to this document. The full analysis of all the options is similarly described in Appendix A1 and included as a separate document, which can be accessed via the [CAA Airspace Change Portal](#).

Each option was compared against the 'Do Minimum baseline' which was established as the baseline for this ACP. This is explained further in Section 3 of this document.

The Options Appraisal also compared the implementation of the proposed RNAV procedure against the current conventional SID.

2.3.2 Shortlisting

Once all the options had been assessed against the criteria, the list of options was refined to identify the Short List to be taken forward to Stage 3. The Short List is contained in Section 6, which also specifies the preferred options.

3 Baseline Definition

3.1 Baseline Overview

In accordance with CAP 1616, a baseline is required for the IOA along with subsequent environmental assessments. A baseline will allow the change sponsor to conduct an assessment to understand the impacts of the various options so that a comparison can be made.

In most Airspace Changes, the baseline will be the 'Do Nothing' option and will largely reflect the current operation. However, as per CAP 1616, Appendix E, Paragraph E21 in certain cases, doing nothing is not a feasible option in reality, and in such cases, the change sponsor must set out its informed view of the future and the minimum changes required to address the issues identified – a 'Do Minimum' option. For this ACP it is necessary to set the baseline at the 'Do Minimum' situation, as Do Nothing is not an option; the current conventional procedure cannot be maintained due to the previous history of the Route 4 SIDs detailed at the beginning of this document.

As CAP 1616 stipulates the level of track data that needs to support an environmental assessment at Stage 3, it was necessary at this stage to ensure that the selection of a baseline would not be compromised, once again, further through the process. A methodology was agreed that would allow recent traffic flying the conventional routing to form the basis of the data set to be used to establish a mean track which could then be populated with representative 2019 levels of traffic data to model the environmental impact associated with the baseline. Notably, the impact of COVID-19 on traffic levels and the ability of ERCD to provide meaningful analysis of those reduced traffic levels throughout the London TMA resulted in different destination sets and track over the ground patterns (due to increased opportunity for vectoring), this meant that the overall pattern was not representative compared to a 'steady state' operation. Therefore, the sponsor proposed a methodology for capturing a traffic sample from the new conventional baseline which ERCD used as the nominal track, then they took the 2019 traffic volume and modelled it using that new conventional baseline.

Further consideration was also necessary of the effect of the UK programme for the rationalisation of the Doppler Very High Frequency Omni-Directional Range (DVOR) navigational infrastructure. A number of airports across the UK will be impacted by the decommissioning of these ground-based navigation aids, towards the end of 2023. Confirmation was sought that the introduction of RNAV substitution - in accordance with CAP 1781 DVOR / DME / NDB Rationalisation: Guidance for the use of RNAV Substitution - to temporarily replace the procedures flown along the new conventional track would align well enough to ensure that the baseline was not compromised at a later stage in the process.

Due to the timescales associated with the DVOR Rationalisation programme, it is anticipated that GAL will be required to undertake a CAP 1781 RNAV Substitution, to maintain current operations in the short term to medium term. This substitution will be required because a more permanent solution (this ACP) cannot be implemented prior to the DVOR being decommissioned in December 2023. This is illustrated in the timeline shown in Figure 1 below.

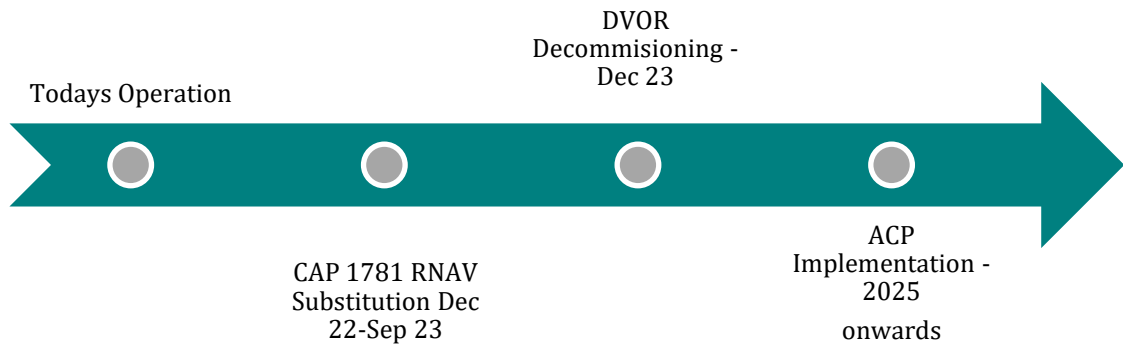


Figure 1 ACP Timeline vs DVR Rationalisation Programme

Please note that an RNAV Substitution under CAP 1781 is separate to the ACP process (and is therefore not part of this ACP) and has been initiated with the CAA by GAL separately.

A single comparison will be made between the RNAV Replication Option 0 (future) and the current operation (Baseline [current]), but it is anticipated that there will be no differences between current baseline, Do Minimum baseline and RNAV Replication Option 0.

3.2 The 'Do Nothing' Option – Baseline [Current]

Baseline [current], is the current 2021 Conventional LAM 6M, 6V procedure which is in use today and is published on the UK Aeronautical Information Publication (AIP). An extract of which is shown in Figure 2 below.

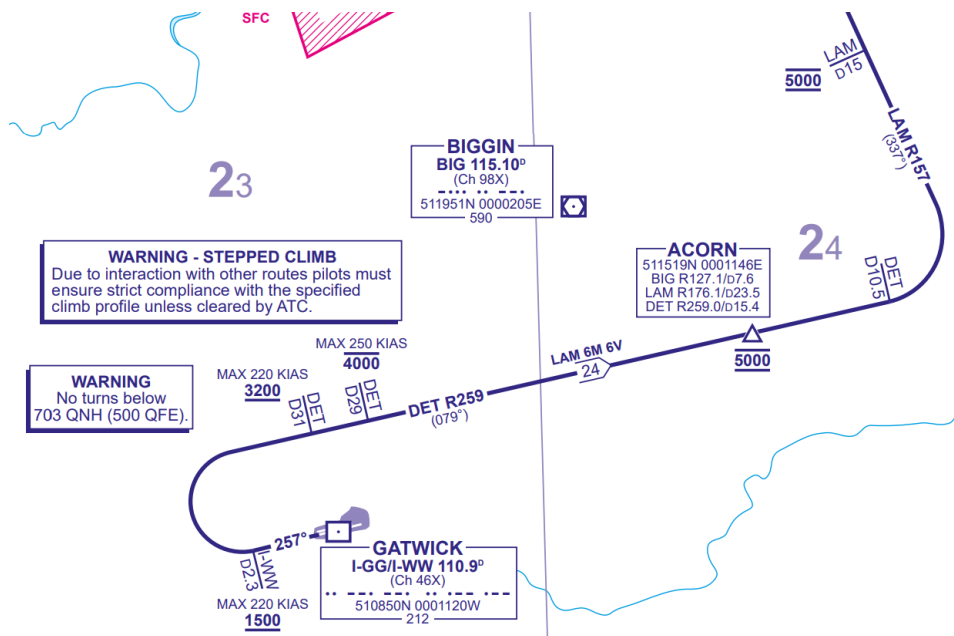


Figure 2 Baseline (current) - Do Nothing Option

As outlined in Section 3.1 above, the Do Nothing is an unviable option as it is based on ground-based navigation aids (LAM and DET VORs), which shall soon be withdrawn from service. The consequence of which is that aircraft would be unable to utilise the SID, an unacceptable outcome if the integrity of the Gatwick Airport operation is to be maintained.

Please note that although the existing conventional procedure extends from Gatwick Airport to LAM, the scope of this ACP will focus on the initial part of the procedure up to a waypoint known as SUNAV. From this point, the procedure will remain as it is today.

3.3 The 'Do Minimum Baseline [baseline – future]'

The Do Minimum baseline consists of each airline executing the existing conventional LAM 6M, 6V procedure using a Flight Management System (FMS) coded overlay procedure through the process defined as RNAV Substitution in CAA's CAP1781 and CAP1926. This procedure is intended to replicate, as closely as possible, the existing LAM 6M, 6V procedure (known as the Do Nothing or Baseline [current]).

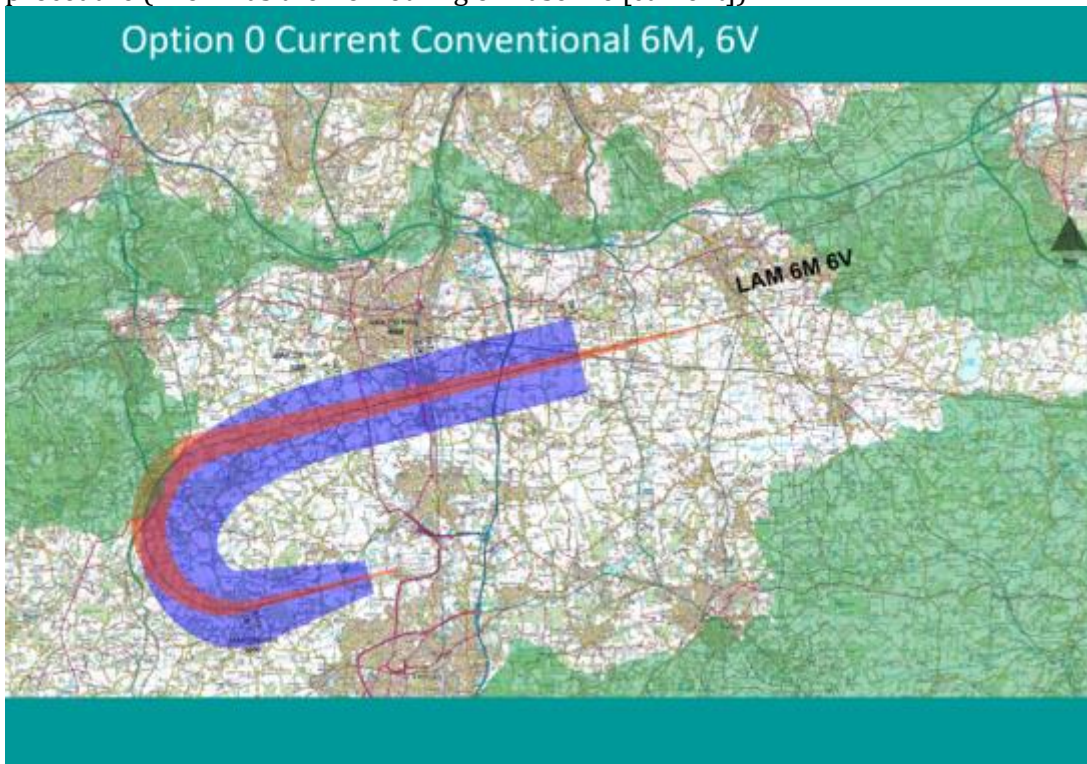


Figure 3 Do Minimum Baseline

3.4 Option 0 (and correlation with Baseline [current] and Do Minimum Baseline [future])

Option 0 is an RNAV replication of the existing conventional LAM 6M, 6V procedure. This procedure is designed to replicate, as closely as possible, the existing LAM 6M, 6V procedure (known as the Do Nothing or Baseline [current]) given various strict safety and airspace design constraints. Option 0 is shown in Figure 3 below.

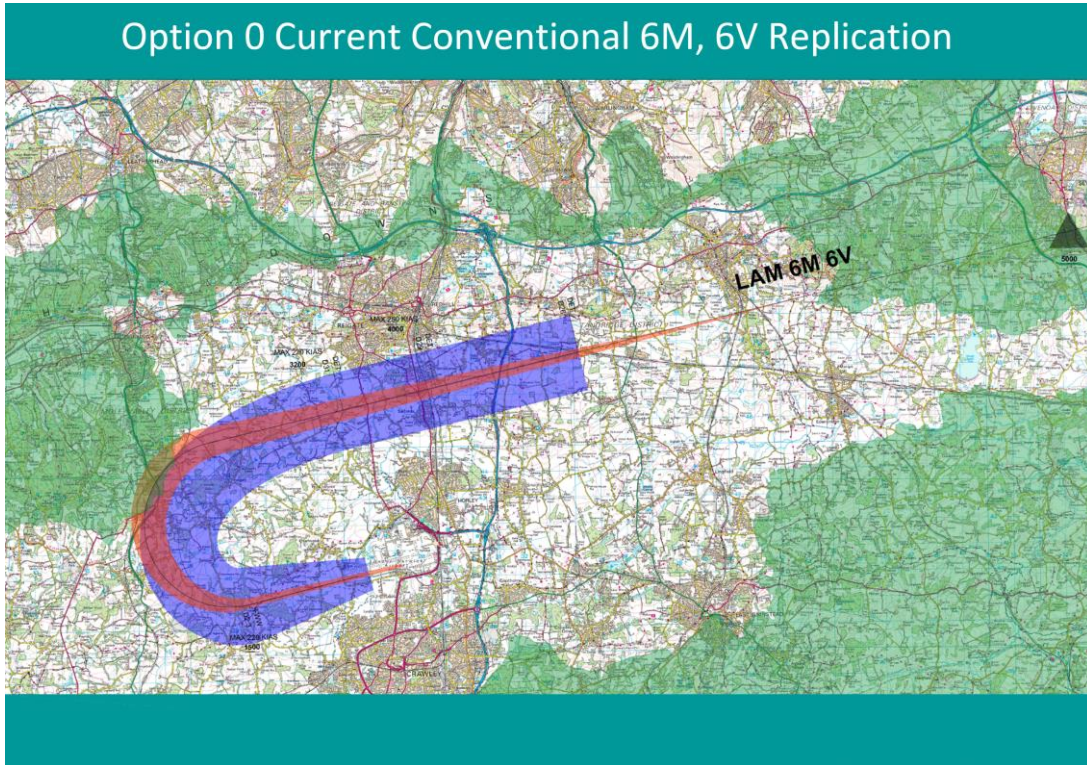


Figure 4 Option 0 – RNAV Replication of existing conventional LAM 6M, 6V procedure

In terms of correlation, Baseline [current], Do Minimum Baseline [baseline - future] and Option 0 are all equivalent in terms of perceived tracks over ground, the only difference being the navigational standard used to define the procedure and the party defining the procedure. As previously outlined, in accordance with CAP 1616, Appendix E, Paragraph E21, Option 0 is the same as the Do Minimum Baseline and consequently will be used as comparator against all other options.

3.5 Assessment of the Current Operation (Baseline [current]) against the Do Minimum Baseline (Baseline [future]) and Option 0

In accordance with CAP 1616, Appendix E, Paragraph E21, when using a 'Do Minimum option' as a baseline, the change sponsor is required to assess the differences between the 'Do Nothing option' and the 'Do Minimum option' to allow communities to understand the effect of the 'do minimum' in relation to current circumstances. To provide some insight into the distribution of aircraft tracks currently departing from Gatwick Airport on the Route 4 departure. Figure 5 below shows a snapshot of Gatwick Airport departures at or below 4000ft and Figure 6 depicts the tracks at or below 6,000ft.

General Aviation (GA) aircraft are not shown in these Figures; GA aircraft arrive and depart from the aerodrome along published VFR routes, or routes agreed between the aircraft

Captain and Gatwick Air Traffic Control (ATC). These VFR routes are not part of this airspace change project.

The aircraft tracks shown in each Figure were generated based on data from summer 2019.

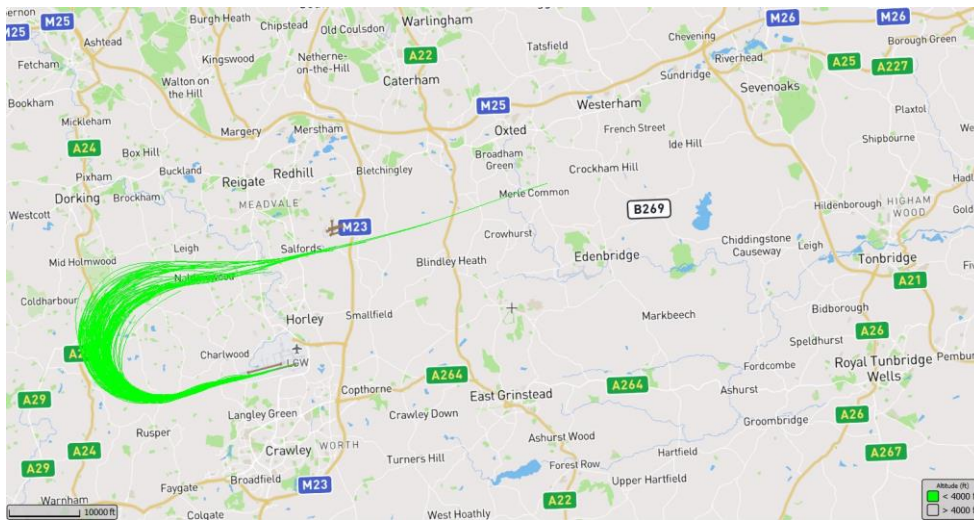


Figure 5 Aircraft tracks at or below 4,000 ft AMSL (summer 2019)

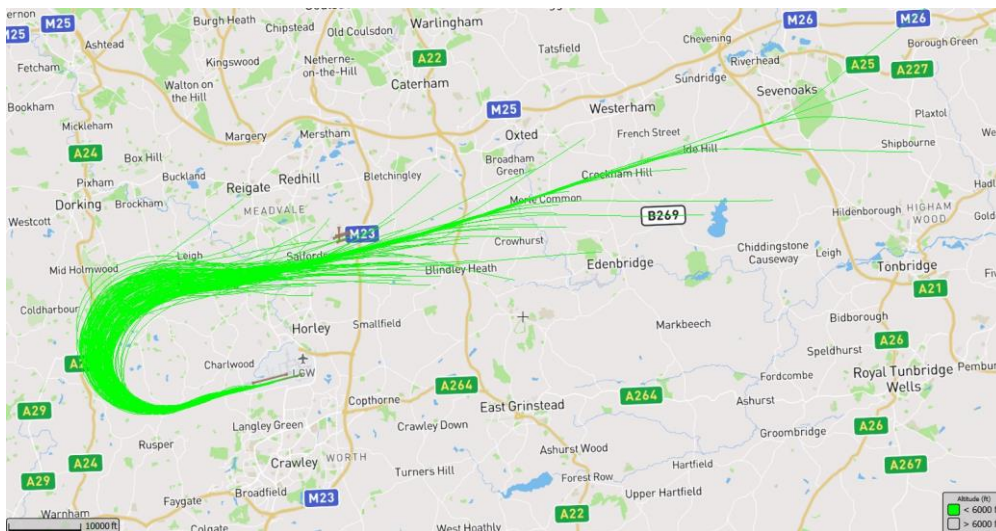


Figure 6 Aircraft tracks at or below 6,000 ft AMSL (summer 2019)

The following sub-sections provide an assessment of the ‘Do Nothing option’ against the ‘Do Minimum option’ based on the criteria set out in ACP 1616, Appendix E, Table E2 as detailed previously in Table 3.

3.5.1 Current Noise Impact for Communities

Considering that the Do Minimum Baseline represents execution of the FMS Overlay of the current conventional SID and Option 0 is an RNAV replication of the current conventional SID, there is expected to be no notable difference in terms of noise impacts between them. Within the conventional procedure (Do Nothing option) there is a degree of dispersion located around the turn. It is acknowledged that this turn is not fully contained within the existing NPR conformance monitoring swathe, however, this is similar to today’s operation. A detailed noise assessment shall be conducted at a subsequent stage of the CAP 1616 process to confirm this hypothesis.

3.5.2 Air Quality

The location of Gatwick Airport itself is out with the boundaries of any Air Quality Management Areas (AQMAs). However, aircraft operating in today's operation (the Do Nothing) may fly within the vicinity of AQMAs and the East Surrey Hospital. Having said that, any overflight (other than that in the immediate vicinity of Gatwick Airport) shall occur above 1,000ft. As specified in CAP 1616 Appendix B, Paragraph B74, it is therefore unlikely that there will be an impact on local communities (including the East Surrey Hospital) due to the effects of mixing and dispersion above 1,000ft. Overflight of areas within the immediate vicinity of Gatwick Airport (below 1,000ft) is unavoidable due to strict airspace design and safety constraints (E.g., Minimum Stabilisation Distance and Obstacle Clearance Heights) that prohibit aircraft from making any manoeuvres until they have reached a specified altitude.

This is also applicable within the 'Do Minimum option' and as such there is little difference in terms of noise impacts when the 'Do Nothing option' is compared to the 'Do Minimum option'. Further analysis will be conducted at a subsequent stage of the CAP 1616 process to confirm.

3.5.3 Emissions

At this stage of the CAP 1616 process, it is acceptable to not utilise quantitative data, therefore the track mileage of each option has been used to determine the qualitative assessment of greenhouse gas emissions and fuel burn. The rationale being, the longer the route, the more fuel is used, and the more emissions are produced.

In terms of track mileage, there is no difference between the 'Do Nothing option' (Baseline [current]), the 'Do Minimum option' (Baseline [future]) and Option 0 as they are all 26.1 Nautical Miles (nm) long. Therefore, at this stage, there is expected to be no difference in terms of greenhouse gas emissions. Please note that this length is measured from Gatwick Airport to SUNAV, rather than for the full length of the SID to LAM.

3.5.4 Capacity and Resilience

There is no difference between the 'Do Nothing option' (Baseline [current]), the 'Do Minimum option' (Baseline [future]) and Option 0 as all three support the current Gatwick Airport capacity cap and equally offer the same level of resilience in the GAL operation in the event of an issue with another departure procedure.

3.5.5 Tranquillity

There is no difference between the 'Do Nothing option' (Baseline [current]), the 'Do Minimum option' (Baseline [future]) and Option 0 as all options remain clear of the nearest National Park (the South Downs) and although Gatwick Airport itself is out with the boundary of any AONB, it is acknowledged that the 'Do Nothing option' (Baseline [current]), the 'Do Minimum option' (Baseline [future]) and Option 0, where they do overfly an AONB, they do so above 1,000ft.

3.5.6 Biodiversity

There is no difference between the 'Do Nothing option' (Baseline [current]), the 'Do Minimum option' (Baseline [future]) and Option 0 as it is not anticipated that they will impact on any biodiversity receptors, simply because of the minimal changes made in terms of aircraft routing when compared to today's operation.

3.5.7 General Aviation Access

There is no difference between 'Do Nothing option' (Baseline [current]), the 'Do Minimum option' (Baseline [future]) and Option 0. General Aviation (GA) aircraft may arrive and depart from the aerodrome along published VFR routes, or routes agreed between the aircraft Captain and Gatwick Airport Air Traffic Control (ATC). These VFR routes are not the subject of this airspace change project and no changes are proposed to the way GA aircraft operate at Gatwick Airport.

3.5.8 Economic Impact: Commercial Airlines and GA

This ACP is not designed to facilitate extra capacity but to enable the full use of the current capacity. Additionally, this ACP is not expected to reduce the flow of air traffic out of the airport. There is no change to the economic impact between 'Do Nothing option' (Baseline [current]), the 'Do Minimum option' (Baseline [future]) and Option 0.

3.5.9 Fuel Burn: Commercial Airlines and GA

Although fuel burn will be assessed throughout this IOA, this shall be conducted by means of track miles flown. The rationale being that the longer the distance flown, the more fuel is used.

As 'Do Nothing option' (Baseline [current]), the 'Do Minimum option' (Baseline [future]) and Option 0 are the same track length (26.1 nm) there is expected to be no difference in terms of fuel burn. Please note that this length is measured from Gatwick Airport to SUNAV, rather than for the full length of the SID to LAM.

3.5.10 Training: Commercial Airlines

There is no difference between 'Do Nothing option' (Baseline [current]), the 'Do Minimum option' (Baseline [future]) and Option 0 as there are no new training costs due to PBN procedures being in place for other departure routes at Gatwick Airport.

3.5.11 Other Costs: Commercial Airlines

There is no difference between 'Do Nothing option' (Baseline [current]), the 'Do Minimum option' (Baseline [future]) and Option 0 as there are no known other costs due to PBN procedures being in place for other departure routes at Gatwick Airport. It is not proportionate or possible for GAL to assess this in greater detail for commercial airlines - there may be costs associated with maintaining legacy systems to continue flying conventional navigation but there are too many variables (e.g., aircraft types, onboard system capability etc.) to consider these effectively. Equally these costs may be nullified if those commercial airlines continue to operate at other airports which maintain conventional procedures.

3.5.12 Infrastructure Costs

There is no difference between "Do Nothing option' (Baseline [current]), the 'Do Minimum option' (Baseline [future]) and Option 0 as there are no new infrastructure costs within this ACP.

3.5.13 Operational Costs

The 'Do Nothing option' (Baseline [current]) requires a functioning conventional navigational facility while the 'Do Minimum option' (Baseline [future]) and Option 0 do not. Therefore, a theoretical reduction in Operational Costs may be realised with the introduction of any PBN route if it enables the decommissioning of a conventional

navigational facility. This saving is not allocated to Gatwick Airport, but to NATS who own and maintain the conventional navigational aids.

3.5.14 Deployment Costs

There is no difference between 'Do Nothing option' (Baseline [current]), the 'Do Minimum option' (Baseline [future]) and Option 0 as there are no additional costs to the deployment of a PBN procedure when all other main runway departure procedures at Gatwick Airport are already PBN.

3.5.15 Safety Assessment

The primary means by which it is intended to provide safety assurance evidence to support the GAL ACP is a Safety Case. The Safety Case is under development and has recently been reviewed due to the outcome of the first Gateway and with reference to the baseline; the Safety Case includes claims, arguments, and evidence that current operations at Gatwick Airport are safe, and this is a key assumption of the Safety Assurance Activities in Stage 2. Assurance evidence that extant operations are safe will be provided in the Full Options Appraisal during Stage 3.

4 Initial Options Appraisal Results

4.1 Introduction

This section provides some additional clarification to assist the reader in understanding the rationale behind the IOA Results, which are presented in full, at the end of this section. The Results Summary, presented in Section 4.5 is a high-level extract of the Full Analysis Table, which is on the airspace change portal as a separate document. It is **highly** recommended that this section should be read before proceeding to read the Full Analysis Table (found in Appendix A1) to provide context and to understand the terminology used.

4.2 IOA Background

It is worth noting that in order to distinguish between option characteristics, each option has been assigned alphabetic/numerical designators. Given the amendments and stakeholder engagement throughout the lifecycle of this ACP, for the avoidance of doubt, Table 4 below shows how the option designators have changed throughout the course of the CAP 1616 Stage 1 and 2 lifecycles.

Option	Focus Groups 1&2 Nov 2019	Focus Groups 3&4 Feb 2022	Current Status Jul 22
Baseline [Current]		Current 2021 Conventional	Current 2021 Conventional Baseline
Do Minimum Baseline [Baseline – future]		RNAV Substitution of the current 2021 Conventional following the guidance set out in CAP1781 ⁵	RNAV Substitution of the current 2021 Conventional
0	Fly-over Fly-by LAM 2X	Fly-over Fly-by LAM 2X (now Option 8 – Jul 22)	Current 2021 Conventional 6M,6V RNAV Replication Equivalent to Do Minimum Baseline
1	Fly-by Fly-by LAM1X Turn by KKW04 not below 2500ft	Fly-by Fly-by LAM1X Turn by KKW04 not below 2500ft	Fly-by Fly-by LAM1X Turn by KKW04 not below 2500ft
2	Fly-over Fly-by (LAM 2X) Direct SUNAV As per LAM2X but DIRECT SUNAV and no southerly track adjustment	Fly-over Fly-by (LAM 2X) Direct SUNAV As per LAM2X but DIRECT SUNAV and no southerly track adjustment	Fly-over Fly-by (LAM 2X) Direct SUNAV As per LAM2X but DIRECT SUNAV and no southerly track adjustment
3	Fly-by Fly-by (Apparent Dispersion Late in Turn)	Fly-by Fly-by (Apparent Dispersion Late in Turn) Fly-by, Fly-by at multiple waypoints for dispersion	Fly-by Fly-by (Apparent Dispersion Late in Turn) Fly-by, Fly-by at multiple waypoints for dispersion

⁵ Do nothing is not an option, a substitution of the conventional SID is the Do Minimum Option, that will also serve as the baseline against which all the future options are compared, projected forward to the point of implementation and at implementation plus ten years. A single comparison will be made between the Baseline and the Do Minimum Baseline, but it is anticipated that there will be no differences.

Option	Focus Groups 1&2 Nov 2019	Focus Groups 3&4 Feb 2022	Current Status Jul 22
	Fly-by, Fly-by at multiple waypoints for dispersion		
4	Fly-over Fly-by (Multiple Initial Turn Points) Multiple turn points with dispersion in the turn	Fly-over Fly-by (Multiple Initial Turn Points) Multiple turn points with dispersion in the turn	Fly-over Fly-by (Multiple Initial Turn Points) Multiple turn points with dispersion in the turn
5	Fly-by Fly-by (Lower Speed Vs Option 1) 2 x 90° turns, similar track across the ground as Option 1 but with a lower speed	Fly-by Fly-by (Lower Speed Vs Option 1) 2 x 90° turns, similar track across the ground as Option 1 but with a lower speed	Fly-by Fly-by (Lower Speed Vs Option 1) 2 x 90° turns, similar track across the ground as Option 1 but with a lower speed
6	Fly-over Fly-by (Multiple Initial and Turn Points) Multiple turn points with apparent dispersion in the turn	Fly-over Fly-by (Multiple Initial and Turn Points) Multiple turn points with apparent dispersion in the turn	Fly-over Fly-by (Multiple Initial and Turn Points) Multiple turn points with apparent dispersion in the turn
7	Constant Radius to Fix (Tracks Concentrated) 'draft'	New Constant Radius to Fix (Tracks Concentrated) 'final'	New Constant Radius to Fix (Tracks Concentrated) 'final'
8			Fly-over Fly-by (Was LAM 2X) This option is the historical LAM 2X Standard Instrument Departure (SID) as published in the UK AIP 2016, which was subsequently withdrawn through CAP1912 in 2019.

Table 4 Options status through Process

4.3 IOA Considerations

The following sub-sections provide context to some of the aspects that were considered as part of the IOA.

4.3.1 Qualitative Noise Methodology

To support the assessment of the noise related criteria, GAL carried out a qualitative assessment of the likely noise impacts of each option on people on the ground as part of the IOA. Within the IOA, consideration has also been given to the overflight of AONBs, NPs and Biodiversity receptors, as described below.

Please note, at this stage no quantitative analysis has been carried out with regards to track mileage or noise contouring. As per the CAP 1616 process, full environmental assessments will be carried out in Stage 3 (Consult).

Additionally, the change sponsor has considered noise modelling requirements as specified in CAP 2091 (CAA Policy on Minimum Standards for Noise Modelling)⁶. The sponsor is required to state at the Stage 2 Gateway what category of noise modelling will be undertaken for further stages of the CAP 1616 process. GAL proposes to conduct noise modelling to comply with the requirements of Category C.

Category C is considered appropriate, as in summer 2019 there were 24,050 people within the 51 dB $L_{Aeq,16h}$ daytime contour which is just under the mandated minimum threshold of 25,000 for Category D. However, there are 27,650 people within the 45 dB $L_{Aeq,8h}$ night-time contour, which falls in the Category C, as it is above the mandated threshold of 25,000 for Category D. As a result, the change sponsor has taken the higher of these figures and has concluded that Category C noise modelling would be more appropriate.

With reference to the baseline, in accordance with CAP 1616, Appendix E, Paragraph E22, by engaging with the local planning authorities. Through stakeholder engagement, GAL have identified that there are in the region of 750 proposed dwellings within the villages of Capel, Hookwood, Leigh, Newdigate and Ockley. In addition, a stakeholder highlighted that the area between Redhill and Banstead is “likely to see further development” although no additional details were provided.

In terms of the baseline assessment, the change sponsor believes that it would be inappropriate to fully consider these proposed dwellings at this stage, due to the immaturity of information available at this time. Nevertheless, the change sponsor acknowledges these developments and shall re-engage to ascertain whether further detail is available later in the process. Subsequent quantitative analysis conducted in Stage 3 of the CAP 1616 process shall capture detailed housing information to form a numerical baseline.

4.3.2 Track Mileage

Please note, this sub-section is for information only. No quantitative comparison of track mileage has been carried out as part of the IOA. Such analysis will be conducted in subsequent environmental assessment throughout the CAP 1616 process.

In the absence of quantitative data at this stage, the track mileage of each option has been used to determine the qualitative assessment of greenhouse gas emissions and fuel burn. The rationale being, the longer the route, the more fuel is used, and the more emissions are produced. In addition, aircraft climb gradients shall be taken into account with regards to emissions at lower altitudes. Furthermore, assessment of these criteria will be made in Stage 3, where quantitative data shall be used.

4.3.3 Tranquillity

As detailed in Table 3 (see Section 2.2), CAP 1616, Appendix B requires change sponsors to consider the impact of the proposed change on levels of Tranquillity with specific reference to AONBs and NPs. Please note, there were no additional areas identified through community engagement.

⁶ <https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=10124>

The location of Gatwick Airport means that it is in close proximity to the Surrey Hills (located to the north and west of GAL) Kent Downs (located to the north of GAL) and High Weald (located to the south of GAL) AONB⁷. Figure 7 below illustrates the location of GAL (indicated by the aircraft icon) in relation the three AONBs previous mentioned (outlined in red).

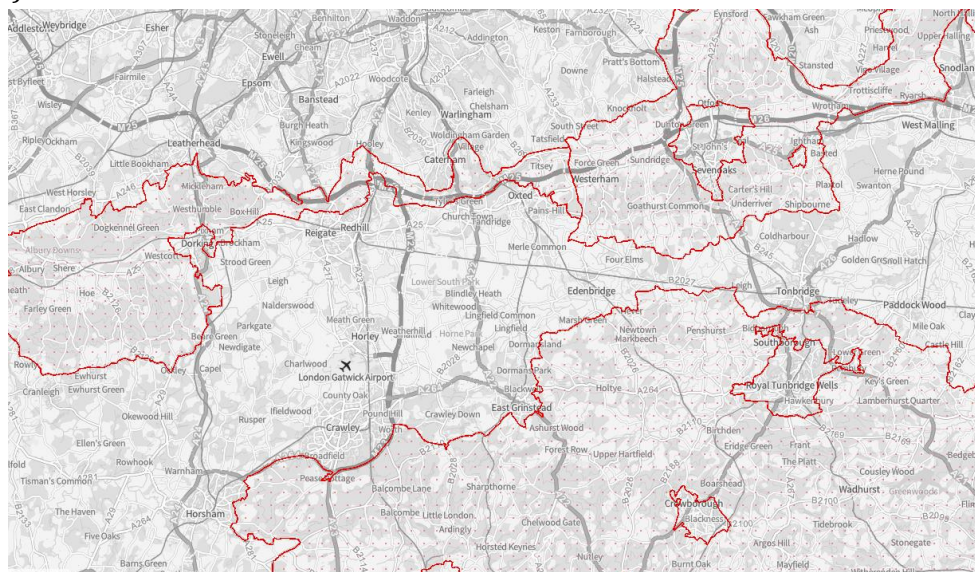


Figure 7 GAL Location relative to AONBs (Source: Magic Maps)

Although Figure 7 above shows that Gatwick Airport itself is outside the boundary of any AONB, it is acknowledged that some of the proposed Route 4 design options do overfly the most easterly section of the Surrey Hills AONB and the most westerly section of the Kent Downs AONB. Please refer to the Design Engagement Document and/or the DPE which both feature graphics displaying the routing of each individual option in comparison to the boundaries of all previously mentioned AONBs.

With regards to impacts on the AONB, the route options presented as part of this ACP that overfly an AONB, all do so above 1,000ft. For example, some options include turns which occur at 1,100ft prior to penetrating the lateral boundary of the Surrey Hills AONB. As a result, from an air quality perspective, based on CAP 1616, Appendix B, Paragraph B74, there is unlikely to be an impact on local air quality within the Surrey Hills AONB due to the effects of mixing and dispersion above 1,000ft. This also applies to the Kent Downs AONB, where aircraft will be significantly higher. In relation to noise, it is acknowledged that the Surrey Hills AONB may be affected by aircraft noise. However, it must be stressed that this is unavoidable due to strict airspace design and safety constraints (E.g., Minimum Stabilisation Distance and Obstacle Clearance Heights) that prohibit aircraft from making any manoeuvres until they have reached a specified altitude.

As stated above, change sponsors are also required to consider the impacts of their design options on Tranquillity with specific reference to NPs. As shown in Figure 8 below (Gatwick Airport indicated by the aircraft icon and the boundary of the nearest NP outlined in dark green), Gatwick Airport is some distance to the north of the nearest NP (South Downs NP). None of the proposed design options are in a southerly direction towards the South Downs NP. Consequently, it is deemed that the routes proposed as part of this ACP shall have no effect on the South Downs NP.

⁷ <https://magic.defra.gov.uk/magicmap.aspx>



Figure 8 GAL Location relative to NPs (Source: Magic Maps)

4.3.4 Biodiversity

As defined in Table 3 (see Section 2.2), CAP 1616 requires change sponsors to consider the impact the proposed change may have on biodiversity within the vicinity of the change. CAP 1616, Appendix B, Paragraph B80 states “In general, airspace change proposals are unlikely to have an impact upon biodiversity because they do not involve ground-based infrastructure”. This statement applies to this ACP as it does not involve ground infrastructure changes. Nevertheless, the change sponsor has investigated “terrestrial, marine and other aquatic ecosystems” that may be impacted, as per CAP 1616, Appendix B, Paragraph B79.

With regards to maritime and other aquatic ecosystems, none of the proposed options within this ACP pass over any major water courses such as major rivers, lakes, or reservoirs. Consequently, it is deemed that the impact of this ACP on water-based ecosystems is the same as the baseline scenario (‘Do Minimum baseline’), of which there is currently no known adverse impact. This is reflected in the Full Analysis Table (as shown in Appendix A1).

In terms of terrestrial ecosystems, the change sponsor acknowledges that the proposed options will overfly Bird Conservation Targeting areas which is relevant to declining farmland birds such as Grey Partridge, Curlew, and Lapwings⁸. Some of which are visualised in Figure 9 below. It is also acknowledged that there are areas of replanted Ancient Woodland and Wood pasture and Parkland priority habitats in the area.

⁸ <https://magic.defra.gov.uk/magicmap.aspx>

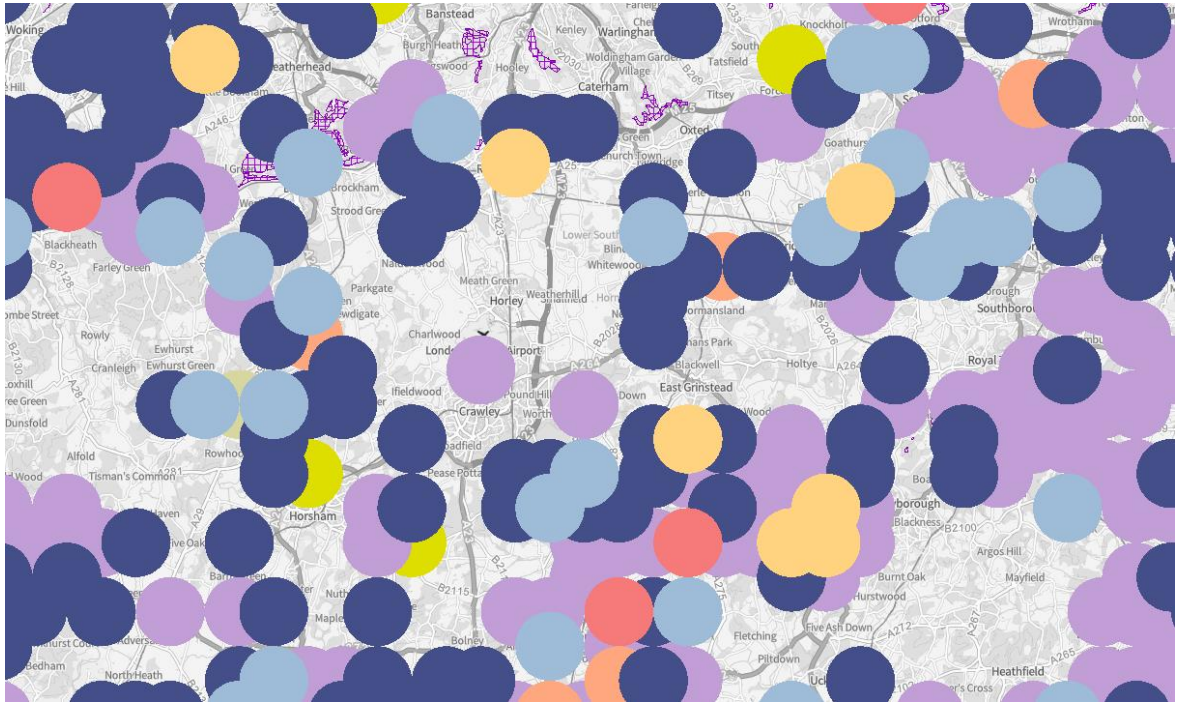
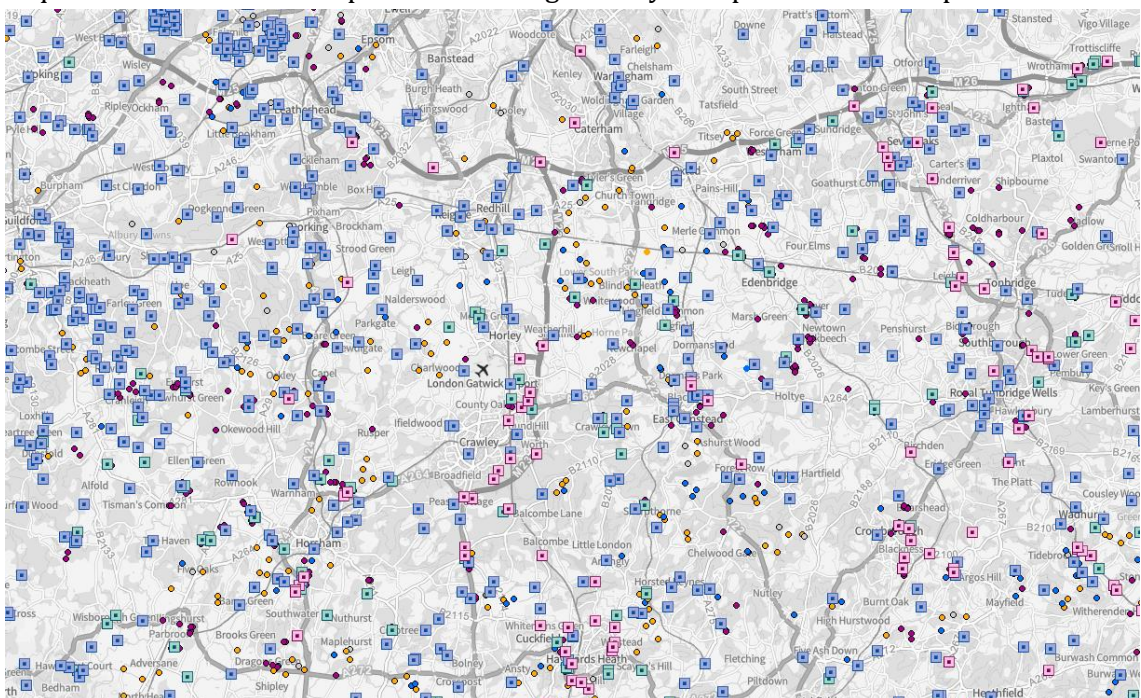


Figure 9 GAL and Bird Species Areas

There is no anticipated impact on any of the areas shown in Figure 9 as a result of this ACP because of the minimal changes proposed in terms of aircraft routing when compared to the IOA baseline ('Do Minimum baseline') and today's operation.

In addition, as specified in CAP 1616, Appendix B, Paragraph B80, change sponsors are required to consider the impact of the change on any European Protected Species as



defined in the Conservation of Habitats and Species Regulations 2010⁹. Based on Figure 8 below, the change sponsor acknowledges that there are several European Protected Species within the area around Gatwick Airport (indicated by the aircraft icon). These include Bats, Great Crested Newts, and other mammals. Considering the limited changes in airspace design that form part of this ACP, the impact on these species is expected to be the same as the baseline scenario ('Do Minimum baseline'), of which there is no anticipated additional adverse impact. This comparison is also applicable to today's operation.

Figure 10 GAL and European Protected Species (Source: Magic Maps)

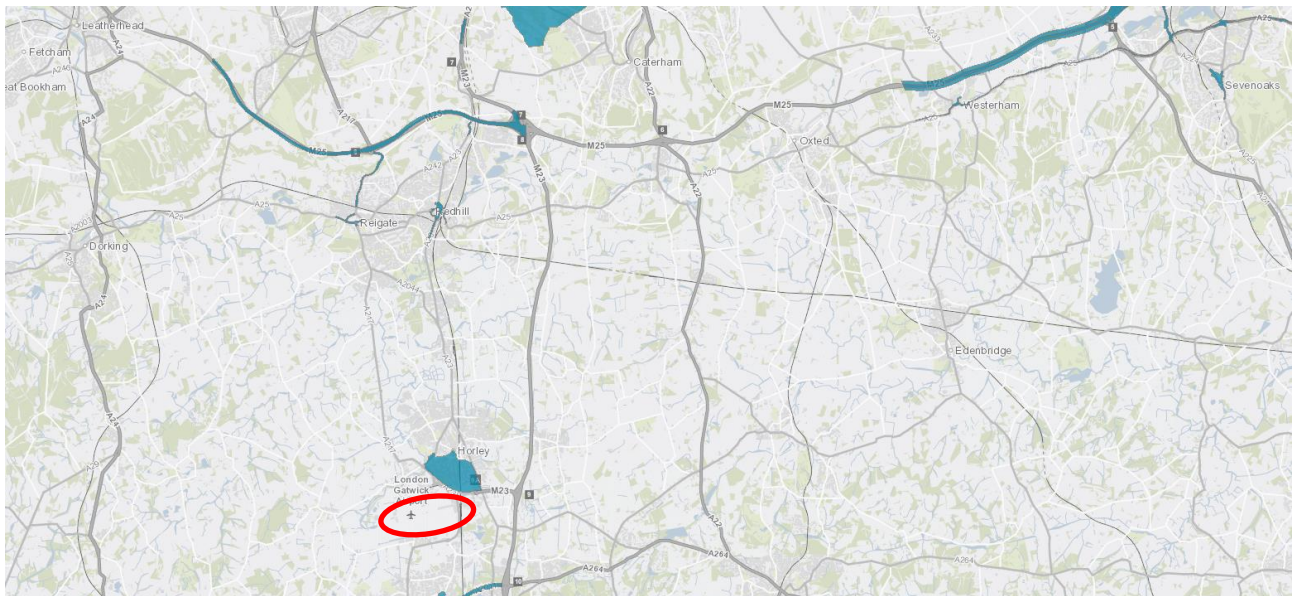
4.3.5 Air Quality Management Areas

Like, AONBs and NPs, CAP 1616 requires change sponsors to consider the impact of proposed changes on Air Quality Management Areas (AQMAs). AQMAs are areas within which local authorities are required to measure, review, and assess the impact of air quality on people's health and the environment¹⁰; most are associated with road traffic emissions.

With reference to Gatwick Airport, the most applicable AQMAs are¹¹:

- AQMA No 1 (M25)
- AQMA No 2 (M25)
- AQMA No 3
- AQMA No 9
- AQMA No 10
- AQMA No 12
- Croydon
- Hazelwick

All of the listed areas require local authorities to measure the levels of Nitrogen Dioxide (NO₂) caused by road traffic. The locations of these AQMAs in relation to Gatwick Airport (highlighted in red) is illustrated in Figure 11 below.



⁹ <https://www.legislation.gov.uk/ukxi/2010/490/contents/made>

¹⁰ <https://uk-air.defra.gov.uk/aqma/#:~:text=What%20are%20Air%20Quality%20Management,in%20the%20next%20few%20years.>

¹¹ <https://uk-air.defra.gov.uk/aqma/maps/>

Figure 11 GAL and AQMAs

At this stage, it cannot be determined which specific routes will overfly which AQMAs. Subsequent analysis in Stage 3 shall be used to confirm. However, an initial assessment using Figure 11 above shows that any overflight of an AQMA will occur only momentarily and is likely to be above 1,000ft. Therefore, when considering CAP 1616, Appendix B, Paragraph B74, it is unlikely that any of the proposed route options as part of this ACP will have an impact on local air quality (including AQMAs) due to the effects on mixing and dispersion above 1,000ft.

Based on CAP 1616, Appendix B, Paragraph B74, it must be stressed that the implementation of this ACP will not have an impact on volumes of air traffic or local transport infrastructure feeding the airport. Furthermore, additional qualitative environmental assessments will be conducted in due course as required by Stage 3 of the CAP 1616 process.

4.4 Comprehensive List of Viable Options

Table 5 below provides a basic description of the comprehensive list of viable options that was established after the DPE.

Option	Description
Baseline [Current]	Current 2021 Conventional Baseline
Do Minimum Baseline [Baseline – future]	RNAV Substitution of the current 2021 Conventional following the regulations set out in the CAP1781 ¹²
0	Current 2021 Conventional 6M,6V RNAV Replication Equivalent to Do Minimum Baseline
1	Fly-by Fly-by LAM1X Turn by KKW04 not below 2500ft
2	Fly-over Fly-by (LAM 2X) Direct SUNAV As per LAM2X but DIRECT SUNAV and no southerly track adjustment
3	Fly-by Fly-by (Apparent Dispersion Late in Turn) Fly-by, Fly-by at multiple waypoints for dispersion
4	Fly-over Fly-by (Multiple Initial Turn Points) Multiple turn points with dispersion in the turn
5	Fly-by Fly-by (Lower Speed Vs Option 1) 2 x 90° turns, similar track across the ground as Option 1 but with a lower speed
6	Fly-over Fly-by (Multiple Initial and Turn Points) Multiple turn points with apparent dispersion in the turn
7	New Constant Radius to Fix (Tracks Concentrated) ‘final’
8	Fly-over Fly-by (Was LAM 2X) This option is the historical LAM 2X Standard Instrument Departure (SID) as published in the UK AIP 2016, which was subsequently withdrawn through CAP1912 in 2019.

Table 5 Comprehensive List of Viable Options

¹² Do nothing is not an option, a substitution of the conventional SID is the Do Minimum Option, that will also serve as the baseline against which all the future options are compared, projected forward to the point of implementation and at implementation plus ten years. A single comparison will be made between the Baseline and the Do Minimum Baseline, but it is anticipated that there will be no differences.

4.5 Results Summary

This section provides a high-level summary of the IOA. An extract of the full analysis table is available in Appendix A1. The complete table can be found on the [CAA airspace change portal](#).

Table 6 below outlines the colour coding scheme used in the subsequent table (Table 7) to distinguish between which options will be carried forward and which have not.

Colour Key	
Preferred Option	Meets objectives, insignificant impact, and is one of the Short-Listed options and is the most favourable.
Carry Forward	Meets objectives, insignificant impact, and is one of the Short-Listed options.
Not Carried Forward	Meets objectives or has an insignificant impact but is less attractive than other options.
Reject	Fails to meet one or more objectives or has a significant impact that cannot be effectively mitigated.
Previously Rejected	Included for completeness.

Table 6 Results Summary Colour Key

Table 7 (the Comprehensive List of Viable Options) below contains a high-level summary of the IOA results, broken down by option number. For completeness, the options that have previously been rejected have also been included within Table 7. For details on the full analysis, please refer to the separate Appendix on the CAA airspace change portal, as detailed in Appendix A1 of this document. Please note, the same colour key is applicable to the Full Analysis Table (as shown in Appendix A1). A copy of Table 6 is included on the Full Analysis Table, when accessed as a separate document via the CAA airspace change portal.

Option No	Description	Status
0	Current 2021 Conventional 6M,6V RNAV Replication Equivalent to Do Minimum Baseline ¹³	Preferred Option – Based on its performance in the IOA, Option 0 has been selected as the preferred option to be taken forward into Stage 3. The rationale being that this option includes dispersion in line with the views of community stakeholders. In addition, Option 0, as it is a replication is not expected to overfly new people and is more consistent with existing published airspace arrangement iaw the ANG 2017 Paragraph 3.3b and pays due regard to the historical tracks iaw the outcome of the court decision following Judicial Review of the original ACP.
1	Fly-by Fly-by LAM1X Turn by KKW04 not below 2500ft	Reject – Based on its performance in the IOA, Option 1 has been rejected as it does not include dispersion, which is contrary to the overwhelming views of community stakeholders.
2	Fly-over Fly-by As per LAM2X but DIRECT SUNAV and no southerly track adjustment	Carry Forward – Based on its performance in the IOA, Option 2 shall be carried forward into Stage 3. The rationale being that this option includes dispersion and is 0.2 nm shorter than the baseline scenario. However, new people may be overflown as a result.
3	Fly-by Fly-by (Apparent Dispersion Late in Turn)	Not Carried Forward – Based on its performance in the IOA, Option 3 shall not be carried forward into Stage 3. The rationale being that although it provides dispersion and may overfly new people, Option 3 is slightly longer in terms of track length when compared to the baseline scenario and Option 4 (on average).
4	Fly-over Fly-by (Multiple Initial Turn Points)	Carry Forward – Based on its performance in the IOA, Option 4 shall be carried forward into Stage 3. The rationale being that this option includes a larger proportion of dispersion. However, it is acknowledged that Option 4 is 0.1 nm (on average) longer the baseline scenario and new people may be overflown as a result.
5	Fly-by Fly-by, (Lower Speed Vs Option 1)	Reject – Based on its performance in the IOA, Option 5 has been rejected as it does not include dispersion, which

¹³ Do nothing is not an option, a substitution of the conventional SID is the Do Minimum Option. Since visually representing the substitution is difficult, the Option 0 Replication, which is designed to be equivalent to baseline (current) and Do Minimum baseline (future) will serve as the baseline against which all the future options are compared, projected forward to the point of implementation and at implementation plus ten years. A single comparison will be made between the B and 0, but it is anticipated that there will be no differences.

Option No	Description	Status
		is contrary to the overwhelming views of community stakeholders.
6	Fly-over Fly-by (Multiple Initial and Turn Points)	Reject – Based on its performance in the IOA, Option 6 has been rejected. Although it provides dispersion, it will overfly new people, Option 6 is also longer in terms of track length when compared to the baseline scenario and Options 3 and 4 (on average).
7	Constant Radius to Fix (Tracks Concentrated)	Reject – Based on its performance in the IOA, Option 7 has been rejected as it does not include dispersion, which is contrary to the overwhelming views of community stakeholders.
8	Fly-over Fly-by (Was LAM 2X) This option is the historical LAM 2X Standard Instrument Departure (SID) as published in the UK AIP 2016, which was subsequently withdrawn through CAP1912 in 2019.	Carry Forward – Based on its performance in the IOA, Option 8 shall be carried forward into Stage 3. The rationale being that this option includes dispersion and is 1 nm shorter than the baseline scenario. However, new people may be overflowed as a result.

Table 7 Results Summary

Please note that further explanation regarding the rationale behind those options taken forward is detailed in Section 6.1

5 Qualitative Safety Assessment

5.1 Safety Assessment Activities Required by CAP 1616

A qualitative Safety Assessment is required for all options identified during Step 2B, and a detailed final safety assessment must be completed by the change sponsor prior to submission in Step 4B. GAL is carrying out the safety assessment activities in accordance with CAP760, the separate guidance provided by the CAA for safety assessment.

GAL is developing a full four-part Safety Case iteratively throughout the CAP 1616 process which will be submitted to the CAA at Step 4B. CAP 1616 requires a non-technical/plain English summary of the safety assessment for publication on the airspace portal.

5.2 Assessment Method

The Qualitative Safety Assessment uses the results of a formal Hazard Analysis and Risk Assessment (HARP) workshop held at Gatwick Airport on 12 December 2019 during which the hazards, causes and consequences relating to each of the longlist of options were identified.

5.3 Additional Options Derived from the Safety Appraisal

There were no additional options added to the comprehensive list of viable options post HARP.

5.4 Safety Assessment Results – Non-Technical Summary

The options have been assessed for safety impacts pre-mitigation. For clarity, an otherwise feasible option would not be immediately disqualified should a significant safety implication be identified against it if a viable mitigation also exists.

The HARP identified a number of dependencies and/or influencing factors across the various options.

Four IFP options have significant Safety implications with all four of them conflicting with other aircraft using the Route 4 SID and three of them not accounting for the prevailing wind direction:

- One because of the degree of dispersion during the turn. Aircraft on the “inside” of the dispersion swathe may come into conflict with aircraft on outside of the dispersion swathe. Additionally, aircraft will choose different points at which to roll out to SUNAV, dependent upon aircraft type/performance and wind.
- Another one includes 3 waypoints placed abeam each other at a distance of 278m with the intention of providing a degree of apparent dispersion. This results in several potential routes that an aircraft may take, however this cannot be scheduled or planned. ATC will not know the aircraft’s intention.
- Two designs utilise three initial turning points placed sequentially 400m apart, one of them followed by 3 waypoints placed abeam each other after the turn. These result in several potential routes that an aircraft may take and a degree of dispersion. However, the choice of turning point cannot be scheduled or planned. ATC will not know the aircraft’s intention.

No other significant safety implications have been identified with the remaining IFP options and any identified hazards will be managed throughout the development of the Safety Case to ensure any appropriate mitigation is identified and implemented.

Additionally, due to the unsuccessful first Gateway 2 the Safety Case was reviewed and updated in April 2022. No new significant safety implications were found.

Those options that are taken forward to shortlist are subject to a full risk assessment as an element of developing the four-part Safety Case prior to submission of the ACP proposal at Step 4B.

The safety considerations relating to the individual options are contained in the Full Analysis Tables referenced as Appendix A1 of this report, which has been uploaded to the CAA airspace change portal as a separate file.

6 Design Options Shortlist

6.1 Shortlisting Method

Once each option (contained within the Comprehensive List of Viable Options) had been considered against the criteria (See Section 2.2) an assessment was made as to which options should proceed into Stage 3.

As can be seen in the Full Analysis Table (Appendix A1), most of the options perform equally within the IOA, with regards to criteria such as air quality, tranquillity, biodiversity, capacity/resilience and to an extent, safety.

As a result, in order to consolidate the list of options, the change sponsor has derived a number of 'filters' to enable the list of options to be shortened. The following sub-sections describe these 'filters'.

6.1.1 Dispersion

In accordance with CAP 1616, Appendix C, Paragraph C28 and the UK Governments Air Navigation Guidance (ANG) 2017, Paragraph 3.35¹⁴, the change sponsor has taken into account the views of stakeholders, including local communities. During Stage 2 engagement activities, there was an overwhelming desire from community stakeholders to include dispersion within the design options. As shown in the DPE, Options 1, 5 and 7 do not include dispersion and have therefore been rejected.

6.1.2 Overflight of New People

Option 0 is the only option within the remaining options list which includes dispersion but is not expected to overfly new people as it replicates what happens today.

The ANG 2017, Paragraph 3.3b states:

"where options for route design from the ground to below 4,000 feet are similar in terms of the number of people affected by total adverse noise effects, preference should be given to that option which is most consistent with existing published airspace arrangements;"

As Option 0 is a replication, it is therefore "most consistent with the existing published airspace arrangements". In addition, Option 0 includes dispersion in line with community stakeholder wishes and has been selected as the Preferred option. Whereas the remaining five options may overfly new people and cannot be discounted using the filter.

6.1.3 Track Length

The remaining five options support dispersion but have the potential to overfly new people, therefore none of the first two 'filters' can be used to reduce these options. The change sponsor has decided to use track length as the 'final filter' and, from an environmental perspective, has selected the shortest routes from the remaining five options. When compared to the baseline scenario (Option 0 or baseline [future]), Options 2 and 8 are 0.2 nm and 1 nm shorter respectively. Consequently, Options 2 and 8 shall be carried forward into Stage 3.

When Options 3, 4 and 6 are considered, it has been deemed that Option 4 shall be carried forward. This is based on the track length of Option 4 (on average) is only 0.1 NM longer

¹⁴ <https://www.gov.uk/government/publications/uk-air-navigation-guidance-2017>

than the baseline scenario (Option 0 or baseline [future]). Meanwhile, Options 3 and 6 are 0.2 nm and 0.4 nm (on average) longer. The additional rationale for carrying Option 4 forward is that it provides a larger proportion of dispersion while minimising the increase in track length.

6.2 Shortlist of Options Taken Forward

Table 8 presents the shortlist of options to be carried forward to Stage 3 along with the associated Initial Appraisal Outcome for that option.

Shortlist Option	Initial Appraisal Outcome
Option 0	<p>Preferred Option</p> <p>Based on its performance in the IOA, Option 0 has been selected as the preferred option to be taken forward into Stage 3. The rationale being that this option includes dispersion in line with the views of community stakeholders. In addition, Option 0, as it is a replication is not expected to overfly new people and is more consistent with existing published airspace arrangement iaw the ANG 2017 Paragraph 3.3b and pays due regard to the historical tracks iaw the outcome of the court decision following Judicial Review of the original ACP.</p>
Option 2	<p>Carried Forward</p> <p>Based on its performance in the IOA, Option 2 shall be carried forward into Stage 3. The rationale being that this option includes dispersion and is 0.2 nm shorter than the baseline scenario. However, new people may be overflowed as a result.</p>
Option 4	<p>Carried Forward</p> <p>Based on its performance in the IOA, Option 4 shall be carried forward into Stage 3. The rationale being that this option includes a larger proportion of dispersion. However, it is acknowledged that Option 4 is 0.1 nm (on average) longer the baseline scenario and new people may be overflowed as a result.</p>
Option 8	<p>Carried Forward</p> <p>Based on its performance in the IOA, Option 8 shall be carried forward into Stage 3. The rationale being that this option includes dispersion and is 1 nm shorter than the baseline scenario. However, new people may be overflowed as a result.</p>

Table 8 – Shortlist of options carried forward to Stage 3

6.3 Next Step - Full Options Appraisal

6.3.1 CAP 1616 Requirement

A full options appraisal of each of the shortlist options takes place at Step 3A and is required during preparation for consultation in Stage 3 to provide a fully developed quantitative assessment of the relevant costs and benefits associated with each option, along with full environmental assessments. This analysis will inform the selection of the Preferred Option and form part of the Consultation materials.

6.3.2 GAL Proposed Method Overview

The Initial Options Appraisal (this document) will be developed into a more quantitative assessment i.e., the costs and benefits of each option e.g., in terms of greenhouse gasses, noise, fuel burn etc. will be monetised using quantitative estimates from the DfT appraisal guidance¹⁵ for health impacts associated with noise, and for the other impacts where possible. GAL will use the DfT's Transport Analysis Guidance (TAG)¹⁵. It must be noted that in some circumstances, through the scaling process defined in CAP 1616, it may be disproportionate to conduct a quantitative analysis on all of the defined criteria. Any decision regarding the scale of Stage 3 shall be discussed and eventually determined by the CAA following Stage 2.

¹⁵DfT Transport Analysis Guidance (TAG):
<https://www.gov.uk/guidance/transport-analysis-guidance-webtag>

A1 Initial Options Appraisal Full Table Analysis

Below is an extract of the IOA Full Analysis Table (Figure 12). The full analysis of the options is contained in the Initial Options Appraisal Full Analysis Table Submission 2 Issue 1, that can be found in PDF format alongside this document on the CAA Airspace Change Portal.

Gatwick Airport ROUTE 4 INITIAL OPTIONS APPRAISAL - FULL ANALYSIS TABLE					
71248 054 Submission 2 Issue 2					
Group	Impact	Level of Analysis	Option 0 - Current Conventional 6M, 6V Replication (Equivalent to Do Minimum Option [baseline - future])	Option 1 - Fly-By Fly-b (LAM 1X)	Option 2 - Fly over Fly-by (LAM 2X) direct SUNAV
Communities	Noise impact on health and quality of life	Initial Options Appraisal: Qualitative	Option 0 is a replication of the conventional LAM 6M 6V procedure. As with the conventional procedure (Baseline) there is a degree of dispersion located around the turn. It is acknowledged that this turn is not fully contained within the existing NPR swathe, however, this is similar to today's operation. As a result, there is expected to be very little difference in terms of impacts over the ground between Option 0, the Do Minimum Option and Baseline (Today's operation), however, it is acknowledged that this option includes dispersion in line with the wishes of community stakeholders.	The track of Option 1 takes it inside the village of Capel (to the east) and outside the village of Beare Green (to the west). After flying straight ahead after take-off, the aircraft will make its first turn not below 2500ft. The flight profile of this option will seek to minimise the adverse impact of noise in the area between these 2 villages. These villages are not directly overflown. However, this option does not include dispersion, which is against the wishes of community stakeholders.	This option uses the same turn as Option 8, but the track adjustment is removed and a new waypoint, NEW11, is placed where the aircraft would nominally roll out of the turn. This option is flown at optimal speed. This option tracks to the east of the village of Capel but overhead the village of Beare Green. From NEW 11, just south of Reigate, the aircraft speed restriction is lifted from 220 KIAS to 250 KIAS. It is acknowledged that this option includes dispersion in line with the wishes of community stakeholders.

Figure 12 IOA Full Analysis Table Extract