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LBHA Airspace Change Proposal

ACP-2018-69

Initial Options Appraisal

Document Details

Reference	Description
Document Title	LBHA Airspace Change Proposal
	Initial Options Appraisal
Document Ref	71311 012
Issue	Issue 1.1
Date	1 st March 2023
Client Name	London Biggin Hill Airport
Classification	

Issue	Amendment	Date
Issue 1	Initial Issue	27 th January 2023
Issue 1.1	Post-Gateway amendments for clarification: Baseline definition; baseline noise and tranquillity impact	1 st March 2023

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1 Introduction

1.1 Introduction

The London Biggin Hill Airport (LBHA) Redesign of Departure and Arrival Routes and Procedures project is currently at Stage 2 – Develop and Assess – of the Civil Aviation Publication (CAP) 1616 Airspace Change process. Step 2B requires the change sponsor to carry out an ‘Initial Options Appraisal’ of the impacts of each of the options identified in Step 2A.

This document provides a narrative explanation of steps taken in Step 2B. The full analysis of the options is contained in the Initial Options Appraisal Table Issue 1, that can be found alongside this document on the Civil Aviation Authority (CAA) airspace portal:

<https://airspacechange.caa.co.uk/PublicProposalArea?pid=95>

1.2 Background

Over the coming years, a national programme of airspace modernisation will result in the redesign the airspace above London and the South East of England. In June 2018, the Aviation Minister, Baroness Sugg, wrote LBHA, setting out the need for an Airspace Modernisation Programme to facilitate the future needs of UK airspace users and asking for our commitment to the development and delivery of this programme. As part of this modernisation process, LBHA is required to redesign the portion of the arrival and departure routes at the airport up to a height of 7,000 ft above mean sea level (amsl), where those routes must join and integrate with a new overarching route structure to be designed entirely by National Air Traffic Services (NATS), the UK’s en-route air traffic service provider.

As part of this redesign, LBHA must follow the guidance provided by the CAA and successfully complete the first 6 stages of CAP 1616 – Airspace Change.

1.3 CAP 1616 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 steps 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 (current stage)
- Stage 3 – Consultation
- Stage 4 – Update and Submit
- Stage 5 – Decide
- Stage 6 - Implement
- Stage 7 – Post-Implementation Review



The project is currently at Stage 2 which requires the development of options that seek to meet the original 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 Progress So Far

In October 2018, LBHA submitted a Statement of Need to the CAA. This is the formal explanation as to why the Airport wishes to make changes within the airspace surrounding the Airport. The CAA indicated that an airspace change was an appropriate mechanism to achieve the objectives in the Statement of Need. A copy of the Statement of Need and other associated documentation can be viewed on the Civil Aviation Authority (CAA) airspace portal.

At the end of July 2019, the first stage in the change process was successfully completed when the Airport's submission passed through the CAA's Stage 1 DEFINE Gateway.

The work undertaken during Stage 1 helped to establish a prioritised shortlist of Design Principles to act as a framework against which Design Options have been drawn up. The prioritised list of Design Principles can be found in the documents uploaded at Stage 1B on the portal.

1.5 Step 2A – Options Development

During Step 2A, LBHA developed a list of design options for the new procedures that seek to meet the original the Statement of Need and are aligned with the Design Principles.

1.6 Step 2A – Design Principle Evaluation

Each of the options developed have been assessed against the prioritised list of Design Principles developed in Stage 1. The Design Principles Evaluation shows to what extent the options meet the Design Principles. Due to the nature of the swathes developed, unless there were overriding safety issues identified, all of the design swathes were carried forward to Step 2B for assessment. The Design Principles Evaluation document can be found at Step 2A on the CAA airspace portal.

1.7 Step 2B – Initial Options Appraisal

At Step 2B, the long list of options has been tested against the criteria contained in CAP 1616, Appendix E, Table E2 ,with the addition of a Qualitative Safety Assessment as required for a Level 1 change at this stage.

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

The Initial Options Appraisal resulted in a shortlist of options to be taken forward to Stage 3 for detailed technical design and consultation. The shortlist, together with a summary of the Initial Options Appraisal, is contained in Section 4.

2 Guidance and Methodology for Options Appraisal

2.1 CAP 1616 Options Appraisal Requirements

The Options Appraisal process was carried out in accordance with the guidance in CAP 1616, and in conjunction with The Green Book¹ and the Department of Transport's Transport Analysis Guidance (TAG) toolkit², which constitute best practice in options appraisal.

Options Appraisal is used as an iterative tool throughout the CAP 1616 process to help refine the options from an initial long list, down to a short list and a final set of preferred options.

The appraisal process typically consists of the following elements:

- High-level objective and assessment criteria
- Baseline definition – current operations
- Long list of 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 of the ACP process as follows:

1. 'Initial' Options Appraisal at Step 2B with the CAA review at the Stage 2 – Develop and Assess Gateway.
2. 'Full' Options Appraisal at Step 3A with the CAA review at Step 3B and the subsequent Consult Gateway.
3. 'Final' Options 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 definition of the 'high-level objective and assessment criteria' and the assessment methodology.

2.2 IOA Minimum Requirements

CAP 1616 prescribes that the following should be included within an IOA as a minimum:

¹ The Green Book: Appraisal and Evaluation in Central Government;
<https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government>

² DfT transport analysis guidance WebTAG:
<https://www.gov.uk/guidance/transport-analysis-guidance-webtag>

- A Comprehensive List of Viable Options (including the ‘Do Nothing/Minimum’ option which will act as a baseline for analysis).
 - A description of the change proposal.
 - An indicator of likely noise impacts.
 - A high-level assessment of benefits and costs involved.
- The criteria for assessing the list of options and the application of these criteria to determine a shortlist of options.
- What evidence the change sponsor will collect, and how it will be collected in order to fill in its evidence gaps and to develop the FOA, during Stage 3 (See Section 2.3).

There is a minimum requirement within CAP 1616 to conduct qualitative analysis within the IOA. However, change sponsors can choose to supplement this with quantitative analysis if they so choose. For this ACP, LBHA will conduct qualitative analysis only for the Initial Options Appraisal. Quantitative analysis will be conducted at Stage 3 of the process.

2.3 CAP 2091 Minimum Standards or Noise Modelling

CAP 2091 – CAA Policy on Minimum Standards for Noise Modelling states that where some noise calculation is required, then the minimum level of sophistication of the modelling process should depend on the size of the current or proposed noise effect of an airport on its local community. CAP 2091 defines the thresholds of population exposed, which will require the use of the more sophisticated categories of noise modelling; once the likely number of residents reaches the minimum recommended threshold, a stakeholder should consider upgrading its noise modelling to that Category. The thresholds for noise modelling categories are shown in Table 1 below:

Category	Lower Threshold	Recommended Minimum Threshold	Mandated Minimum Threshold	Maximum Threshold
A	0	400,000	500,000	none
B	0	160,000	200,000	500,000
C	0	20,000	25,000	200,000
D	0	1,600	2,000	25,000
E	0	0	0	2,000

Table 1 – Thresholds for Noise Modelling Categories

The same thresholds have been set for population in the day and night contours for each of the noise Categories since the different Lowest Observed Adverse Effect Levels for day and night already capture the difference in noise perception between day and night noise.

As part of Gateway 2 for ACPs, CAP 2091 requires the change sponsor to justify to the CAA which Category its noise modelling methodology is required to fall into from the definitions contained in CAP 2091 and summarised in Table 2 below, and which Category it currently falls into.

Aircraft noise			Aircraft tracks (arrival and departure routes)		
Category	Noise data	Flight profiles	Centreline (mean track)	Dispersion (variation around centreline)	Usage (allocation of traffic to routes)
A	ICAO dataset modified for local noise monitor data for all aircraft types	Local track-keeping data	Local track-keeping data	Local track-keeping data	Local track-keeping data
B	ICAO dataset validated by local noise monitor data for major aircraft types	Local track-keeping data	Local track-keeping data	Local track-keeping data	Local track-keeping data
C	ICAO dataset	Local track-keeping data	Local track-keeping data	Local track-keeping data	Local track-keeping data
D	ICAO dataset	ICAO dataset	Local data from airport	ECAC guidance or data from airport	Local data from airport
E	ICAO dataset	ICAO dataset	Local data from airport	ECAC guidance or data from airport	Local data from airport

Table 2 – Summary of Noise Modelling Categories

The CAA consider that a stakeholder's noise modelling can only be declared to be in a particular Category if it meets **all** the criteria in the table for that Category.

The population within the 51dB noise contour means that LBHA will conduct quantitative noise modelling analysis in accordance with Category D standards, based on the criteria set out in CAP 2091. Category D standards of modelling are yet to be defined and as such, Category D is the same as category E. Category E noise modelling as defined in CAP 2091 is shown below:

- Category E – There is no adaptation of the noise model and standardised reference values only are used. The standard ICAO dataset is used (flight profiles, noise data), with no amendments for local effects. Data reported from the modelled airport (rather than track-keeping data) is used to identify the usage of arrival and departure routes for a typical day. The track over the ground for each arrival and departure route is derived from the published coordinates in the UK AIP or as advised by the airport. Dispersion

around the nominal track of each such route is based on the dispersion guidance contained in the latest version of ECAC Doc. 29.

2.4 Full Options Appraisal (FOA) Evidence Capture

Consistent with the requirements of CAP 1616, the IOA is a qualitative analysis of each option against a defined baseline. This is expanded on within the FOA, which is conducted at Stage 3, to include quantitative analysis. The FOA, requires change sponsors to assess each of the design options against each other in relation to the criteria defined in CAP 1616, Appendix E using primarily quantitative metrics. These metrics include the assessment of the environmental impacts of the proposed change.

As defined in CAP 1616a, the FOA requires change sponsors to collect quantitative environmental metrics that describe the baseline scenario and conduct a series of modelling activities for each of the design options, to enable an environmental comparison. The required metrics include:

- 10-year traffic forecasts.
- Standard noise metrics (to Category E standards):
 - LAeq noise contours
 - 100% noise mode contours
 - Nx contours
 - Difference contours
 - Lmax spot point levels
- Operational diagrams.
- Overflight (based on the CAA definition of overflight found in CAP 1498 – Definition of Overflight).
- Fuel/CO₂ modelling analysis using the most recent appropriate version of Eurocontrol's Base of Aircraft Data (BADA) as the data source.

Data for the modelling will be provided by LBHA and will be based on 2022's air traffic data since this is the most recent 'typical' year for air traffic.

The results will be subsequently assessed using the Government's transport analysis tools to provide a monetised output; these are known as TAG.

The modelling is intended to provide a comparison between today's operation (the baseline), in order to show the impact of the proposed change at the point of implementation and also 10 years post-implementation. Modelling is also required to show the situation at the proposed implementation date and 10 years post-implementation without applying the proposed change. More information regarding these metrics shall be provided during the FOA at Stage 3.

A cost-benefit analysis will be performed, and a preferred option (or combination of options) will be stated. Compromises and trade-offs may be necessary between airports taking part in the FASI-S regional airspace change. These will be guided by the advice and tools provided by the Airspace Change Organising Group (ACOG), the independent team tasked with coordinating the redesign of the UK's airspace.

2.5 High Level Objectives and Assessment Criteria

For a Level 1 Airspace Change, the criteria against which the appraisal options must be assessed are contained in Table E2 of CAP 1616. Table 1 below describes these with the addition of the Safety Assessment Criteria at the bottom.

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 WebTAG is required.
Wider Society	Capacity and resilience	A qualitative assessment of the impact on overall UK airspace structure. Quantitative methodologies may be required that allows monetisation of the impact.
General Aviation	Access	A qualitative assessment of the effect of the proposal on the access to airspace for GA users. Quantitative methodologies may be required that allows monetisation of the impact.
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.
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 CAP 760.

Table 3 – Assessment Criteria for Level 1 Change

2.6 Method

2.6.1 Overview

The Initial Options Appraisal was carried out by comparing all of the options side by side against the CAP 1616 criteria in tabular form. The Appraisal also included the results of a Qualitative Safety Assessment. The assessment is based around a qualitative assessment at this stage of the CAP 1616 process, with a Full quantitative appraisal being conducted during Stage 3. At this point, for the purpose of the economic assessment required for the Full Options Appraisal, each of the procedure designs will be considered in combination with other procedures to assess the holistic options that deliver the operational requirement at London Biggin Hill Airport. Each option will include arrival and departure procedures that work for each runway direction.

The Initial Options Appraisal compared the implementation of each of the proposed procedures against the Do Nothing Option, defined in Section 3, which represents the current-day scenario. The full analysis of all the options is described in Appendix A1 and included as a separate MS Excel spreadsheet.

2.6.2 Shortlisting

Once all the options had been assessed against the criteria, the list of options was refined to identify the shortlist of options that would be taken forward to Stage 3. The shortlist is contained in Section 4.

3 Baseline Definition

3.1 Baseline Definition

In accordance with CAP 1616, a baseline will be required for all environmental assessments. This will allow the change sponsor to conduct an assessment to understand the current impacts so that a comparison can be made with the impacts of the options. In most cases, the baseline will be the 'Do Nothing' option and will largely reflect the current-day scenario.

3.2 The Do Nothing Option

The Do Nothing option represents the current situation at Biggin Hill Airport and will be used as the baseline against which all other options are measured. LBHA is situated in Class G, uncontrolled airspace; the only regulated airspace currently at LBHA is the Aerodrome Traffic Zone (ATZ) established to protect the airport's operations and all en-route traffic is required to avoid it unless permission has been granted to enter by LBHA. The LBHA ATZ is the airspace extending from the surface to a height of 2,000 ft above the level of the aerodrome within the area bounded by a circle centred on the mid-point of the runway and having a radius of 2.5 nm. Figure 1 below shows the location of LBHA in relation to the current surrounding airspace profile.



Figure 1 – Biggin Hill Airport Local Area

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Aerodrome and Approach Control functions are provided at LBHA. Aerodrome Control is responsible for Ground Control, Tower Control, and Clearance Delivery. Aerodrome Control co-ordinates with Approach Control for:

- Departing Instrument Flight Rules (IFR) flights.
- Departing Visual Flight Rules (VFR) flights.
- Arriving aircraft which make their first call on the Tower frequency (unless they are transferred to Approach Control).



LBHA Approach Control provides the following Air Traffic service (ATS):

- Procedural Service (only available to IFR aircraft).
- Basic Service.
- Alerting Service.

NATS Ltd through Terminal Control (TC) Thames Director, are contracted to provide radar services to IFR flights arriving or departing from LBHA, regardless of the service requested by the pilot.

Before any IFR flight departs, or immediately before an inbound or transit IFR flight contacts LBHA Approach, co-ordination must be affected with TC Thames Director regardless of the type of ATS being provided.

LBHA has published Noise Sensitive Areas (NSA) and Noise Preferential Routes (NPR). The NSAs are detailed in the Noise & Airspace section of the airport website (<https://biggin-yourairport.co.uk/noise-airspace/>). The NPRs are published in the UK AIP EGKB AD 2.21.

LBHA has a voluntary Noise Abatement Procedure agreed as part of the Deed of Variation, agreed in 2016 with the London Borough of Bromley. Any changes through that Deed of Variation, have to be agreed mutually between both parties. As such, there is a means by which NSAs and NPRs can be amended to meet AMS or FASI requirements, if required.

There are no conventional departure Instrument Flight Procedures published for LBHA. Departing aircraft are to follow the procedures published in the Aeronautical Information Publication (AIP), which includes noise abatement procedures for aircraft departing under both Instrument Flight Rules (IFR) and Visual Flight Rules (VFR). There are Standard Departure Routes via the ATS route network published in the AIP. All Standard Departure Routes currently route aircraft to the Detling (DET) Doppler Very High Frequency Omni Range (VOR/DME) ground-based electronic beacon.

Aircraft arriving from the ATS en-route network will either be cleared to follow the RNAV1 Arrival Transition procedure, published in the AIP, or will be radar vectored by Thames Director prior to transfer to Biggin Hill Approach for the appropriate approach procedure. The baseline operational environment includes the following list of conventional Instrument Approach Procedures (IAP):

- ILS/DME/VOR to Runway 21
- LOC/DME/VOR to Runway 21
- VOR/DME to Runway 21

There are currently no IAP's for Runway 03. If Runway 03 is in use due to the prevailing wind, the pilot will break off the Runway 21 Instrument Approach at approximately 2nm from the airfield, to position visually for Runway 03.

Changes to the IAPs is out of scope of this ACP.

Runway 21 is the dominant runway, used approximately 78% of the time, due to aircraft normally taking-off and landing into the prevailing south westerly wind.

LBHA handled 36,763 aircraft movements in 2021, all of which were non-commercial operations, comprising Business Jets, Light Aircraft, military aircraft

and helicopters. LBHA does not support Commercial Air Transport (CAT) operations providing scheduled and charter services. This figure is expected to increase to approximately 50,000 annual movements in 2023 and 51,000 movements in 2024, the expected year of implementation. LBHA expect the business to continue to grow, with an anticipated growth in aircraft movements of 1,000 aircraft per annum for the period of 10 years from the intended year of implementation. The anticipated annual movements for 2034, 10 years after implementation, is expected to be 61,000. Figures have been provided by LBHA Management.

3.3 Noise Impact for Communities

The aircraft forecast predicts a gradual increase in aircraft movements for the period of 10 years from the intended year of implementation. This would lead to an increase in aircraft noise over time from the current position of no noise impact.

The IFR departure from LBHA is always flown out to the east of the airfield, irrespective of the runway in use. This means that the same communities are being overflown no matter what the required departure direction of the aircraft is. All IFR arrivals will either be cleared to follow the RNAV1 Arrival Transition procedure, published in the AIP, or will be radar vectored by ATC prior to conducting an Instrument Approach. The current radar vector swathe for arriving aircraft is shown in Figure 2 below, showing the extent of communities overflown under today's operations.

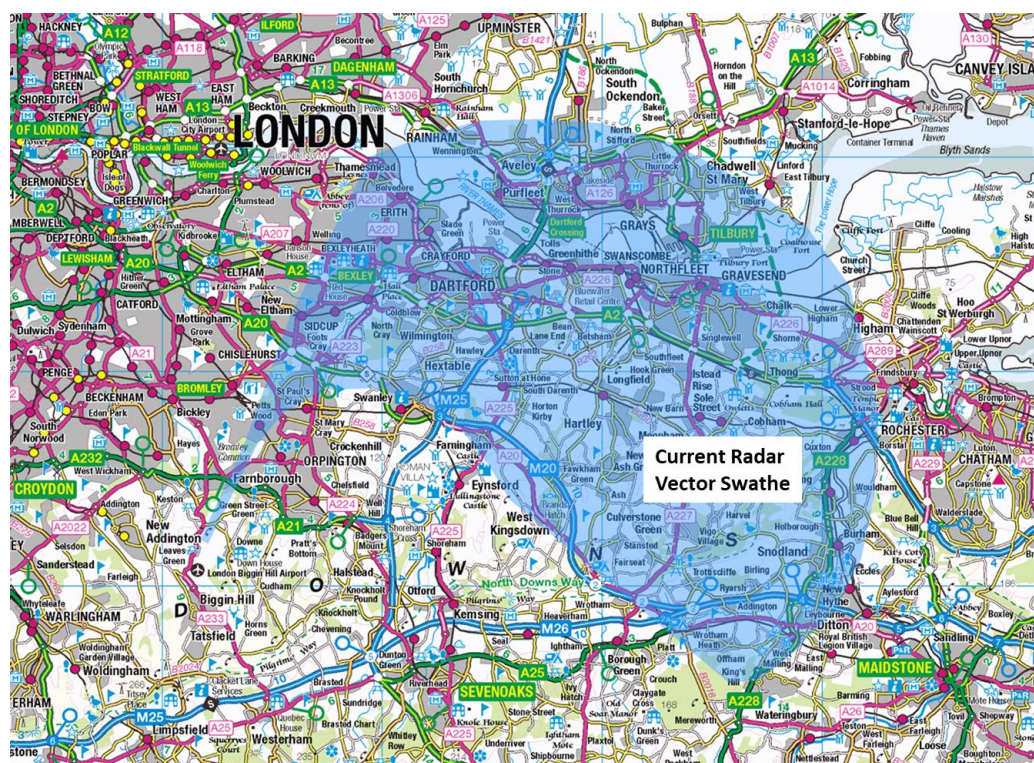


Figure 2 – Current Radar Vector Swathe

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Aircraft will be transferred to Biggin Hill Approach for the appropriate approach procedure to Runway 21. If Runway 03 is in use, aircraft will break off the Runway 21 approach to conduct a circling visual approach to Runway 03. Therefore, the same communities will be overflown by aircraft on final approach, regardless of the runway in use.

3.4 Air Quality

Government guidance states that aircraft flying higher than 1,000ft are unlikely to have a significant impact on local air quality. Today, arriving aircraft descend through 1,000ft at approximately 3 nm (about 6 km) on approach to the runway. This is in the very final stages of the approach and close to the critical stage of landing. Aircraft circling to land on Runway 03 will also remain at or below 1,000 ft within 3 nm of the runway. Departing aircraft will generally climb above 1,000 ft within 1-2 nm of the airport before turning to follow the Standard Departure Routes. Any impact on local air quality below 1,000ft is therefore likely to be within 3 nm of the airport.

The Air Quality Management Area's (AQMA) local to the airport are:

- Croydon AQMA, covering the road transport network across the borough.
- Bromley AQMA, covering the road transport network across the whole of the northwest corner of the borough.
- Bexley AQMA, covering transport and industrial sources across the whole borough.
- Sevenoaks District Council, multiple small areas relating to the road transport network.

It is assessed that there is no impact on the Bromley, Bexley and Sevenoaks District Council AQMAs due to their location relative to the airport.

Although the Croydon AQMA, shown in Figure 3 below, is within 3 nm of the airport, it is considered there would be little or no impact due to aircraft emissions on the AQMA as aircraft are likely to be at or above 1,000 ft following take-off from Runway 21 or circling to land on Runway 03.



Figure 3 – Local Air Quality Management Areas

Source: DEFRA

3.5 Tranquillity

For the purposes of airspace change proposals, the impact upon tranquillity need only be considered with specific reference to Areas of Outstanding Natural Beauty (AONB) and National Parks as well as local areas identified through community engagement.

The location of LBHA, means that it is close to the Kent Downs AONB, Surrey Hills AONB and the High Weald AONB, as shown in Figure 4 below.

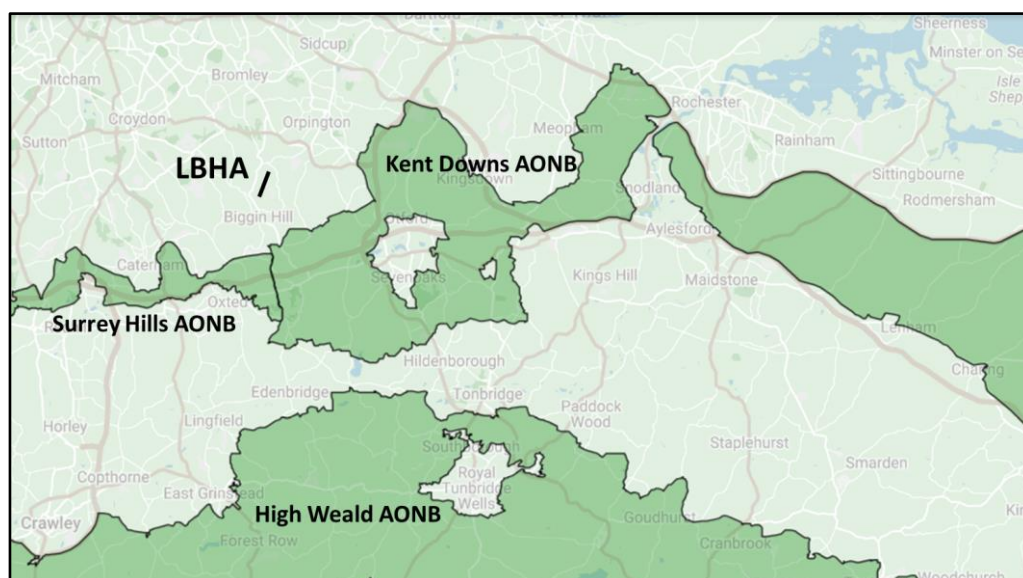


Figure 4 – LBHA Location relative to AONB

Source: [Landscapesforlife.org.uk](https://landscapesforlife.org.uk)

All IFR departures route to the east of the airport and overfly the Kent Downs AONB. Similarly, IFR arrivals are vectored by Thames Director to conduct an Instrument Approach to Runway 21, which would position aircraft also over the Kent Downs AONB. Some arrivals from the south may overfly the High Weald AONB whilst under the control of Thames Director. Aircraft are likely to be above 4,000 ft so the impact is expected to be minimal.

3.6 Biodiversity

Airspace changes are unlikely to have an impact on biodiversity because they do not normally involve changes to ground based infrastructure (habitat disturbance).

Air pollutants such as soot, dust, ammonia, or carbon dioxide can also directly and indirectly influence biodiversity at designated sites such as RAMSAR Sites, Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC) and Special Protection Areas (SPA). The only areas in the vicinity of LBHA are SSSI's, as shown in Figure 5 below. These are likely to be affected only by aircraft flying below 1,000 ft due to the effects of mixing and dispersion. LBHA considers that, due to the size and location of the sites, there is minimal impact on the biodiversity of these sites due to aircraft pollution.



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3.9 General Aviation Access

The Do Nothing option is not proposing any changes to the parameters of the current airspace structure around LBHA and therefore no change to airspace access is predicted.

3.10 Economic Impact: Business Aircraft and GA

By doing nothing, there is a risk that the airport will not grow due to capacity issues. By having all departures in one direction, this could add track miles to aircraft which will have a negative economic effect on users which may mean other airports become more favourable. The predominant broad swathes of arrivals traffic to LBHA from the east will remain the same which may stifle growth if/when demand increases as expected over time.

3.11 Fuel Burn: Business Aircraft and GA

The Do Nothing option is an ineffective in terms of fuel burn due to:

- extended track miles by having all departures and arrivals to/from the east, regardless of en-route requirements.
- protracted level flight at lower altitudes before entry into CAS and the LTMA.
- Aircraft unable to perform continuous climb or descent operations

3.12 Infrastructure Costs

The existing infrastructure will remain in place and will incur no additional costs apart from routine maintenance. No additional infrastructure is required to maintain extant operational procedures.

3.13 Operational Costs

No changes to operational costs are attributable to maintaining the extant operational procedures except where linked to maintenance of infrastructure.

3.14 Training Costs

There will be no additional training costs associated with the Do Nothing option.

3.15 Other Costs

There will be no other costs associated with the Do Nothing option.

3.16 Deployment Costs

There will be no additional deployment costs associated with the Do Nothing option.

3.17 Safety Assessment

This current baseline operates within a set of safety standards that are adhered to and maintained and there is no expected change by remaining with the current baseline.

4 Design Options Shortlist

4.1 Shortlist of Options Taken Forward

Table 5 presents the shortlist of options carried forward to Stage 3 along with a summary of the Initial Appraisal Outcome for that option. The original options were reduced to fifteen preferred options and four less attractive but viable options.

Shortlist Option	Initial Appraisal Outcome
D3 – Runway 21 East 1	Preferred Option Concerns regarding the proximity to the Gatwick CTA. Design work will need to be cognisant of Kenley Airfield. This option is similar to current operations and is a viable option for Runway 21 departures to the east or north.
D4 – Runway 21 East 2	Alternate Option Concerns regarding the proximity to the Gatwick CTA and overflight of the AONB. Suggestion to extend the swathe further south (subject to coordination with Gatwick Airport) to increase flexibility, although this would increase AONB overflight.
D5 – Runway 21 South 1	Preferred Option Concerns regarding the proximity to the Gatwick CTA, overflight of the AONB and the impact of noise caused by overflight. Design work will need to be cognisant of Kenley Airfield.
D8 – Runway 21 West 1	Preferred Option Concerns regarding the impact of noise on the local communities and overflight of the AONB. Design work will need to be cognisant of Kenley Airfield but LBHA considers that there is scope to develop a suitable procedure within this swathe.



Shortlist Option	Initial Appraisal Outcome
D9 – Runway 21 West 2	<p>Alternate Option</p> <p>Design work will need to be cognisant of Kenley Airfield. Safety concerns regarding cockpit workload due to the circling nature of the procedure at the southern extreme of the swathe. Consideration required of the preference of RAF Kenley for routes to the south of the airfield together with the safety concerns relating to the circling procedure.</p>
D11 – Runway 03 East 1	<p>Preferred Option</p> <p>Concerns regarding the impact of noise, specifically the densely populated area to the north of the airport. Will consider utilising the southern extreme of the swathe only, similar to current operations.</p>
D12 – Runway 03 East 2	<p>Alternate Option</p> <p>Concerns regarding the impact of noise, specifically the densely populated area to the north of the airport if aircraft extend before turning left. This option was considered to have the least impact on the AONB. Design work will need to be cognisant of Kenley Airfield.</p>
D13 – Runway 03 South 1	<p>Preferred Option</p> <p>Concerns regarding the impact of noise, specifically the densely populated area to the north of the airport if aircraft extend before turning left. Design work will need to be cognisant of Kenley Airfield.</p>
D14 – Runway 03 South 2	<p>Alternate Option</p> <p>Concerns regarding the impact of noise, specifically the densely populated area to the north of the airport if aircraft extend before turning right, and overflight of the AONB. Design work will need to be cognisant of Kenley Airfield.</p>
D15 – Runway 03 West 1	<p>Preferred Option</p> <p>Concerns regarding the impact of noise, specifically the densely populated area to the north of the airport if aircraft extend before turning left, and overflight of the AONB. Design work will need to be cognisant of Kenley Airfield.</p>



Shortlist Option	Initial Appraisal Outcome
D16 – Runway 03 West 2	Alternate Option Stakeholder concerns regarding the impact of noise and overflight of the AONB.
A1 – Transition East	Preferred Option Similar to current arrival procedures; avoids densely populated areas and avoids the AONB.
A2 – Transition South	Preferred Option Concerns regarding the overflight of the AONB. LBHA considers that the height of the aircraft on the procedure and further design work would minimise the impact on the AONB..
A3 – Transition West	Preferred Option Concerns regarding the impact of noise and overflight of the AONB. Suggestion to extend the western swathe further into the Heathrow CTA to facilitate flexibility for both the positioning of the specific route and tactical options available to appropriately manage the traffic.
A4 – Transition North	Preferred Option Over some densely populated areas to the north of the airport, but LBHA considers that the height of the aircraft on the procedure would minimise the impact of noise.

Table 4 – Shortlist of options carried forward to Stage 3

4.2 Next Step – Route Development

Once the exact entry and exit points into and out of the airspace network (above 7,000 ft amsl) have been finalised by NERL, the swathe options presented at Stage 2 will be developed into actual routes. As the routes are developed, there will be many interdependencies between various stakeholders involved in FASI(S) and compromises and trade-offs may be necessary; these will be guided by ACOG.

4.3 Next Step - Full Options Appraisal

4.3.1 CAP 1616 Requirement

A Full Options Appraisal of each of the options 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. This analysis will inform

the selection of the Preferred Option(s) and form part of the consultation materials.

4.3.2 **Proposed Method Overview**

The Initial Options Appraisal (this document) will be developed into a 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 Department for Transport's (DfT) appraisal guidance³ for health impacts associated with noise, and for the other impacts where this is possible. The DfT's Transport Analysis Guidance (TAG) toolkit will be used to quantify and analyse the costs and benefits of each **combined** shortlist option (see 4.3.3 below).

4.3.3 **Combining the Procedures for the Full Options Appraisal**

For the purpose of the assessment required for the Full Options Appraisal, we will consider each of the procedure designs in combination with other procedures to assess the holistic options that deliver the operational requirement at LBHA. Each option will include arrival and departure procedures that are operationally viable for each runway direction.

The Instrument Departures, Transitions and Approach IFPs are combined in various ways to create an 'operational picture' of where aircraft arriving and departing LBHA will fly. Figure 6 below illustrates an example 'option' of a viable option that includes arrivals (Transitions and Approaches) and departures for each runway that work together. Figure 6 is an example for illustrative purposes only, and does not represent any of the actual proposed procedure options.

Although only one runway direction will be used at any given time, each combined option will need to reflect anticipated operating times for both runway directions, for periods representative of local meteorological conditions. The proposed methodology for assessment and combination of options will be discussed with the CAA prior to completing the Full Options Appraisal during Stage 3.

³ <https://www.gov.uk/guidance/transport-analysis-guidance-webtag>

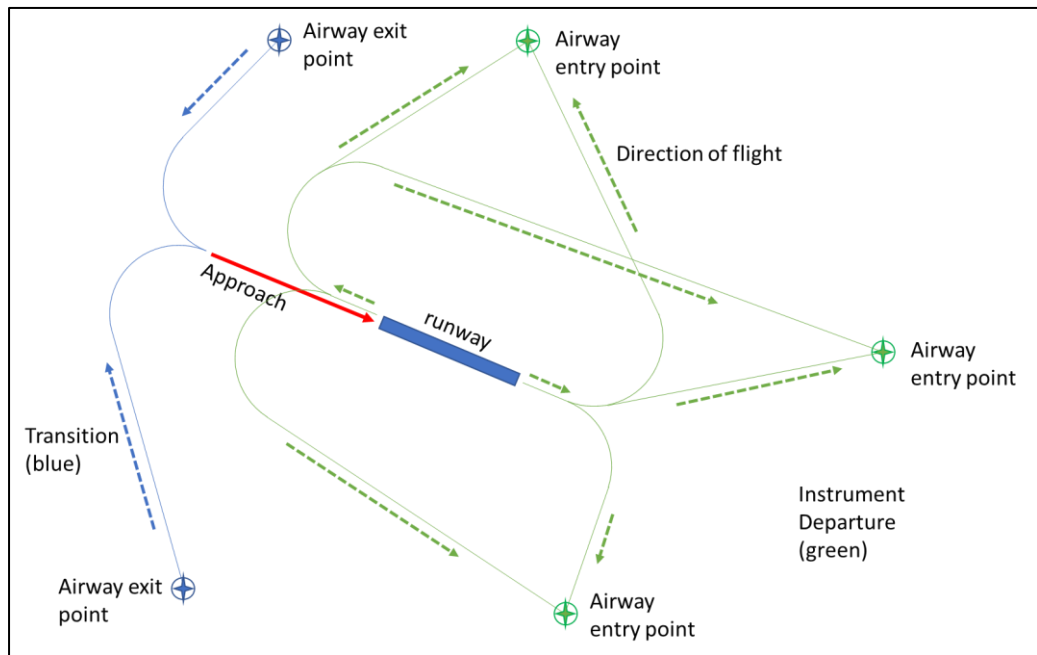


Figure 6 – Illustrative Example of Combined Arrivals and Departures

A1 Initial Options Appraisal (Full Table Analysis)

A1.1 Initial Options Appraisal Table

This Appendix is delivered as a separate MS Excel-based file with the format as shown in the extract below. The Appendix contains the full analysis carried out on the list of options, as considered during CAP 1616 Stage 2 – Develop and Assess. The full analysis of the options is contained in the Initial Options Appraisal Table Issue 1, that can be found in PDF format alongside this document on the CAA airspace portal.

INITIAL OPTIONS APPRAISAL									
<p>Summary of Analysis</p> <p>Stakeholder concerns regarding the proximity to the Gatwick CTA and the impact of noise, including the heavily populated area to the north of the airport. Discouraging any of the swathe directly north to avoid overflight of these populations would result in this option being similar to Option D (Runway 21 East 3) therefore this option will not be taken forward.</p> <p>Stakeholder concerns regarding the proximity to the Gatwick CTA. Design work will need to be cognisant of Kenley Airfield. This option is similar to current operations and a viable option for Runway 21 East 3. This option will be taken forward for further development at Stage 3. This is the preferred option due to the impacts are likely to be similar to today's operations. This is a viable option for the proximity to the Gatwick CTA and overflight of the AONB.</p> <p>Stakeholder concerns regarding the proximity to the Gatwick CTA and overflight of the AONB. One stakeholder suggested extending the swathe further south (subject to coordination with Gatwick Airport) to increase flexibility, although this would increase AONB overflight. This option will be taken forward for further development at Stage 3. This is an alternative to the preferred option due to the impacts are likely to be similar to today's operations. This is a viable option for the proximity to the Gatwick CTA and overflight of the AONB.</p> <p>Design work will need to be cognisant of Kenley Airfield. Safety concerns regarding cockpit workload due to the circling nature of the procedure at the southern extreme of the swathe. This option will be taken forward for further development at Stage 3. This is the preferred option due to the impacts are likely to be similar to today's operations. This is an alternative to the preferred option due to the impacts are likely to be similar to today's operations. This is a viable option for the proximity to the Gatwick CTA and overflight of the AONB.</p> <p>Stakeholder concerns regarding the impact of noise, specifically the heavily populated area to the north of the airport. Utilising the southern extreme of the swathe only, similar to current operations. This option will be taken forward for further development at Stage 3. This is the preferred option due to the impacts are likely to be similar to today's operations. This is an alternative to the preferred option due to the impacts are likely to be similar to today's operations. This is a viable option for the proximity to the Gatwick CTA and overflight of the AONB.</p> <p>Stakeholder concerns regarding the impact of noise, specifically the heavily populated area to the north of the airport. Utilising the southern extreme of the swathe only, similar to current operations. This option will be taken forward for further development at Stage 3. This is the preferred option due to the impacts are likely to be similar to today's operations. This is an alternative to the preferred option due to the impacts are likely to be similar to today's operations. This is a viable option for the proximity to the Gatwick CTA and overflight of the AONB.</p> <p>Stakeholder concerns regarding the impact of noise, specifically the heavily populated area to the north of the airport. Utilising the southern extreme of the swathe only, similar to current operations. This option will be taken forward for further development at Stage 3. This is the preferred option due to the impacts are likely to be similar to today's operations. This is an alternative to the preferred option due to the impacts are likely to be similar to today's operations. This is a viable option for the proximity to the Gatwick CTA and overflight of the AONB.</p> <p>Stakeholder concerns regarding the impact of noise, specifically the heavily populated area to the north of the airport. Utilising the southern extreme of the swathe only, similar to current operations. This option will be taken forward for further development at Stage 3. This is the preferred option due to the impacts are likely to be similar to today's operations. This is an alternative to the preferred option due to the impacts are likely to be similar to today's operations. This is a viable option for the proximity to the Gatwick CTA and overflight of the AONB.</p> <p>This option was supported by some stakeholders as it would be a direct route to the runway, avoiding the heavily populated area to the north of the airport. A CDA could be used to facilitate a shorter route into ATVEY from the north. This option will be taken forward for further development at Stage 3. This is the preferred option.</p> <p>Stakeholder concerns regarding the impact of noise and overflight of the AONB. One stakeholder suggested extending the swathe further south to the Heathrow CTA to facilitate flexibility for both the north and south. This option will be taken forward for further development at Stage 3. This is the preferred option.</p>									
Group	Impact	Level of Analysis	Runway 21 East 1 (D1)	Runway 21 East 1 (D2)	Runway 21 East 1 (D4)	Runway 21 West 1 (D1)	Runway 21 West 2 (D1)	Runway 21 East 1 (D1)	Runway 21 East 1 (D1)
Communities	Noise impact on health and quality of life	Initial Options Appraisal: Qualitative	Noise impacts are likely to be better or broadly similar to today, although new populations could be introduced into new populations to noise, including densely populated areas to the north of the airport. Improved vertical profile has the potential to improve the impact of noise overall.	Noise impacts are likely to be better or broadly similar to today, although new populations could be introduced into new populations to noise. Improved vertical profile has the potential to improve the impact of noise overall.	Noise impacts are likely to be better or broadly similar to today, although new populations could be introduced into new populations to noise. Improved vertical profile has the potential to improve the impact of noise overall.	Noise impacts are likely to be better or broadly similar to today, although new populations could be introduced into new populations to noise. Improved vertical profile has the potential to improve the impact of noise overall.	Noise impacts are likely to be better or broadly similar to today, although new populations could be introduced into new populations to noise. Improved vertical profile has the potential to improve the impact of noise overall.	Noise impacts are likely to be better or broadly similar to today, although new populations could be introduced into new populations to noise. Improved vertical profile has the potential to improve the impact of noise overall.	Noise impacts are likely to be better or broadly similar to today, although new populations could be introduced into new populations to noise. Improved vertical profile has the potential to improve the impact of noise overall.
Communities	Air Quality	Initial Options Appraisal: Qualitative	Unlikely to be any significant change to current procedures. Local Air Quality is only likely to be affected by departing aircraft below 1,000 ft. Aircraft are likely to be below 1,000 ft in the same locations as today's operations.	Unlikely to be any significant change to current procedures. Local Air Quality is only likely to be affected by departing aircraft below 1,000 ft. Aircraft are likely to be below 1,000 ft in the same locations as today's operations.	Unlikely to be any significant change to current procedures. Local Air Quality is only likely to be affected by departing aircraft below 1,000 ft. Aircraft are likely to be below 1,000 ft in the same locations as today's operations.	Unlikely to be any significant change to current procedures. Local Air Quality is only likely to be affected by departing aircraft below 1,000 ft. Aircraft are likely to be below 1,000 ft in the same locations as today's operations.	Unlikely to be any significant change to current procedures. Local Air Quality is only likely to be affected by departing aircraft below 1,000 ft. Aircraft are likely to be below 1,000 ft in the same locations as today's operations.	Unlikely to be any significant change to current procedures. Local Air Quality is only likely to be affected by departing aircraft below 1,000 ft. Aircraft are likely to be below 1,000 ft in the same locations as today's operations.	Unlikely to be any significant change to current procedures. Local Air Quality is only likely to be affected by departing aircraft below 1,000 ft. Aircraft are likely to be below 1,000 ft in the same locations as today's operations.
Water Society	Greenhouse Gas Impact	Initial Options Appraisal: Qualitative	A high performance and uninterrupted climb direct to 7,000 ft is available, and therefore this could decrease the greenhouse gas impact and contribution.	A high performance and uninterrupted climb direct to 7,000 ft is available, and therefore this could decrease the greenhouse gas impact and contribution.	A high performance and uninterrupted climb direct to 7,000 ft is available, and therefore this could decrease the greenhouse gas impact and contribution.	A high performance and uninterrupted climb direct to 7,000 ft is available, and therefore this could decrease the greenhouse gas impact and contribution.	A high performance and uninterrupted climb direct to 7,000 ft is available, and therefore this could decrease the greenhouse gas impact and contribution.	A high performance and uninterrupted climb direct to 7,000 ft is available, and therefore this could decrease the greenhouse gas impact and contribution.	A high performance and uninterrupted climb direct to 7,000 ft is available, and therefore this could decrease the greenhouse gas impact and contribution.
General Aviation	Access	Initial Options Appraisal: Qualitative	May require CAS to be introduced to protect the procedure, which this will be the minimum amount required this may impact access for GA.	May require CAS to be introduced to protect the procedure, which this will be the minimum amount required this may impact access for GA.	May require CAS to be introduced to protect the procedure, which this will be the minimum amount required this may impact access for GA.	May require CAS to be introduced to protect the procedure, which this will be the minimum amount required this may impact access for GA.	May require CAS to be introduced to protect the procedure, which this will be the minimum amount required this may impact access for GA.	May require CAS to be introduced to protect the procedure, which this will be the minimum amount required this may impact access for GA.	May require CAS to be introduced to protect the procedure, which this will be the minimum amount required this may impact access for GA.
General Aviation / Commercial Airlines	Fuel Burn	Initial Options Appraisal: Qualitative	Could represent a more direct route than current procedures which could reduce fuel burn. Fuel burn could be reduced as continuous climb possible to 7,000 ft.	Could represent a more direct route than current procedures which could reduce fuel burn. Fuel burn could be reduced as continuous climb possible to 7,000 ft.	Could represent a more direct route than current procedures which could reduce fuel burn. Fuel burn could be reduced as continuous climb possible to 7,000 ft.	Could represent a more direct route than current procedures which could reduce fuel burn. Fuel burn could be reduced as continuous climb possible to 7,000 ft.	Could represent a more direct route than current procedures which could reduce fuel burn. Fuel burn could be reduced as continuous climb possible to 7,000 ft.	Could represent a more direct route than current procedures which could reduce fuel burn. Fuel burn could be reduced as continuous climb possible to 7,000 ft.	Could represent a more direct route than current procedures which could reduce fuel burn. Fuel burn could be reduced as continuous climb possible to 7,000 ft.
Airport / Air Navigation Service Provider	Infrastructure Costs	Initial Options Appraisal: Qualitative	No additional infrastructure costs associated with the introduction of this route or procedures.	No additional infrastructure costs associated with the introduction of this route or procedures.	No additional infrastructure costs associated with the introduction of this route or procedures.	No additional infrastructure costs associated with the introduction of this route or procedures.	No additional infrastructure costs associated with the introduction of this route or procedures.	No additional infrastructure costs associated with the introduction of this route or procedures.	No additional infrastructure costs associated with the introduction of this route or procedures.
Airport / Air Navigation Service Provider	Operational Costs	Initial Options Appraisal: Qualitative	Operational costs associated with implementing the new procedures relate to IP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication are anticipated. Once implemented, the costs of ownership of these procedures is very low, requiring maintenance of the procedure on a five yearly basis. More detail would be expected to become apparent during Stage 3 of the ACP process.	Operational costs associated with implementing the new procedures relate to IP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication are anticipated. Once implemented, the costs of ownership of these procedures is very low, requiring maintenance of the procedure on a five yearly basis. More detail would be expected to become apparent during Stage 3 of the ACP process.	Operational costs associated with implementing the new procedures relate to IP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication are anticipated. Once implemented, the costs of ownership of these procedures is very low, requiring maintenance of the procedure on a five yearly basis. More detail would be expected to become apparent during Stage 3 of the ACP process.	Operational costs associated with implementing the new procedures relate to IP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication are anticipated. Once implemented, the costs of ownership of these procedures is very low, requiring maintenance of the procedure on a five yearly basis. More detail would be expected to become apparent during Stage 3 of the ACP process.	Operational costs associated with implementing the new procedures relate to IP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication are anticipated. Once implemented, the costs of ownership of these procedures is very low, requiring maintenance of the procedure on a five yearly basis. More detail would be expected to become apparent during Stage 3 of the ACP process.	Operational costs associated with implementing the new procedures relate to IP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication are anticipated. Once implemented, the costs of ownership of these procedures is very low, requiring maintenance of the procedure on a five yearly basis. More detail would be expected to become apparent during Stage 3 of the ACP process.	Operational costs associated with implementing the new procedures relate to IP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication are anticipated. Once implemented, the costs of ownership of these procedures is very low, requiring maintenance of the procedure on a five yearly basis. More detail would be expected to become apparent during Stage 3 of the ACP process.
Airport / Air Navigation Service Provider	Deployment Costs	Initial Options Appraisal: Qualitative	Deployment costs would be expected for this proposal for air traffic controller training for controllers and assistants at Biggin Hill Airport and NATS Swadlow. More detail would be expected to become apparent during Stage 3 of the ACP process.	Deployment costs would be expected for this proposal for air traffic controller training for controllers and assistants at Biggin Hill Airport and NATS Swadlow. More detail would be expected to become apparent during Stage 3 of the ACP process.	Deployment costs would be expected for this proposal for air traffic controller training for controllers and assistants at Biggin Hill Airport and NATS Swadlow. More detail would be expected to become apparent during Stage 3 of the ACP process.	Deployment costs would be expected for this proposal for air traffic controller training for controllers and assistants at Biggin Hill Airport and NATS Swadlow. More detail would be expected to become apparent during Stage 3 of the ACP process.	Deployment costs would be expected for this proposal for air traffic controller training for controllers and assistants at Biggin Hill Airport and NATS Swadlow. More detail would be expected to become apparent during Stage 3 of the ACP process.	Deployment costs would be expected for this proposal for air traffic controller training for controllers and assistants at Biggin Hill Airport and NATS Swadlow. More detail would be expected to become apparent during Stage 3 of the ACP process.	Deployment costs would be expected for this proposal for air traffic controller training for controllers and assistants at Biggin Hill Airport and NATS Swadlow. More detail would be expected to become apparent during Stage 3 of the ACP process.
Safety Assessment	Safety Assessment	Initial Options Appraisal: Qualitative	CAS to contain the new procedures would require a safety case to overcome the issues identified which would then produce a more robust safety argument that is in operation today.	CAS to contain the new procedures would require a safety case to overcome the issues identified which would then produce a more robust safety argument that is in operation today.	CAS to contain the new procedures would require a safety case to overcome the issues identified which would then produce a more robust safety argument that is in operation today.	CAS to contain the new procedures would require a safety case to overcome the issues identified which would then produce a more robust safety argument that is in operation today.	CAS to contain the new procedures would require a safety case to overcome the issues identified which would then produce a more robust safety argument that is in operation today.	CAS to contain the new procedures would require a safety case to overcome the issues identified which would then produce a more robust safety argument that is in operation today.	CAS to contain the new procedures would require a safety case to overcome the issues identified which would then produce a more robust safety argument that is in operation today.