London Biggin Hill Airport RNAV (GNSS) Runway 21 ACP-2019-86

Appendix A3 - Final Options Appraisal

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Glossary

Acronym	Meaning
ACP	Airspace Change Proposal
ANOMS	Automatic Noise Operations Monitoring System (Data source for all track density images in this document)
ATC	Air Traffic Control
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CTR	Control Zone
DME	Distance Measuring Equipment (Ground based equipment)
GNSS	Global Navigation Satellite System
IAP	Instrument Approach Procedure (A conventional Approach using Ground Based or Satellite Based Information)
IF	Intermediate Fix
ILS	Instrument Landing System (Ground based equipment)
LBHA	London Biggin Hill Airport
LCY	London City Airport
MAP	Missed Approach Procedure
PANS-OPS	Procedures for Air Navigation Services – Aircraft Operations (Rules for designing instrument approach and departure procedures)
PAPI	Precision Approach Path Indicator
PBN	Performance Based Navigation (Satellite Navigation)
RNAV	Area Navigation (Satellite Navigation)
RNP	Required Navigation Performance
VOR	VHF Omnidirectional Ranging Beacon (Ground based equipment)

1 Final Options Appraisal

1.1 Introduction

Airspace change proposals vary greatly in terms of size and complexity. Therefore the Airspace Change process is sufficiently scalable to accommodate different types of proposal. This means that not all airspace change proposals necessarily need to be subjected to each and every element of the process. This Airspace Change Proposal (ACP) is small in area and virtually nil in impact over the ground.

After the Stage 2 Gateway, London Biggin Hill Airport (LBHA) engaged with the CAA to understand the possibilities of scaling the environmental assessments for Stage 3. The evidence for reducing the scale of the environmental assessments was sent to the CAA on 17th June 2022 and has been included at Appendix A1 to the Consultation Strategy, which can be found on the airspace change portal alongside this document. LBHA has elected to continue with the ACP submission on the basis of this scaled approach, specifically with the content of the Final Options Appraisal.

1.2 Final Options Appraisal

As identified in the Initial Options Appraisal submission that was accepted at the Stage 2 Gateway, this ACP is not expected to change the impacts over the ground when compared to the current LBHA operation. The expected up take of all these procedures is expected to be a total of no more than 2 aircraft a month; this was based on the non-availability of Thames Director (formerly Thames Radar) to provide an approach service and on historic usage of the existing procedure. Data from Thames Director has shown that the existing procedure was only utilised 20 times in 2020, 8 times in 2021, only twice in 2022 and was not utilised at all in 2023. The higher number in 2020 was attributed to the increased unavailability of Thames Director during the Covid-19 pandemic. Thames Director have now aligned their provision of service hours with the LBHA opening hours which is likely to result in even less aircraft utilising any RNAV procedures, therefore the figure of 2 aircraft a month is felt to be in excess of expected usage.

Any environmental modelling, for instance noise contours, would not show any differences due to the very small numbers involved in this change. LBHA considers that a quantitative assessment is unnecessary as there would be no change to the current situation. Therefore, the Change Sponsor has concluded that a Final Options Appraisal based on a qualitative assessment is deemed proportionate and appropriate. The qualitative assessment conducted during the Initial Options Appraisal that was completed at Stage 2 of the CAP 1616 process will form the Final Options Appraisal for this proposal and is included in Section 2 of this document.

LBHA recognise that monitoring after implementation will provide an opportunity to report specifically on utilisation that will enable better understanding.

1.3 High-level Objectives & 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 1 below. Additionally, Safety Assessment, Tranquillity and Biodiversity (as defined in CAP 1616, Appendix B) have been added 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.
	Air Quality	Any change in air quality is to be considered[1].
Wider Society	Greenhouse Gas impact	Assessment of changes in greenhouse gas levels in accordance with WebTAG is required.
	Capacity and resilience	A qualitative assessment of the impact on overall UK airspace structure.
General Aviation (GA)	Access	A qualitative assessment of the effect of the proposal on the access to airspace for GA users.
GA/commercial airlines	Economic impact from increased effective capacity	Forecast increase in air transport movements and estimated passenger numbers or cargo tonnage carried.
	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.
	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.
	Operational costs	Where a proposal would lead to a change in operational costs, these should be assessed.

[1] Air Quality assessments are only applicable below 1,000 feet and includes the consideration of Air Quality Management Areas (AQMAs).

Affected Group	Impact	Description
	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 (Guidance on the Conduct of Hazard Identification, Risk Assessment, and the Production of Safety Cases: For Aerodrome Operators and Air Traffic Service Providers).
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.

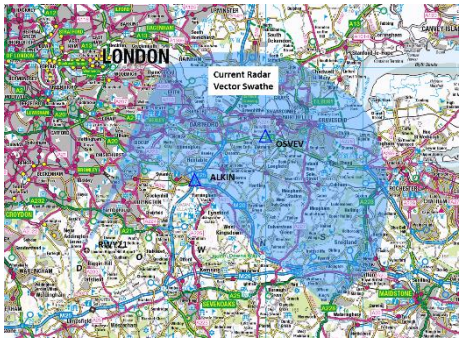
Table 1 – Final Options Appraisal Assessment Criteria

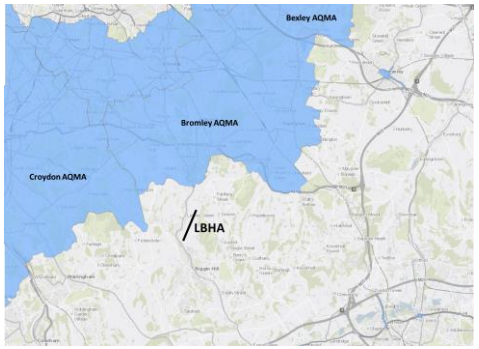
2 Options Appraisal

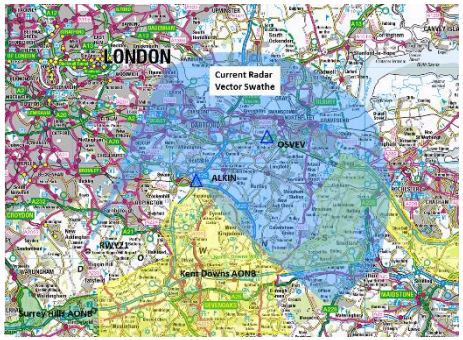
2.1 Do Nothing Baseline

Do Nothing Baseline - Today's Operation		
Arriving aircraft receive radar vectors from Thames Director Air Traffic Controllers as they approach OSVEV from the east, until they are established on the ILS to land at LBHA. If radar vectors are not available, aircraft will need to use ground-based navigation aids to make the approach onto the ILS.		
Group	Impact	Qualitative Assessment

Communities	Noise impact on health and quality of life	Today's operation entails aircraft receiving radar vectors to establish an approach on the ILS. The majority of aircraft inbound to LBHA receive radar vectors, with the main swathe of these being in the OSVEV area as shown in the figure below. The swathe has been produced using an Automatic Noise Operations Management System (ANOMS), which has recently been acquired by the airport. This data is more accurate than the previous swathe images used in earlier documentation, which was based on radar data provided by Thames Director. The swathe contains the tracks of aircraft making an approach to LBHA below 3,000 ft. Aircraft outside the swathe between 3,000 ft and 7,000 ft may also have an impact on noise, but the position, and therefore impact, of these aircraft will not change as a result of this ACP. On the rare occasion that radar vectors are not available, aircraft will need to use ground-based navigation aids to position to make the approach onto the ILS, as indicated by the red line on the figure below. The LBHA Noise Abatement Policy (NAP) has recently been reviewed and has resulted in no change to the existing NAP. Therefore, there will be no change to the noise impact due to the NAP. Due to the continual use of radar vectoring associated with this option, the dispersion of traffic due to radar vectors (and therefore the dispersion of the noise impact) is varied across the whole swathe area shown in the figure above. If radar vectors are not available, and aircraft use ground-based navigation aids to make the approach onto the ILS, the track flown will also be contained within the swathe area shown. All areas beneath the swathe can be considered to be overflown under current operations.



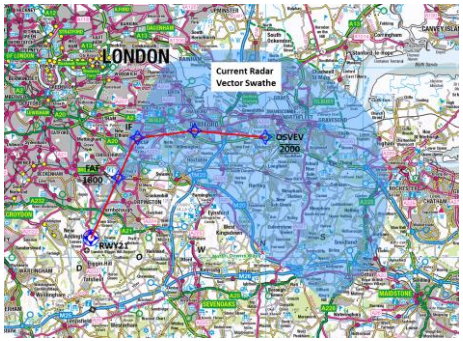
	Air Quality	The majority of local areas overflown are impacted when the aircraft is above 1,000 ft. Parts of Locksbottom and Farnborough are likely to be impacted as the aircraft will be at approximate 1,000 ft around 3 NM from touchdown. In addition, today's operation involves the overflight of the Princess Royal University Hospital, 2 NM from touchdown; this is unavoidable to ensure a safe and stable approach is flown following the establishment of the ILS. Government guidance states that aircraft flying higher than 1,000 ft are unlikely to have a significant impact on local air quality. Today, arriving aircraft descend through 1,000 ft 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 1,000 ft 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 northern part 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 Bexley and Sevenoaks District Council AQMAs due to their location relative to the airport. Although the Croydon AQMA 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, circling to land on Runway 03 or executing a Missed Approach Procedure (MAP). There may be an impact on the Bromley AQMA as aircraft reach the final stages of the approach to land at the airport. Bromley Council Air Quality Action Plan 2020-2025 considers that the main sources of atmospheric pollutants of concern (Nitrogen Dioxide and Particulate Matter) is traffic emissions, large scale combustion

		plants, construction sites and domestic heating. There is no reference to the impact of aircraft from LBHA therefore any impact is likely to be small.
Wider Society	Greenhouse Gas impact	Within the baseline scenario, the majority of aircraft will leave the network in the vicinity of OSVEV and require radar vectoring. Due to the tactical nature of radar vectoring, it cannot be guaranteed that aircraft will take the most efficient route between OSVEV and LBHA.
	Capacity and resilience	The baseline scenario provides no new route to assess, as a result design efficiency was not considered. This scenario offers LBHA resilience, in the short term, within the existing operation due to the current availability of a VOR/DME and ILS approach.
	Tranquillity	Any aircraft routing from the south or east of LBHA would likely be required to fly over the Kent Downs AONB or Surrey Hills AONB below 7,000 ft whilst being radar vectored towards LBHA, as shown in the figure below. The majority of the aircraft doing so would be above 2,000 ft at the time, therefore, the impact on the AONBs is deemed to be minimal.  The closest National Park (NP) to LBHA is South Downs NP, approximately 23 NM south of the airport. Due to this distance, it is deemed that the impact on the South Downs NP is very limited; aircraft would not be within the vicinity of LBHA at the time of overflight and would likely be controlled by Thames Director.
	Biodiversity	In general, airspace change proposals are unlikely to have an impact upon biodiversity because they do not involve ground-based infrastructure. Hence, there is no known impact in terms of biodiversity associated with today's operation. This includes inter alia terrestrial, marine and other aquatic ecosystems and the ecological complexes.
General Aviation	Access	There is no direct impact on access for general/business aviation associated with today's operation as LBHA is located within Class G airspace.

General Aviation / commercial airlines	Economic impact from increased effective capacity	In today's operation, LBHA may experience capacity limitations due to traffic volumes in the LTMA, but this is a rare event and is expected to have a limited impact on LBHA operations.
	Fuel burn	Due to the tactical nature of radar vectoring in today's operation, it cannot be guaranteed that aircraft would be given the most efficient route as they approach LBHA. Therefore, fuel burn is variable due to the radar vectoring taking place.
Commercial airlines	Training costs	There are no direct training costs associated with the LBHA operation.
	Other costs	There are no direct additional costs associated with the LBHA operation.
Airport / Air navigation service provider	Infrastructure costs	The ongoing maintenance cost of the ILS and PAPIs will continue. There may be an additional infrastructure cost associated with the continuation of the VOR operation, should this be required.
	Operational cost	There are no anticipated additional operational costs unless an RNAV Substitution (under CAP 1781) is required.
	Deployment costs	There are no anticipated additional deployment costs unless an RNAV Substitution (under CAP 1781) is required.
	Safety	As the baseline scenario is the existing operation, it is assumed to be safe. LBHA has existing safety cases which are not expected to be impacted by any RNAV Substitution (under CAP 1781).

2.2 RNP Approach Runway 21 Option Z

RNP Approach Runway 21 Option Z – a direct route from OSVEV onto the approach procedure
A direct track from OSVEV onto the Final Approach Fix for a full satellite-based Approach. This option introduces a new location for the IF which is clear of the London City Airport CTR whilst also meeting the PANS-OPS criteria for the procedure. This design provides connectivity with the enroute network via OSVEV and replicates the tracks flown from OSVEV with radar vectors to intercept the ILS approach.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	Although this procedure does not replicate the existing VOR/DME approach, it does replicate the likely ground track for aircraft receiving radar vectors from OSVEV to intercept the ILS procedure. Therefore, the dispersion of traffic and therefore noise will be relatively similar to the baseline scenario. This procedure provides a direct link between OSVEV and the approach procedure. Traffic will remain below 3,000 ft within the current swathe area shown in the figure below. Aircraft between 3,000 ft and 7,000 ft will be the same as the Do Nothing option, so there will be no new areas overflown as a result of implementing this procedure. 
	Air Quality	Like the existing procedure, the majority of local areas overflown are impacted when the aircraft is above 1,000 ft. Parts of Locksbottom and Farnborough are likely to be impacted as the aircraft will be at approximate 1,000 ft around 3 NM from touchdown. This will have the same impact as today's operations. In addition, today's operation involves the overflight of the Princess Royal University Hospital, 2 NM from touchdown; this is unavoidable to ensure a safe and stable approach is flown following the establishment at the FAF, as per today's operations. The location of the FAF and associated flight path thereafter will remain as close as possible to the baseline scenario, resulting in no change in terms of air quality. There will be no change to the impact on AQMA's from the baseline scenario as the position of aircraft below 1,000 ft on the approach to land will be the same as today's operations.

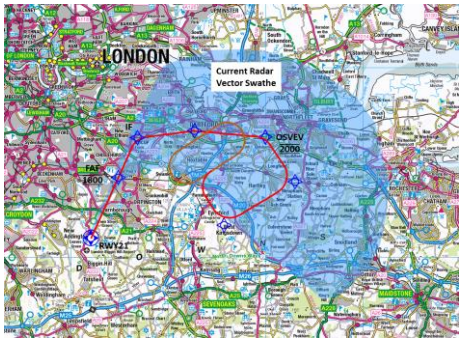
Wider Society	Greenhouse Gas impact	This procedure includes a more direct routing between OSVEV and the approach procedure prior to establishing at the FAF. This more direct routing means that aircraft are likely to fly fewer track miles than those currently utilising the existing conventional procedure. As this procedure replicates the likely ground track for aircraft receiving radar vectors from OSVEV to intercept the ILS procedure the aircraft following this procedure will fly in the same area when compared to the baseline scenario. As a result, this procedure is expected to have no additional impact on emissions over today's operations.
	Capacity and resilience	This procedure has been designed to mimic the radar vectored arrivals in today's operation. There is no expected impact on capacity and resilience associated with this procedure. As this procedure includes a more direct link from OSVEV to the approach procedure, it is deemed more efficient than the existing conventional procedure. Additionally, following the removal of the VOR, this procedure provides resilience as an alternative to a solely ILS approach into LBHA.
	Tranquillity	Any aircraft routing from the South or East of LBHA would likely be required to fly over the Kent Downs AONB or Surrey Hills AONB below 7,000 ft whilst routing towards OSVEV. The majority of the aircraft doing so would be above 2,000 ft at the time, therefore, the impact on the AONBs is deemed to be minimal. Overflight would occur prior to aircraft being established on this procedure and whilst under the control of Thames Director as opposed to LBHA, as shown in the figure below. This represents no change to the Do Nothing scenario. However, as this procedure provides connectivity to the enroute network to the north east of OSVEV, overflight of the AONBs is less likely, resulting in less impact than the Do Nothing option.  The closest National Park (NP) to LBHA is South Downs NP, approximately 23 NM south of the airport. Due to this distance, it is deemed that the impact on the South Downs NP is very limited; aircraft would not be within the vicinity of LBHA at the time of overflight and would likely be controlled by Thames Director. This also represents no change to the Do Nothing scenario.

	Biodiversity	In general, airspace change proposals are unlikely to have an impact upon biodiversity because they do not involve ground-based infrastructure. Hence, there is no known impact in terms of biodiversity associated with this procedure. This includes inter alia terrestrial, marine and other aquatic ecosystems and the ecological complexes. Furthermore, there is no anticipated impact on any European Protected Species as outlined in the Conservation of Habitats and Species Regulations 2010 such as Bats, Great Crested Newts or other mammals as a direct result of this procedure due to the limited change involved.
General Aviation	Access	There is no direct impact on access for general aviation associated with this procedure. This procedure mimics the situation today, therefore, there is no impact on GA access compared to today's operations. Business aviation aircraft that operate to/from LBHA are already equipped to fly PBN approaches so there will be no impact on access for business aviation.
General Aviation / commercial airlines	Economic impact from increased effective capacity	As part of this option, LBHA may experience capacity limitations due to traffic volumes in the LTMA. This is present in today's operation and therefore no change to the impact is expected.
	Fuel burn	This procedure includes a more direct routing between OSVEV and the approach procedure prior to establishing at the FAF. This more direct routing means that aircraft are likely to fly fewer track miles and therefore less fuel burn is expected compared with those aircraft currently utilising the existing conventional procedure. While radar vectoring is likely to still be utilised for the majority of the time, the provision of a direct link between OSVEV and the approach procedure does facilitate the most efficient routing, and therefore has the possibility of reducing fuel burn when compared with the baseline scenario.
Commercial airlines	Training costs	Flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. No additional training costs are anticipated, this represents no change to the Do Nothing scenario.
	Other costs	There are no anticipated additional costs associated with this procedure. This represents no change to the Do Nothing scenario.
Airport / Air navigation	Infrastructure costs	The ongoing maintenance cost of the PAPIs will continue. This represents no change to the Do Nothing scenario.

service provider	Operational cost	Operational costs associated with implementing the new procedures relate to IFP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication are anticipated. Once implemented, the cost of ownership of this procedure is very low, requiring maintenance of the procedure on a five yearly basis.
	Deployment costs	There will be some ATC training costs associated with the implementation of this procedure, but these are expected to be minimal.
	Safety	As this proposed procedure is a replication of the current radar vectoring arrival, there is no perceived additional safety concerns outside the parameters that exist today. There are no specific safety risks associated with this procedure.

2.3 RNP Approach Runway 21 Option Y

RNP Approach Runway 21 Option Y – a route from the Hold onto the approach procedure
A route from the Hold onto the Final Approach Fix for a full satellite-based Approach. This procedure enables aircraft to re-join the approach from the Hold following a missed approach. The initial part of the procedure is required to allow aircraft to safely self-navigate and re-position to make a further approach to the airfield. It will only be utilised when radar vectors are not available from ATC and aircraft have carried out a Missed Approach Procedure from a previous approach. It is anticipated therefore that this procedure will only be used rarely. Once aircraft have passed OSVEV from the Hold, the approach procedure becomes the same as the procedure described above (RNP Approach Runway 21 Option Z).

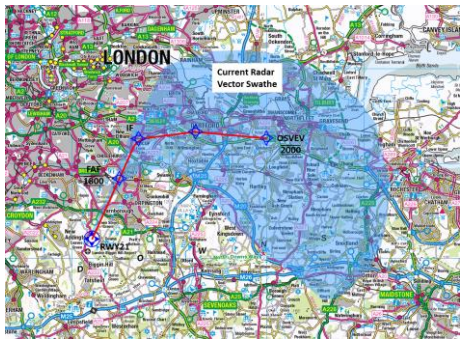
Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	Although this procedure does not replicate the ground track that aircraft would follow currently when departing the Hold to join the existing VOR/DME approach, the route flown by aircraft, as shown in the figure below, generally remains within the current radar vector swathe and once beyond OSVEV, replicates the likely ground track for aircraft receiving radar vectors from OSVEV to intercept the ILS procedure. Therefore, the dispersion of traffic and therefore noise will be relatively similar to the baseline scenario. Although the initial turn when departing the Hold appears to take the aircraft out of the current swathe, the area overflown is still currently overflown by both arriving and departing aircraft so no new populations will be overflown with this procedure. In addition, this procedure will only be utilised when radar vectors are not available to be provided by ATC and aircraft have carried out a Missed Approach Procedure from a previous approach. It is anticipated therefore that this procedure will only be used rarely, so there will be no discernible change in the impact of noise from this procedure. 

	Air Quality	Like the existing procedure, the majority of local areas overflown are impacted when the aircraft is above 1,000 ft. Parts of Locksbottom and Farnborough are likely to be impacted as the aircraft will be at approximate 1,000 ft around 3 NM from touchdown. This will have the same impact as today's operations. In addition, today's operation involves the overflight of the Princess Royal University Hospital, 2 NM from touchdown; this is unavoidable to ensure a safe and stable approach is flown following the establishment at the FAF, as per today's operations. The location of the FAF and associated flight path thereafter will remain as close as possible to the baseline scenario, resulting in no change in terms of air quality. There will be no change to the impact on AQMA's from the baseline scenario as the position of aircraft below 1,000 ft on the approach to land will be the same as today's operations.
Wider Society	Greenhouse Gas impact	This procedure has longer track miles than aircraft would fly currently when departing the Hold to join the existing VOR/DME approach following a missed approach. However, the procedure will only be utilised when radar vectors are not available to be provided by ATC and aircraft have carried out a Missed Approach Procedure from a previous approach. It is anticipated therefore that this procedure will only be used rarely, so this procedure is not expected to have any significant additional impact on emissions over today's operations.
	Capacity and resilience	There is no expected impact on capacity and resilience associated with this option. Following the removal of the BIG VOR, this option provides resilience as an alternative to a solely ILS approach into LBHA.

	Tranquillity	Overflight of the boundary area of the Kent Downs AONB would occur by aircraft as they leave the Hold to carry out a further approach procedure, as shown in the figure below. Use of this procedure is likely to be rare as it will only be required when radar vectors are not available from ATC and aircraft have carried out a Missed Approach Procedure from a previous approach, therefore the impact on the AONB is deemed to be minimal.  The closest National Park (NP) to LBHA is South Downs NP, approximately 23 NM south of the airport. Due to this distance, there would be no impact on the South Downs NP from aircraft re-joining an approach procedure having executed a missed approach. This represents no change to the Do Nothing scenario.
	Biodiversity	In general, airspace change proposals are unlikely to have an impact upon biodiversity because they do not involve ground-based infrastructure. Hence, there is no known impact in terms of biodiversity associated with this option. This includes inter alia terrestrial, marine and other aquatic ecosystems and the ecological complexes. Furthermore, there is no anticipated impact on any European Protected Species as outlined in the Conservation of Habitats and Species Regulations 2010 such as Bats, Great Crested Newts or other mammals as a direct result of this option due to the limited change involved.
General Aviation	Access	There is no direct impact on access for general aviation associated with this procedure. This procedure mimics the likely routing for aircraft receiving radar vectors to re-join the approach procedure following a missed approach, therefore, there is no impact on GA access compared to today's operations. Business aviation aircraft that operate to/from LBHA are already equipped to fly PBN approaches so there will be no impact on access for business aviation.
General Aviation /	Economic impact from increased effective capacity	As part of this option, LBHA may experience capacity limitations due to traffic volumes in the LTMA. This is present in today's operation and therefore no change to the impact is expected.

commercial airlines	Fuel burn	This procedure has longer track miles than aircraft would fly currently when departing the Hold to join the existing VOR/DME approach following a missed approach. However, the procedure will only be utilised when radar vectors are not available to be provided by ATC and aircraft have carried out a Missed Approach Procedure from a previous approach. It is anticipated therefore that this procedure will only be used rarely, so this procedure is not expected to have any significant additional impact on fuel burn over today's operations.
Commercial airlines	Training costs	Flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. No additional training costs are anticipated with this option. This represents no change to the Do Nothing scenario.
	Other costs	There are no anticipated additional costs associated with this option. This represents no change to the Do Nothing scenario.
Airport / Air navigation service provider	Infrastructure costs	The ongoing maintenance cost of the PAPIs will continue.
	Operational cost	Operational costs associated with implementing the new procedures relate to IFP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication are anticipated. Once implemented, the cost of ownership of this procedure is very low, requiring maintenance of the procedure on a five yearly basis.
	Deployment costs	There will be some ATC training costs associated with the implementation of this procedure, but these are expected to be minimal.
	Safety	As this proposed option is similar to the current radar vectoring following a missed approach, there is no perceived additional safety concerns outside the parameters that exist today. There are no specific safety risks associated with this option.

2.4 RNP to ILS Approach Runway 21 Option Z

<table>
<tr><td colspan="3">RNP to ILS Approach Runway 21 Option Z – a direct route from OSVEV onto the ILS</td></tr>
<tr><td colspan="3">This procedure enables aircraft to intercept the ILS procedure from the en-route network at OSVEV. This option introduces a new location for the IF which is clear of the London City Airport CTR whilst also meeting the PANS-OPS criteria for the procedure. This design provides connectivity with the enroute network via OSVEV and replicates the tracks flown from OSVEV with radar vectors to intercept the ILS approach.</td></tr>
<tr><td>Group</td><td>Impact</td><td>Qualitative Assessment</td></tr>
<tr><td>Communities</td><td>Noise impact on health and quality of life</td><td>Although this procedure does not replicate the existing VOR/DME approach, it does replicate the likely ground track for aircraft receiving radar vectors from OSVEV to intercept the ILS procedure. Therefore, the dispersion of traffic and therefore noise will be relatively similar to the baseline scenario. This procedure provides a direct link between OSVEV and the approach procedure. Traffic will remain below 3,000 ft within the current swathe area shown in the figure below. Aircraft between 3,000 ft and 7,000 ft will be the same as the Do Nothing option, so there will be no new areas overflown as a result of implementing this procedure.
 
</td></tr>
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	Air Quality	Like the existing procedure, the majority of local areas overflown are impacted when the aircraft is above 1,000 ft. Parts of Locksbottom and Farnborough are likely to be impacted as the aircraft will be at approximate 1,000 ft around 3 NM from touchdown. This will have the same impact as today's operations. In addition, today's operation involves the overflight of the Princess Royal University Hospital, 2 NM from touchdown; this is unavoidable to ensure a safe and stable approach is flown following the establishment at the FAF, as per today's operations. The location of the FAF and associated flight path thereafter will remain as close as possible to the baseline scenario, resulting in no change in terms of air quality. There will be no change to the impact on AQMA's from the baseline scenario as the position of aircraft below 1,000 ft on the approach to land will be the same as today's operations.
Wider Society	Greenhouse Gas impact	This option includes a more direct routing between OSVEV and the approach procedure prior to establishing at the FAF. This more direct routing means that aircraft are likely to fly fewer track miles than those currently utilising the existing conventional procedure. As this procedure replicates the likely ground track for aircraft receiving radar vectors from OSVEV to intercept the ILS procedure the aircraft following this procedure will fly in the same area when compared to the baseline scenario. As a result, this option is expected to have no additional impact on emissions over today's operations.
	Capacity and resilience	This option has been designed to mimic the radar vectored arrivals in today's operation as opposed to optimising efficiency. There is no expected impact on capacity associated with this procedure. The inclusion of a PBN to ILS approach will have resilience benefits. In the event of poor visibility, aircraft would be able to utilise the PBN to ILS approach rather than a full PBN approach. Such an approach reduces the minimum descent height, allowing for more aircraft to operate into LBHA during low visibility.

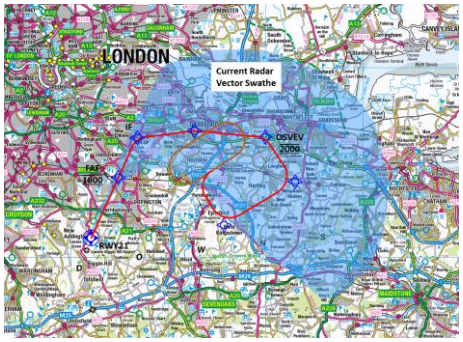
	Tranquillity	Any aircraft routing from the South or East of LBHA would likely be required to fly over the Kent Downs AONB or Surrey Hills AONB below 7,000 ft whilst be vectored towards OSVEV. The majority of the aircraft doing so would be above 2,000 ft at the time, therefore, the impact on the AONBs is deemed to be minimal. Overflight would occur prior to aircraft being established on this option and whilst under the control of Thames Director as opposed to LBHA, as shown in the figure below. This represents no change to the Do Nothing scenario. However, as this option provides connectivity to the enroute network to the north east of OSVEV, overflight of the AONBs is less likely, resulting in less impact than the Do Nothing option.  The closest National Park (NP) to LBHA is South Downs NP, approximately 23 NM south of the airport. Due to this distance, it is deemed that the impact on the South Downs NP is very limited; aircraft would not be within the vicinity of LBHA at the time of overflight and would likely be controlled by Thames Director. This also represents no change to the Do Nothing scenario.
	Biodiversity	In general, airspace change proposals are unlikely to have an impact upon biodiversity because they do not involve ground-based infrastructure. Hence, there is no known impact in terms of biodiversity associated with this option. This includes inter alia terrestrial, marine and other aquatic ecosystems and the ecological complexes. Furthermore, there is no anticipated impact on any European Protected Species as outlined in the Conservation of Habitats and Species Regulations 2010 such as Bats, Great Crested Newts or other mammals as a direct result of this option due to the limited change involved.
General Aviation	Access	There is no direct impact on access for general aviation associated with this procedure. This procedure mimics the situation today, therefore, there is no impact on GA access compared to today's operations. This procedure is beneficial in terms of increased business aviation access to LBHA during periods of bad weather as it includes a lower approach minima as part of the RNP to ILS segment.

General Aviation / commercial airlines	Economic impact from increased effective capacity	LBHA may experience capacity limitations due to traffic volumes in the LTMA. This is present in today's operation and therefore no change to the impact is expected.
	Fuel burn	This procedure includes a more direct routing between OSVEV and the approach procedure prior to establishing at the FAF. This more direct routing means that aircraft are likely to fly fewer track miles and therefore less fuel burn will occur compared with those currently utilising the existing conventional procedure. While radar vectoring is likely to still be utilised for the majority of the time, the provision of a direct link between OSVEV and the approach procedure does facilitate the most efficient routing, and therefore has the possibility of reducing fuel burn when compared with the baseline scenario.
Commercial airlines	Training costs	Flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. No additional training costs are anticipated with this procedure. This represents no change to the Do Nothing scenario.
	Other costs	There are no anticipated additional costs associated with this procedure. This represents no change to the Do Nothing scenario.
Airport / Air navigation service provider	Infrastructure costs	The ongoing maintenance cost of the ILS and PAPIs will continue.
	Operational cost	Operational costs associated with implementing the new procedures relate to IFP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication are anticipated. Once implemented, the cost of ownership of this procedure is very low, requiring an IFP review of the procedure on a five yearly basis.
	Deployment costs	There will be some ATC training costs associated with the implementation of this procedure, but these are expected to be minimal.

	Safety	As this proposed option is a replication of the current radar vectoring arrival, there is no perceived additional safety concerns outside the parameters that exist today. There are no specific safety risks associated with this option. With specific reference to the PBN to ILS section of this option, possible hazards were identified that may lead to increased pilot workload or result in an aircraft failing to establish on the ILS. These are: • Mode switch from RNAV to ILS • Mode switch from ILS to RNAV on MAP Neither of these are anticipated to be a safety issue as there are suitable mitigating factors that would reduce the level of risk to as low as reasonably practicable.

2.5 RNP to ILS Approach Runway 21 Option Y

RNP to ILS Approach Runway 21 Option Z – a route from the Hold onto the ILS
A route from the Hold to intercept the ILS procedure. This procedure enables aircraft to re-join the approach from the Hold following a missed approach. The initial part of the procedure is required to allow aircraft to safely self-navigate and re-position to make a further approach to the airfield. It will only be utilised when radar vectors are not available from ATC and aircraft have carried out a Missed Approach Procedure from a previous approach. It is anticipated therefore that this procedure will be rarely used. Once aircraft have passed OSVEV from the Hold, the approach procedure becomes the same as the procedure described above (RNP to ILS Approach Runway 21 Option Z).

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	Although this procedure does not replicate the ground track that aircraft would follow currently when departing the Hold to join the existing VOR/DME approach, the route flown by aircraft, as shown in the figure below, generally remains within the current radar vector swathe and once beyond OSVEV, replicates the likely ground track for aircraft receiving radar vectors from OSVEV to intercept the ILS procedure. Therefore, the dispersion of traffic and therefore noise will be relatively similar to the baseline scenario. Although the initial turn when departing the Hold appears to take the aircraft out of the current swathe, the area overflown is still currently overflown by both arriving and departing aircraft so no new populations will be overflown with this procedure. In addition, this procedure will only be utilised when radar vectors are not available to be provided by ATC and aircraft have carried out a Missed Approach procedure from a previous approach. It is anticipated therefore that this procedure will be rarely used, so there will be no discernible change in the impact of noise from this procedure. 

	Air Quality	Like the existing procedure, the majority of local areas overflown are impacted when the aircraft is above 1,000 ft. Parts of Locksbottom and Farnborough are likely to be impacted as the aircraft will be at approximate 1,000 ft around 3 NM from touchdown. This will have the same impact as today's operations. In addition, today's operation involves the overflight of the Princess Royal University Hospital, 2 NM from touchdown; this is unavoidable to ensure a safe and stable approach is flown following the establishment at the FAF, as per today's operations. The location of the FAF and associated flight path thereafter will remain as close as possible to the baseline scenario, resulting in no change in terms of air quality. There will be no change to the impact on AQMA's from the baseline scenario as the position of aircraft below 1,000 ft on the approach to land will be the same as today's operations.
Wider Society	Greenhouse Gas impact	This procedure has longer track miles than aircraft would fly currently when departing the Hold to join the existing VOR/DME approach following a missed approach. However, the procedure will only be utilised when radar vectors are not available to be provided by ATC and aircraft have carried out a Missed Approach Procedure from a previous approach. It is anticipated therefore that this procedure will be rarely used , so this procedure is not expected to have any significant additional impact on emissions over today's operations.
	Capacity and resilience	There is no expected impact on capacity associated with this procedure. The inclusion of a PBN to ILS approach will have resilience benefits. In the event of poor visibility, aircraft would be able to utilise the PBN to ILS approach rather than a full PBN approach. Such an approach reduces the minimum descent height, allowing for more aircraft to operate into LBHA during low visibility.

	Tranquillity	Overflight of the boundary area of the Kent Downs AONB would occur by aircraft as they leave the Hold to carry out a further approach procedure, as shown in the figure below. Use of this procedure is likely to be rare as it will only be required when radar vectors are not available from ATC and aircraft have carried out a Missed Approach Procedure from a previous approach, therefore the impact on the AONB is deemed to be minimal.  The closest National Park (NP) to LBHA is South Downs NP, approximately 23 NM south of the airport. Due to this distance, there would be no impact on the South Downs NP from aircraft re-joining an approach procedure having executed a missed approach. This also represents no change to the Do Nothing scenario.
	Biodiversity	In general, airspace change proposals are unlikely to have an impact upon biodiversity because they do not involve ground-based infrastructure. Hence, there is no known impact in terms of biodiversity associated with this procedure. This includes inter alia terrestrial, marine and other aquatic ecosystems and the ecological complexes. Furthermore, there is no anticipated impact on any European Protected Species as outlined in the Conservation of Habitats and Species Regulations 2010 such as Bats, Great Crested Newts or other mammals as a direct result of this procedure due to the limited change involved.
General Aviation	Access	There is no direct impact on access for general aviation associated with this procedure. This procedure mimics the likely routing for aircraft receiving radar vectors to re-join the approach procedure following a missed approach, therefore there is no impact on GA access compared to today's operations. This procedure is beneficial in terms of increased business aviation access to LBHA during periods of bad weather as it includes lower approach minima as part of the RNP to ILS segment.
General Aviation /	Economic impact from increased effective capacity	As part of this procedure, LBHA may experience capacity limitations due to traffic volumes in the LTMA. This is present in today's operation and therefore no change to the impact is expected.

commercial airlines	Fuel burn	This procedure has longer track miles than aircraft would fly currently when departing the Hold to join the existing VOR/DME approach following a missed approach. However, the procedure will only be utilised when radar vectors are not available from ATC and aircraft have carried out a Missed Approach Procedure from a previous approach. It is anticipated therefore that this procedure will only be used rarely, so this procedure is not expected to have any significant additional impact on fuel burn over today's operations.
Commercial airlines	Training costs	Flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. No additional training costs are anticipated with this procedure. This represents no change to the Do Nothing scenario.
	Other costs	There are no anticipated additional costs associated with this procedure. This represents no change to the Do Nothing scenario.
Airport / Air navigation service provider	Infrastructure costs	The ongoing maintenance cost of the ILS and PAPIs will continue.
	Operational cost	Operational costs associated with implementing the new procedures relate to IFP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication are anticipated. Once implemented, the cost of ownership of this procedure is very low, requiring an IFP review of the procedure on a five yearly basis.
	Deployment costs	There will be some ATC training costs associated with the implementation of this procedure, but these are expected to be minimal.
	Safety	As this proposed option is similar to the current radar vectoring following a missed approach, there is no perceived additional safety concerns outside the parameters that exist today. There are no specific safety risks associated with this option. With specific reference to the PBN to ILS section of this option, possible hazards were identified that may lead to increased pilot workload or result in an aircraft failing to establish on the ILS. These are: • Mode switch from RNAV to ILS • Mode switch from ILS to RNAV on MAP Neither of these are anticipated to be a safety issue as there are suitable mitigating factors that would reduce the level of risk to as low as reasonably practicable.

2.6 MAP Do Nothing Baseline

<table>
<tr><td colspan="3">MAP Do Nothing Baseline - Today's Operation</td></tr>
<tr><td colspan="3">The current MAP is based on the BIG VOR, which is due to be removed. Aircraft turn right to BIG VOR and climb to not above 2,000 ft before leaving BIG VOR on a radial to enter the hold.</td></tr>
<tr><td>Group</td><td>Impact</td><td>Qualitative Assessment</td></tr>
<tr><td>Communities</td><td>Noise impact on health and quality of life</td><td>In today's operation, aircraft carry out the existing MAP (with no intervention) by climbing straight ahead to 2 NM and then make a right-hand turn, pass over LBHA at approximately 2,000 ft and enter the hold at ALKIN before establishing for another approach on the IAP. The use of the MAP is a rare occurrence, approximately 30 times annually. However, following completion of the initial segment of the MAP, aircraft are often provided with radar vectors to re-establish on approach, and aircraft do not follow the same ground track for each MAP event, as shown by the red Missed Approach tracks in the figure below. As a result, the full procedure is rarely used.
 

In terms of noise, due to the very nature of a MAP, aircraft typically fly at lower altitudes to recommence an approach using the IAP from the ALKIN hold. As this is such a rare occurrence, any noise impact of the MAP is minimal but it is acknowledged that communities within the immediate vicinity of LBHA would be overflown (as indicated by the blue shaded area in the figure below) and impacted by noise. However, for safety reasons (maintaining a stable climb-out), this is unavoidable.</td></tr>
</table>

	Air Quality	In the Do Nothing baseline scenario for the MAP, air quality below 1,000 ft is minimised other than for the areas in the immediate vicinity of LBHA such as farmland to the west of Biggin Hill village. However, this is unavoidable for safety reasons. As the procedure continues, more populated areas such as Locksbottom and Farnborough are overflown. Furthermore, in today's operation, as part of the MAP, the far easterly portion of the Croydon AQMA may be overflown. However, overflight of these areas is highly likely to be above 1,000 ft meaning the impact is minimal due to dispersion, as per CAP 1616.
Wider Society	Greenhouse Gas impact	Within the Do Nothing baseline scenario, the MAP is not the most direct track back to the ALKIN hold due to local airspace and capacity constraints. The current routing is practical when these constraints are considered.
	Capacity and resilience	The MAP has a theoretical minor impact on capacity with regards to arriving traffic that will also be enroute to ALKIN, however, due to the frequency of use of the MAP, this is rarely encountered in the practical application.
	Tranquillity	The existing MAP routes to the west of LBHA and then flies north, avoiding overflying the Kent Downs AONB. Due to the south westerly alignment of the runway, aircraft carrying out the MAP would likely fly close to the northerly portion of the Surrey Hills AONB, but not over it. This is unavoidable due to aircraft performance and airspace constraints. However, by this point, aircraft would likely be between 1,500 ft and 2,000 ft minimising the impact on this area. The closest National Park (NP) to LBHA is South Downs NP, approximately 23 NM south of the airport. Due to this distance, there will be no impact from the Do Nothing scenario on the South Downs NP.
	Biodiversity	In general, airspace change proposals are unlikely to have an impact upon biodiversity because they do not involve ground-based infrastructure. Hence, there is no known impact in terms of biodiversity associated with today's operation. This includes inter alia terrestrial, marine and other aquatic ecosystems and the ecological complexes.
General Aviation	Access	There is no direct impact on access for general aviation associated with today's operation as LBHA is in Class G airspace. The current MAP requires aircraft to fly within the immediate vicinity of Kenley airfield. However, the current frequency of use has not resulted in an adverse impact on gliding operations.
General Aviation /	Economic impact from increased effective capacity	In today's operation, LBHA may experience capacity limitations due to traffic volumes in the LTMA, but this is a rare event and has a limited impact on LBHA operations.

commercial airlines	Fuel burn	The existing MAP may not be the most direct routing back to the ALKIN hold, but it aims to reduce track mileage and fuel burn to as low as reasonably practical, given aircraft performance and local airspace constraints. Radar vectoring is also used during the existing MAP. Fuel burn is variable due to the radar vectoring that takes place.
Commercial airlines	Training costs	There are no direct training costs associated with the LBHA operation.
	Other costs	There are no direct additional costs associated with the LBHA operation.
Airport / Air navigation service provider	Infrastructure costs	There may be an additional infrastructure cost associated with the continuation of the VOR operation, should this be required.
	Operational cost	There are no anticipated additional operational costs unless an RNAV Substitution (under CAP 1781) is required.
	Deployment costs	There are no anticipated additional deployment costs unless an RNAV Substitution (under CAP 1781) is required.
	Safety	As the baseline scenario is the existing operation, it is assumed to be safe. LBHA has existing safety cases which are not expected to be impacted by any RNAV Substitution (under CAP 1781).

2.7 Missed Approach Procedure

Missed Approach Procedure
This Missed Approach Procedure is applicable to each of the approach procedure segments described in paragraphs 2.2 to 2.5 above. When executing a missed approach, aircraft will turn right initially, whilst remaining 2 NM clear of RAF Kenley, to route back through the airfield overhead. Aircraft then route south east initially before turning north to join the Hold at ALKIN. The Hold is flown clockwise based on the point ALKIN, which is the same as today.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	The initial portion of the MAP, until the aircraft passes overhead the airfield, mimics the existing MAP from Runway 21 and therefore there will be no change in the impact of aircraft noise. The new procedure differs from the existing MAP as the aircraft routes south east before turning north towards the Hold. Although this is different to the current situation, the areas overflown are already overflown by both arriving and departing aircraft, so there should be no discernible difference in the impact of noise from the baseline scenario. In addition, the new MAP routes further from Keston and avoids the built-up areas around Farnborough and Orpington, which may result in a slight reduction in noise. However, due to the small number of aircraft that are expected to execute the MAP, any change in noise impact is not expected to be discernible from the current situation. No new communities will be overflown by implementing this option. 
	Air Quality	As the initial part of this MAP mimics the existing MAP from Runway 21, there will likely be the same impact as occurs in the baseline scenario in terms of local air quality, especially as the areas overflown by aircraft at less than 1,000 ft are mainly all farmland to the west of Biggin Hill village. This procedure would overfly the eastern portion of the Croydon AQMA. However, aircraft are likely be above 1,000 ft, meaning the impact on local air quality is minimal due to dispersion, as per CAP1616.

Wider Society	Greenhouse Gas impact	This procedure has been designed to be the most practical MAP solution based on the applicable aircraft performance, airspace design and airspace capacity constraints and has been designed to be PANS-OPS compliant. Although steps have been taken to minimise track mileage to as low as practically possible, this procedure is longer than the existing procedure, so there is likely to be a small increase in CO_2 emissions associated with this procedure. However, due to the small number of aircraft that are expected to execute the MAP, there is not expected to be any significant change in emissions from the current situation.
	Capacity and resilience	This design mimics the current route and has minimal impact on subsequent arrivals as it utilises the overhead and does not impose inbound restrictions. This procedure provides an element of resilience as aircraft carrying out a missed approach do not interact with other arriving aircraft.
	Tranquillity	Due to the south westerly alignment of the runway, aircraft carrying out the MAP would likely fly close to the northerly portion of the Surrey Hills AONB, but not over it. This is unavoidable due to aircraft performance and airspace design constraints and aircraft would likely be between 1,500 ft and 2,000 ft minimising the impact on this area. This represents no change from the baseline scenario. Once aircraft pass through the airfield overhead and route south east then north, overflight of the Kent Downs AONB will occur. This impact is likely to be greater than the baseline scenario, but as the aircraft will be approximately 2,000 ft at this point, and the number of aircraft carrying out this procedure is expected to be low, the impact is considered to be minimal.  The closest National Park (NP) to LBHA is South Downs NP, approximately 23 NM south of the airport. Due to this distance, there will be no impact on the South Downs NP; this represents no change from the baseline scenario.

	Biodiversity	In general, airspace change proposals are unlikely to have an impact upon biodiversity because they do not involve ground-based infrastructure. Hence, there is no known impact in terms of biodiversity associated with the Missed Approach Procedure. This includes inter alia terrestrial, marine and other aquatic ecosystems and the ecological complexes. Furthermore, there is no anticipated impact on any European Protected Species as outlined in the Conservation of Habitats and Species Regulations 2010 such as Bats, Great Crested Newts or other mammals as a direct result of this procedure due to the limited change involved.
General Aviation	Access	This option mimics the situation today, therefore, there is no impact on general aviation access compared to today's operations. This procedure requires aircraft to fly within the immediate vicinity of Kenley airfield as with the baseline scenario and may have a very minor impact on gliding operations from this site. However, the procedure remains outside 2 NM from Kenley airfield, as requested by the airfield operator, therefore the impact is expected to be minimal.
General Aviation / commercial airlines	Economic impact from increased effective capacity	As part of this option, LBHA may experience capacity limitations due to traffic volumes in the LTMA. This is present in today's operation and therefore no impact is expected.
	Fuel burn	Although this may not be the most direct routing, this procedure aims to minimise fuel burn to as low as practically possible based on aircraft performance, airspace design and airspace capacity constraints. This procedure involves aircraft flying at 2,000 ft to deconflict with other inbound traffic to Runway 21. Additionally, it is anticipated that an element of radar vectoring may continue, so this full procedure will only be required when radar vectors are not available. Due to the small number of aircraft that are expected to execute the MAP, there is not expected to be any significant change in fuel burn from the current situation.
Commercial airlines	Training costs	Flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. No additional training costs are anticipated, this represents no change to the Do Nothing scenario.
	Other costs	There are no anticipated additional costs associated with this procedure.
Airport / Air navigation	Infrastructure costs	This procedure has no infrastructure costs.

service provider	Operational cost	Operational costs associated with implementing the new procedures relate to IFP design, validation (ground and airborne), safety assessment, airspace change and consultation, certification and publication are anticipated. Once implemented, the cost of ownership of these procedures is very low, requiring an IFP review of the procedure on a five yearly basis.
	Deployment costs	There will be some ATC training costs associated with the implementation of this procedure, but these are expected to be minimal.
	Safety	With specific reference to converting from an ILS approach to a PBN departure within this option, possible hazards were identified that may lead to increased pilot workload or result in an aircraft failing to re-establish on the PBN procedure following a missed approach. These are: • Mode switch from RNAV to ILS • Mode switch from ILS to RNAV on MAP Neither of these are anticipated to be a safety issue as there are suitable mitigating factors that would reduce the level of risk to as low as reasonably practicable.