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

Full 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)
AMSL	Above Mean Sea Level
ATC	Air Traffic Control
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CTR	Control Zone
CTA	Control Area
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
IFR	Instrument Flight Rules
ILS	Instrument Landing System (Ground based equipment)
LBHA	London Biggin Hill Airport
LCY	London City Airport
LNAV	Lateral Navigation (A Satellite based Approach)
LPV	Localiser Performance with Vertical Guidance (A Satellite based Approach)
MAP	Missed Approach Procedure
NATS	National Air Traffic Services



Acronym	Meaning
PANS-OPS	Procedures for Air Navigation Services – Aircraft Operations (Rules for designing instrument approach and departure procedures)
PBN	Performance Based Navigation (Satellite Navigation)
RNAV	Area Navigation (Satellite Navigation)
VNAV	Vertical Navigation (A Satellite based Approach)
VOR	VHF Omnidirectional Ranging Beacon (Ground based equipment)



1 Full 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 to the Stage 3 Gateway on the basis of this scaled approach, specifically the content of the Full Options Appraisal (FOA).

1.2 Full Options Appraisal

As identified in the Initial Options Appraisal submission accepted at the Stage 2 Gateway, this ACP is not expected to change the impacts over the ground when compared to the current operation. The expected up take of this procedure is expected to be 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 and was used only twice in 2022. 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 procedure, 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 qualitative assessment conducted during the Initial Options Appraisal for the following elements, that was completed at Stage 2 of the CAP 1616 process will form the Full Options Appraisal for this proposal, and is included at Appendix A1 to this document:

- LAeq and TAG
- 100% noise mode contours
- Nx contours
- Difference contours
- L_{max} spot point levels
- Annual CO₂
- CO₂ and TAG
- Local AQ



Per flight CO₂ quantitative analysis would be based on the length of the procedures and takes no account of utilisation. For this ACP the track distances are broken down into 3 parts; from OSVEV to ALKIN, ALKIN to the Threshold and OSVEV to the Threshold.

OSVEV to ALKIN

Currently there is no procedure between these 2 points. As explained in our Stage 2 documentation aircraft can arrive at ALKIN from any direction but do this predominantly from the OSVEV area; this is because the current network exit point is OSVEV. However, the vast majority of aircraft receive radar vectors in this area. There is no way to measure the distance flown other than to take a measurement directly between OSVEV and ALKIN. One of our remaining options, Option 2AD incorporates a link between OSVEV and ALKIN; this link is a straight line between these 2 points.

Consequently there is NO difference in terms of track miles/CO₂ burn between aircraft following the current VOR/DME procedure and either Option 2A (which would require radar vectors as today) or 2AD.

ALKIN to Threshold

The nominal length of the current VOR/DME procedure (ALKIN to Threshold) is 21.761 km but, by default of being a conventional procedure this is not completely representative of the actual distance flown. Consequently we have also had to account for the fix tolerances which give the shortest possible distance of 20.173 km and the longest possible distance of 24.099 km.

Option 2A and Option 2AD have exactly the same design from ALKIN to Threshold, this distance is 24.386 km, and will, due to the navigational standards provide a very accurate assessment of what will be flown.

OSVEV to Threshold

Option PE is a more direct track onto the Final Approach Fix for the ILS or a full satellite based Approach which does not route via ALKIN. The track length for this procedure is 23.957 km, and will, due to the navigational standards provide a very accurate assessment of what will be flown.

Track distance comparison

Implementation of either Option 2A or 2AD produces an increased track mileage of 2.25 km or 1.215 nm over the median averaged VOR/DME procedure. This is due to the design requirements for PBN procedures, as noted in our Stage 2 documentation, it is not possible to reduce track length and remain compliant. The increase in track mileage will produce an equivalent increase in CO₂ emissions per flight over the Do Nothing scenario. The increase in track mileage will be the same for both of these options being considered.

Implementation of Option PE is likely to result in fewer track miles flown than both the existing procedure and the alternate options as the distance shown above is from OSVEV and not ALKIN. The track distance is however, likely to be very similar to that flown by the majority of aircraft arriving at LBHA with radar vectors.

The MAP option mimics the existing MAP from Runway 21. Aircraft are expected to carry out the initial segments of the MAP and may then receive radar vectors to re-establish an approach as is the situation in the baseline scenario. There is no



expectation that aircraft will follow the same ground track for each MAP event and therefore the distances flown are likely to be very similar to today's operation.

There is no option to retain the current procedure, and the FOA work would not provide information that would help a stakeholder to make a choice between Option 2A or Option 2AD. Option PE is likely to realise benefits over Options 2A and 2AD due to the shorter track length, but is unlikely to show any benefit over the baseline option as it is very similar to the route flown by the majority of aircraft receiving radar vectors. In addition, the numbers that would be expected to fly this procedure are very small compared to the total number of arrivals so implementation of this procedure is unlikely to have any impact. Consequently, LBHA considers that any FOA work would be nugatory and disproportionate to the change being proposed.

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




A1 Options Appraisal

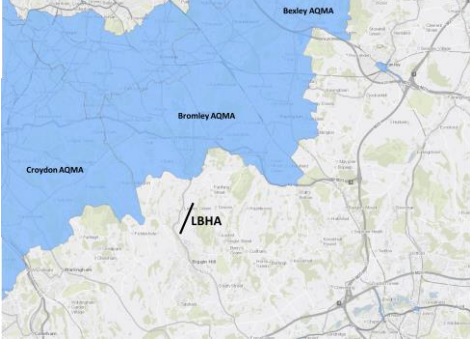
A1.1 Do Nothing Baseline

Option 1 - 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	<p>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.</p> <p>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 opposite. 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.</p> 
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	<p>Air Quality</p>	<p>The majority of local areas overflow 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.</p> <p>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.</p>  <p>The Air Quality Management Area's (AQMA) local to the airport are:</p> <ul style="list-style-type: none">• 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. <p>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).</p> <p>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.</p>
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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	<p>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.</p>  <p>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.</p>
	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 /	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.




commercial airlines	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 is no anticipated additional operational costs unless an RNAV Substitution (under CAP 1781) is required.
	Deployment costs	There is 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).

A1.2 Option 2A

Option 2A - VOR/DME Replication from ALKIN		
A direct track from ALKIN (the existing holding point) onto the Final Approach Fix for the ILS or a full satellite-based approach. This option requires a pilot to self-navigate to ALKIN to start the procedure, it does not link to the enroute network for arriving aircraft.		
Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	<p>Option 2A replicates as closely as possible, the existing VOR/DME approach. Therefore there will be very little change to tracks flown, meaning that the dispersion of traffic and therefore noise will be relatively similar to the baseline scenario.</p>  <p>Due to requirement for the pilot to self-navigate to ALKIN to start the procedure, the dispersion of traffic (and therefore the dispersion of the noise impact) will remain the same as the Do Nothing option. Within the swathe area shown in the figure above, aircraft will be below 3,000 ft. Aircraft between 3,000 ft and 7,000 ft will be the same as the Do Nothing option, hence there will be no change in impact. There will be no new areas overflown as a result of implementing this option.</p>
	Air Quality	<p>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 todays 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 todays 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.</p> <p>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 todays operations.</p>



Wider Society	Greenhouse Gas impact	As per the existing procedure, the majority of aircraft will leave the network in the vicinity of OSVEV and self-navigate for a PBN approach via ALKIN. This Option does not include a direct link from OSVEV to ALKIN, although aircraft would be effectively flying this anyway while self-positioning to ALKIN. In terms of emissions, this option produces an increased track mileage of 2.25 km or 1.215 nm over the median averaged VOR/DME procedure. This is due to the design requirements for PBN procedures. The increase in track mileage will produce an equivalent increase in CO ₂ emissions per flight over the Do Nothing scenario.
	Capacity and resilience	<p>This option has been designed to mimic the existing procedure in today's operation as opposed to optimising efficiency. There is no expected impact on capacity and resilience associated with this option. Additionally, following the removal of the VOR in December 2022 (or later as previously explained through CAP 1781 or commercial arrangement), this option provides resilience as an alternative to a solely ILS approach into LBHA.</p> <p>An element of this option does include a PBN to ILS approach which does 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.</p>
	Tranquillity	<p>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 ALKIN. 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.</p> <div style="display: flex; align-items: flex-start;">  <p>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.</p> </div>




	Biodiversity	<p>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.</p> <p>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.</p>
General Aviation	Access	There is no direct impact on access for general/business aviation associated with this option. This option 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. This option is beneficial in terms of increased business aviation access to LBHA during periods of bad weather as this option includes lower approach minima as part of the PBN to ILS segment.
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	As this option is a direct replication of what already exists, there will be no expected additional impact in terms of fuel burn.
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 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 costs of ownership of these procedures is very low, requiring maintenance of the procedure on a five yearly basis.



	Deployment costs	There is no perceived deployment costs associated with this option.
	Safety	<p>As this proposed option is a replication of the existing VOR/DME approach, the only hazard identified with this option is the lack of radar vectoring between OSVEV and ALKIN, which is currently provided by NATS Thames Director. However, in the event of a communications failure, this is unavailable, leading to an increase in pilot workload. This can be mitigated through standard loss of communication procedures.</p> <p>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:</p> <ul style="list-style-type: none">• Mode switch from RNAV to ILS• Mode switch from ILS to RNAV on MAP <p>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. In addition, it is considered that Thames Director aligning their provision of service hours with the LBHA opening hours provides mitigation to this potential issue.</p>


A1.3 Option 2AD

Option 2AD - VOR/DME Replication direct from OSVEV		
A direct track from OSVEV, via ALKIN, onto the Final Approach Fix for the ILS or a full satellite based Approach. This design is exactly the same as the previous option with an additional section between ALKIN and OSVEV that results in connectivity with the enroute network.		
Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	As this option replicates, as closely as possible, the existing VOR/DME approach, there should be very little change to tracks flown, meaning that the dispersion of traffic and therefore noise will be relatively similar to the baseline scenario. This option provides a direct link between OSVEV and ALKIN, reducing the need for radar vectors between these waypoints, which is unlikely to impact the noise footprint or numbers overflow. 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 overflow as a result of implementing this option.
		



	Air Quality	<p>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.</p> <p>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.</p>
	Greenhouse Gas impact	<p>This option includes a direct routing between OSVEV and ALKIN prior to establishing at the FAF. This more direct routing means that aircraft will start the procedure from OSVEV rather than ALKIN, but effectively still fly in the same area when compared to the baseline scenario. In terms of emissions, this option produces an increased track mileage of 2.25 km or 1.215 nm over the median averaged VOR/DME procedure. This is due to the design requirements for PBN procedures. The increase in track mileage will produce an equivalent increase in CO₂ emissions per flight over the Do Nothing scenario.</p>
Wider Society	Capacity and resilience	<p>This option has been designed to mimic the existing procedure in today's operation as opposed to optimising efficiency. There is no expected impact on capacity and resilience associated with this option. As this option includes a direct link from OSVEV to ALKIN, it is deemed more efficient than Option 2A. Additionally, following the removal of the VOR in December 2022 (or later as previously explained through CAP 1781 or commercial arrangement), this option provides resilience as an alternative to a solely ILS approach into LBHA.</p> <p>An element of this option does include a PBN to ILS approach which does 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.</p>



	<p>Tranquillity</p>	<p>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.</p>  <p>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.</p>
	<p>Biodiversity</p>	<p>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.</p> <p>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.</p>
<p>General Aviation</p>	<p>Access</p>	<p>There is no direct impact on access for general/business aviation associated with this option. This option 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. This option is beneficial in terms of increased business aviation access to LBHA during periods of bad weather as this option includes lower approach minima as part of the PBN to ILS segment.</p>




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 option includes a more direct routing between OSVEV and ALKIN prior to establishing at the FAF. While radar vectoring is likely to still be utilised for the majority of the time, the provision of a direct link between OSVEV and ALKIN does facilitate the most efficient routing between the 2 points, and therefore has the possibility of reducing fuel burn, for a very small number of aircraft (if the air traffic situation allows) when compared with the baseline scenario. Additionally, since Option 2AD and Option 2A do not start from the same point, a direct fuel burn comparison cannot be made.
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 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 costs of ownership of these procedures is very low, requiring maintenance of the procedure on a five yearly basis.
	Deployment costs	There is no perceived deployment costs associated with this option.

	Safety	<p>As this proposed option is a replication of the existing VOR/DME approach, there is no perceived additional safety concerns outside the parameters that exist today. There are no specific safety risks associated with this option.</p> <p>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:</p> <ul style="list-style-type: none"> • Mode switch from RNAV to ILS • Mode switch from ILS to RNAV on MAP <p>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. In addition, it is considered that Thames Director aligning their provision of service hours with the LBHA opening hours provides mitigation to this potential issue.</p>
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A1.4 Option PE

Option PE – a revised route from OSVEV onto the approach procedure		
<p>A more direct track from OSVEV onto the Final Approach Fix for the ILS or 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, which includes a 30° intercept of the Final Approach Fix. 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. This is our preferred option as it has connectivity with the existing Arrivals procedure via OSVEV and minimises the impact on London City Airport operations.</p>		
Group	Impact	Qualitative Assessment



Communities	Noise impact on health and quality of life	<p>Although this option 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 option 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 overflowed as a result of implementing this option.</p> 
	Air Quality	<p>Like the existing procedure, the majority of local areas overflowed 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.</p> <p>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.</p>
Wider Society	Greenhouse Gas impact	<p>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 the previous options, but effectively still 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.</p>



	Capacity and resilience	<p>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 and resilience associated with this option. As this option includes a more direct link from OSVEV to the approach procedure, it is deemed more efficient than the previous options. Additionally, following the removal of the VOR in December 2022 (or later as previously explained through CAP 1781 or commercial arrangement), this option provides resilience as an alternative to a solely ILS approach into LBHA.</p> <p>An element of this option does include a PBN to ILS approach which does 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.</p>
	Tranquillity	<p>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.</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>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.</p> </div> </div>




	Biodiversity	<p>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.</p> <p>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.</p>
General Aviation	Access	<p>There is no direct impact on access for general/business aviation associated with this option. This option 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. This option is beneficial in terms of increased business aviation access to LBHA during periods of bad weather as this option includes lower approach minima as part of the PBN to ILS segment.</p>
General Aviation / commercial airlines	Economic impact from increased effective capacity	<p>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.</p>
	Fuel burn	<p>This option includes a more direct routing between OSVEV and the approach procedure prior to establishing at the FAF. 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, for a very small number of aircraft (if the air traffic situation allows) when compared with the baseline scenario.</p>
Commercial airlines	Training costs	<p>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.</p>
	Other costs	<p>There are no anticipated additional costs associated with this option. This represents no change to the Do Nothing scenario.</p>
Airport / Air navigation	Infrastructure costs	<p>The ongoing maintenance cost of the ILS and PAPIs will continue.</p>



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 costs of ownership of these procedures is very low, requiring maintenance of the procedure on a five yearly basis.
	Deployment costs	There is no perceived deployment costs associated with this option.
	Safety	<p>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.</p> <p>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:</p> <ul style="list-style-type: none"> • Mode switch from RNAV to ILS • Mode switch from ILS to RNAV on MAP <p>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. In addition, it is considered that Thames Director aligning their provision of service hours with the LBHA opening hours provides mitigation to this potential issue.</p>

A1.5 MAP Do Nothing Baseline

Option 8 - MAP Do Nothing Baseline - Today's Operation		
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.		
Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	<p>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.</p>  <p>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 overflowed (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.</p>

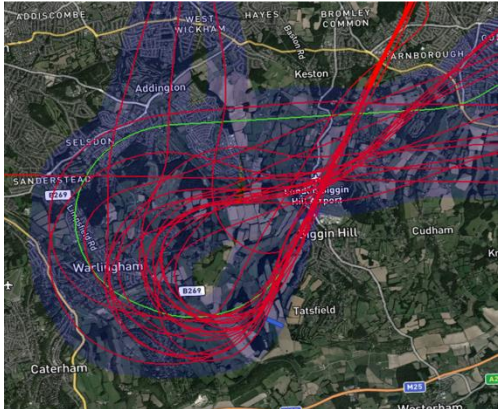


	Air Quality	In the Do Nothing baseline scenario for the MAP, air quality below 1,000 ft is minimised other than for the areas in the immediate vicinity of LBHA such as farmland to the west of Biggin Hill village. However, this is unavoidable for safety reasons. As the procedure continues, more populated 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/business 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 is no anticipated additional operational costs unless an RNAV Substitution (under CAP 1781) is required.
	Deployment costs	There is 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).

A1.6 Option 9

Option 9 - MAP Do Minimum Option		
Mimics the current right turn MAP to ALKIN (via the LBHA overhead), although with different protection areas due to the PBN design criteria.		
Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	<p>As this MAP option mimics the existing MAP from Runway 21 there will be a limited impact in terms of the disruption of aircraft noise. Aircraft are expected to carry out the initial segments of the MAP and may then receive radar vectors to re-establish an approach as is the situation in the baseline scenario and there is no expectation that aircraft will follow the same ground track for each MAP event. However, due to design regulation constraints, the protection areas will differ to the existing procedure. Furthermore, once the aircraft has reached ALKIN, the holding pattern will be slightly different to the extant procedure which may have a minor impact on noise dispersion.</p> <p>No new communities will be overflown by implementing this option.</p> 



	Air Quality	As this MAP option 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 overflowed by aircraft at less than 1,000 ft are mainly all farmland to the west of Biggin Hill village. Providing this MAP option would mean that the dispersion of aircraft carrying out a MAP would remain to the west of Biggin Hill village. This option would overfly the eastern portion of the Croydon AQMA. However, aircraft are likely to 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	As this MAP option mimics the existing MAP from Runway 21 there will be a limited impact in terms of CO ₂ emissions as it is designed to be the most practical MAP solution based on the applicable aircraft performance, airspace design and airspace capacity constraints. Therefore, the CO ₂ emissions associated with this option would be expected to have the same impact as that occurring in the baseline scenario and steps have been taken to minimise track mileage to as low as practically possible.
	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 option provides an element of resilience as aircraft carrying out a missed approach do not interact with other arriving aircraft.
	Tranquillity	Like the existing MAP, this option 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 design 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 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 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	This option mimics the situation today, therefore, there is no impact on general/business aviation access compared to today's operations. Business aviation aircraft that operate to/from LBHA are already equipped to fly PBN approaches. This option 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 expected frequency of the use of this MAP is very low, therefore, in reality the impact is expected to be minimal. A LOA/MOU could be used to mitigate the impact further.
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 option mimics the existing MAP and aims to minimise fuel burn to as low as practically possible based on aircraft performance, airspace design and airspace capacity constraints. This option involves aircraft flying the procedure 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. This represents no change from the Do Nothing 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 option. This represents no change to the Do Nothing scenario.
	Other costs	There are no anticipated additional costs associated with this option.
Airport / Air navigation service provider	Infrastructure costs	This options has no infrastructure costs.
	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 costs of ownership of these procedures is very low, requiring maintenance of the procedure on a five yearly basis.
	Deployment costs	There is no perceived deployment costs associated with this option.



	Safety	<p>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:</p> <ul style="list-style-type: none">• Mode switch from RNAV to ILS• Mode switch from ILS to RNAV on MAP <p>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. In addition, it is considered that Thames Director aligning their provision of service hours with the LBHA opening hours provides mitigation to this potential issue.</p>
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