



# ***AIRSPACE MODERNISATION AIRSPACE CHANGE PROPOSAL***

## ***STEP 2B INITIAL OPTIONS APPRAISAL***

### ***APPENDIX B***

#### ***PBN ARRIVALS Runway 27L - Part 1***



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All airspace design options in this document are subject to change throughout the airspace change process, as options are matured in detail and refined in accordance with safety requirements, design principles, appraisals and stakeholder engagement and consultation.



# **Initial Options Appraisal**

## **PBN Arrivals**

### **Runway 27L**



All airspace design options in this document are subject to change throughout the airspace change process, as options are matured in detail and refined in accordance with safety requirements, design principles, appraisals and stakeholder engagement and consultation.

Version 1.0 (July 2023)

PBN Arrivals – Runway (RWY) 27L Baseline  
‘Do Nothing’

Option Description

This represents the baseline for Doing Nothing with 27L arrivals in the 0430-0600 period. The image represents the areas overflowed at least once per day on average by 27L arrivals in 2019, 0430-0600.



Communities – Noise impact on health & quality of life

Metric	Option Value	Difference to Baseline
Population above Partial LOAEL (daytime, LA <sub>eq</sub> , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA <sub>eq</sub> , 8h)	642,300	N/A
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	1,131,900	N/A

Communities - Air Quality

As this is the Baseline ‘Do Nothing’, there is no change to Air Quality.

Wider Society – Greenhouse Gas Impact

Metric	Option Value	Difference to Baseline
Overall Track Miles (nm) of all routes	427	N/A

Wider Society – Tranquillity & Biodiversity

Metric	Option Value	Difference to Baseline
Total Area of AONBs/National Parks (NPs) overflowed between 0-7000ft once a day on average (night-time)	0km <sup>2</sup>	N/A
Total Area of AONBs/NPs overflowed experiencing at least one event of N60 on average (night-time)	0km <sup>2</sup>	N/A
Total Area of Richmond Park overflowed between 0-7000ft at least once a day on average (night-time)	0km <sup>2</sup>	N/A
Number of sites (RAMSAR, SAC, SPA, SSSI) overflowed between 0-1640ft which observe a potential change in location overflowed	N/A	N/A
Number of sites (RAMSAR, SAC, SPA, SSSI) overflowed between 0-3000ft which observe a potential change in location overflowed	N/A	N/A

Wider Society – Capacity/Resilience

Arrival throughput is not a concern 0430-0600.

Heathrow's capacity for this ACP is limited by the existing 480,000 movement cap.

General Aviation (GA) – Access

No additional Controlled Airspace (CAS) required.  
Option would not facilitate the release of CAS.  
Option not expected to impact existing helicopter routes.



**General Aviation / Commercial Airlines – Economic impact from increased effective capacity**

As this is the Baseline ‘Do Nothing’ there is no economic effect expected on GA or Commercial Airline operations.

Arrival delay is not an issue during the 0430-0600 period.

**General Aviation / Commercial Airlines – Fuel Burn**

Change in Fuel Burn (annual - tonnes)	No change
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**Commercial Airlines – Training costs**

Option does not require any re-equipage or upgrade costs for airlines. No training costs required for airlines.

**Commercial Airlines – Other costs**

None identified.

**Airport/Air Navigation Service Provider (ANSP) – Infrastructure costs**

Doing nothing means no changes to infrastructure costs.

**Airport/ANSP – Operational costs**

Doing nothing means no change to operational costs.

**Airport/ANSP – Deployment costs**

Doing nothing mean no deployment costs.

**Safety**

Doing nothing means no Instrument Flight Procedure (IFP) design considerations.

**Adherence to Airspace Modernisation Strategy (AMS)**

Doing nothing with Westerly arrivals will not align with the AMS. It will not enable environmental benefits, increase airspace capacity, reduce noise impacts or maximise benefits from NERL’s re-design of the London Terminal Manoeuvring Area (LTMA). No change and therefore no ACP submission will not enable enhancements to safety, enhanced integration or reductions in the volume of CAS.

**Interdependencies, Conflicts & Trade-Offs**

Option may result in conflicts/interdependencies with Gatwick Airport’s options.

**Outcome of PBN Arrival RWY27L Baseline ‘Do Nothing’**

The Baseline (Do Nothing) Option was discontinued during the Design Principles Evaluation (DPE) phase of Stage 2, owing to the option not meeting the objectives set by the Airspace Modernisation Strategy (AMS).

**OPTION DISCONTINUED (During DPE)**



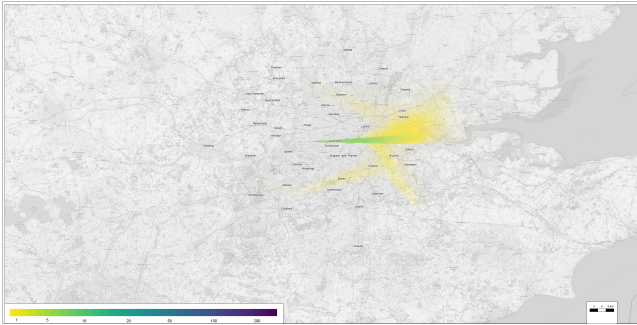
# CAP1616 - INITIAL OPTIONS APPRAISAL – SUPPLEMENTARY METRICS

## PBN Arrivals – RWY 27L Do Nothing (Night)

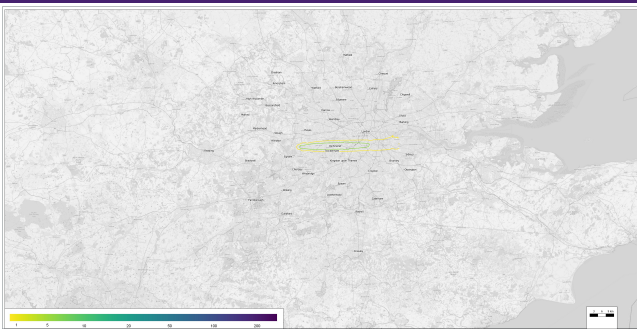


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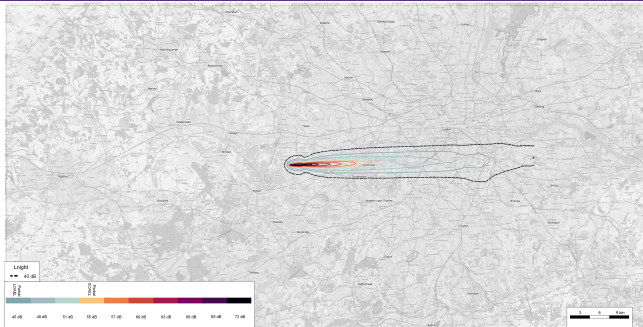
### Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Do Nothing	
≥ 1	873,200	873,200	
≥ 5	297,500	297,500	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	


### Aircraft Noise Events

Rate	Population experiencing noise events above N60 each day		N60 events contour map
	Baseline	Do Nothing	
≥ 1	1,131,900	1,131,900	
≥ 5	420,500	420,500	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	

### Noise Exposures

Population count	Baseline	Do Nothing	Partial LOAEL contour map
Estimated total population above 40 dB $L_{Aeq,1.5h}$	1,283,300	1,283,300	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$ )	642,300	642,300	

### Noise Exposure Change

Change in Noise Exposure	Population experiencing at least 1 dB reduction within partial LOAEL or brought out of partial LOAEL	Population experiencing no change in noise exposure within partial LOAEL	Population experiencing at least 1 dB increase within partial LOAEL or brought into partial LOAEL	Change in noise exposure map
Partial LOAEL	0 (0 brought out of Partial LOAEL by Option)	0	0 (0 brought into Partial LOAEL by Option)	





PBN Arrivals – RWY 27L Option A

Option Description

This option was developed to address DP2. This option assumes a single PBN arrival track used for all RWY27L arrivals capable of RNP-AR during the 0430-0600 period from BEDEK, TOBID, LOGAN & BEGTO.



Communities – Noise impact on health & quality of life

Metric	Option Value	Difference to Baseline
Population above Partial LOAEL (daytime, LA <sub>eq</sub> , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA <sub>eq</sub> , 8h)	257,500	-384,800
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	486,500	-645,400

Communities - Air Quality

As there is no change to track distribution below 1000ft, there is no effect on Air Quality from this option.

Wider Society – Greenhouse Gas Impact

Metric	Difference to Baseline
Track Miles of the routes used (nm)	-23

Wider Society – Tranquillity & Biodiversity

Metric	Option Value	Difference to Baseline
Total Area of AONBs/National Parks (NPs) overflown between 0-7000ft once a day on average (night-time)	0km <sup>2</sup>	No change
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	0km <sup>2</sup>	No change
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	Less than 1km <sup>2</sup>	Less than 1km <sup>2</sup>
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-1640ft which observe a potential change in location overflown	0	No change
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-3000ft which observe a potential change in location overflown	5	+5

Wider Society – Capacity/Resilience

Arrival throughput not of concern 0430-0600. A single or multiple PBN route could handle the low number of arrivals in this period if required.

There is no distinguishing difference between any option regards arrival throughput. Any aircraft not RNP-AR equipped would have another PBN route to rely on.

Heathrow's capacity for this ACP is limited by the existing 480,000 movement cap.

General Aviation – Access

No additional CAS required.

Option would not facilitate the release of CAS.

Option may impact existing helicopter routes, further work is required to understand if there is an impact on route H3.



**General Aviation / Commercial Airlines –  
Economic impact from increased effective  
capacity**

No economic effect expected on GA operations.

Arrival delay is not an issue during the 0430-0600 period. Use of PBN arrivals during this time would be for noise mitigation purposes only. PBN arrivals in this time will not affect delay performance. There is no distinguishing difference between any option regards arrival delay.

**General Aviation / Commercial  
Airlines – Fuel Burn**

Change in Fuel  
Burn (compared  
to the Baseline -  
annual - tonnes)

Not able to quantify  
at this time, owing  
to uncertainty in  
new stack locations

**Commercial Airlines – Other costs**

None identified.

**Commercial Airlines – Training costs**

This option would require RNP-AR capability and approvals. This can come with significant costs for airlines, however, it is unknown at this time whether RNP-AR route options would be progressed in isolation i.e. without other arrival procedures being available. Should an RNP-AR arrival be mandatory, there may be additional costs for some operators. This will be quantified in Stage 3.

**Airport/Air Navigation Service Provider (ANSP) –  
Infrastructure costs**

Option may require re-location and/or addition of Noise Monitoring Terminals.

**Airport/ANSP – Operational costs**

This option is not anticipated to change airport nor ANSP operational costs. Heathrow will continue to require ILS and other ground based infrastructure even with the implementation of PBN arrival procedures.

Option may lead to a change in the number of properties eligible for the noise insulation scheme) which could lead to a change in operational costs for the airport.

**Airport/ANSP – Deployment costs**

There will be considerable costs associated with deployment in terms of operational training and system upgrades which will be quantified in Stage 3. However, there is not expected to be any differences in these costs between the different options.

**Safety**

There are no IFP design issues identified with this option however, there are no RNP-AR arrivals published in the UK at this time. Therefore additional considerations may arise through the regulatory approval process.

Although new or revised safety assurances may be needed, an acceptable safety argument is envisaged to be achievable.

**Interdependencies, Conflicts & Trade-Offs**

Option not expected to interact with other airports' options.

**Adherence to AMS**

Supports the AMS through increased systemisation and meeting the Governments key environmental objectives by utilising PBN. The use of PBN arrivals has been appraised at this stage during periods where the landing rate is less critical. PBN arrivals in a system design might enable simplification, safety, efficiency and resilience enhancements and/or provide respite opportunities.

**Outcome of PBN Arrival RWY27L Option A**

Option A provides significant reductions against all the noise metrics. It indicates a decrease in track miles when compared with the Baseline and no overflight of AONBs or NPs.

The option indicates a small increase in Richmond Park overflight and a significant number of biodiversity sites between 0-3000ft that may experience a change in location overflight. This option will be explored further in Stage 3.

**OPTION CARRIED FORWARD TO STAGE 3**



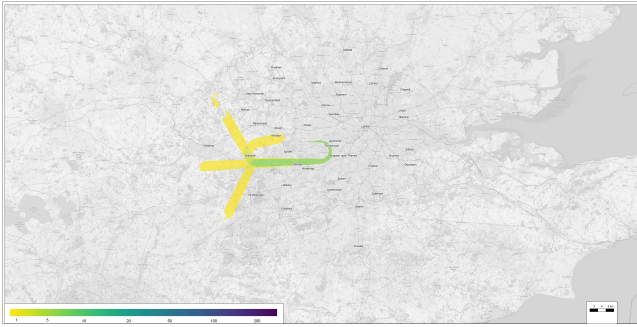
# CAP1616 - INITIAL OPTIONS APPRAISAL – SUPPLEMENTARY METRICS

## PBN Arrivals – RWY 27L Option A (Night)

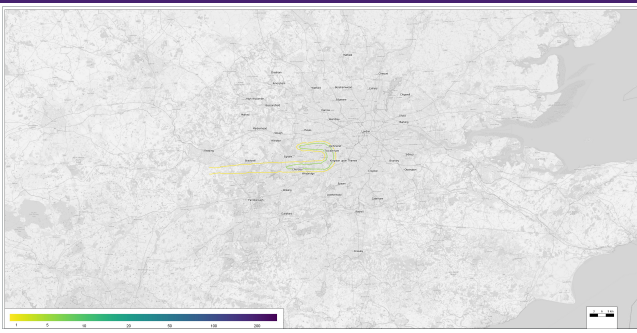


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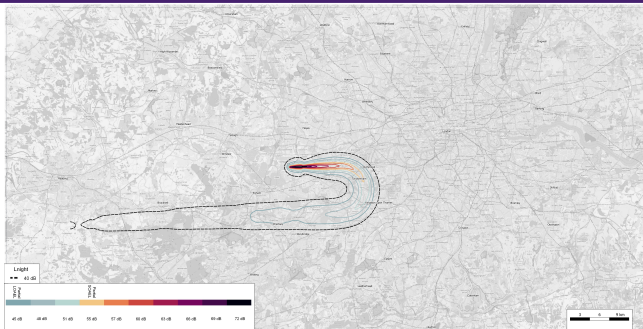
### Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option A	
≥ 1	873,200	375,200	
≥ 5	297,500	133,400	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	


### Aircraft Noise Events

Rate	Population experiencing noise events above N60 each day		N60 events contour map
	Baseline	Option A	
≥ 1	1,131,900	486,500	
≥ 5	420,500	220,000	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	

### Noise Exposures

Population count	Baseline	Option A	Partial LOAEL contour map
Estimated total population above 40 dB $L_{Aeq,1.5h}$	1,283,300	516,900	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$ )	642,300	257,500	

### Noise Exposure Change

Change in Noise Exposure	Population experiencing at least 1 dB reduction within partial LOAEL or brought out of partial LOAEL	Population experiencing no change in noise exposure within partial LOAEL	Population experiencing at least 1 dB increase within partial LOAEL or brought into partial LOAEL	Change in noise exposure map
Partial LOAEL	150,400 (of which 132,800 brought out of Partial LOAEL by Option)	86,200	153,700 (of which 115,900 brought into Partial LOAEL by Option)	
				



PBN Arrivals – RWY 27L Option B

Option Description

This option was developed to address DP2. This option assumes a single PBN arrival track used for all RWY27L arrivals capable of RNP-AR during the 0430-0600 period from ALESO.



Communities – Noise impact on health & quality of life

Metric	Option Value	Difference to Baseline
Population above Partial LOAEL (daytime, LA <sub>eq</sub> , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA <sub>eq</sub> , 8h)	260,200	-382,100
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	428,700	-703,200

Communities - Air Quality

As there is no change to track distribution below 1000ft, there is no effect on Air Quality from this option.

Wider Society – Greenhouse Gas Impact

Metric	Difference to Baseline
Track Miles of the routes used (nm)	+11

Wider Society – Tranquillity & Biodiversity

Metric	Option Value	Difference to Baseline
Total Area of AONBs/National Parks (NPs) overflown between 0-7000ft once a day on average (night-time)	49km <sup>2</sup>	+49km <sup>2</sup>
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	2km <sup>2</sup>	+2km <sup>2</sup>
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	4km <sup>2</sup>	4km <sup>2</sup>
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-1640ft which observe a potential change in location overflown	0	No change
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-3000ft which observe a potential change in location overflown	6	+6

Wider Society – Capacity/Resilience

Arrival throughput not of concern 0430-0600. A single or multiple PBN route could handle the low number of arrivals in this period if required.

There is no distinguishing difference between any option regards arrival throughput. Any aircraft not RNP-AR equipped would have another PBN route to rely on.

Heathrow's capacity for this ACP is limited by the existing 480,000 movement cap.

General Aviation – Access

No additional CAS required.

Option would not facilitate the release of CAS.

Option may impact existing helicopter routes, further work is required to understand if there is an impact on route H3/H7.





**General Aviation / Commercial Airlines – Economic impact from increased effective capacity**

No economic effect expected on GA operations.

Arrival delay is not an issue during the 0430-0600 period. Use of PBN arrivals during this time would be for noise mitigation purposes only. PBN arrivals in this time will not affect delay performance. There is no distinguishing difference between any option regards arrival delay.

**General Aviation / Commercial Airlines – Fuel Burn**

Change in Fuel Burn (compared to the Baseline - annual - tonnes)

Not able to quantify at this time, owing to uncertainty in new stack locations

**Commercial Airlines – Training costs**

This option would require RNP-AR capability and approvals. This can come with significant costs for airlines, however, it is unknown at this time whether RNP-AR route options would be progressed in isolation i.e. without other arrival procedures being available. Should an RNP-AR arrival be mandatory, there may be additional costs for some operators. This will be quantified in Stage 3.

**Airport/Air Navigation Service Provider (ANSP) – Infrastructure costs**

Option may require re-location and/or addition of Noise Monitoring Terminals.

**Airport/ANSP – Deployment costs**

There will be considerable costs associated with deployment in terms of operational training and system upgrades which will be quantified in Stage 3. However, there is not expected to be any differences in these costs between the different options.

**Safety**

There are no IFP design issues identified with this option however, there are no RNP-AR arrivals published in the UK at this time. Therefore additional considerations may arise through the regulatory approval process.

Although new or revised safety assurances may be needed, an acceptable safety argument is envisaged to be achievable.

**Interdependencies, Conflicts & Trade-Offs**

Option may result in conflicts/interdependencies with Gatwick's options.

**Commercial Airlines – Other costs**

None identified.

**Airport/ANSP – Operational costs**

This option is not anticipated to change airport nor ANSP operational costs. Heathrow will continue to require ILS and other ground based infrastructure even with the implementation of PBN arrival procedures.

Option may lead to a change in the number of properties eligible for the noise insulation scheme) which could lead to a change in operational costs for the airport.

**Adherence to AMS**

Supports the AMS through increased systemisation and meeting the Governments key environmental objectives by utilising PBN. The use of PBN arrivals has been appraised at this stage during periods where the landing rate is less critical. PBN arrivals in a system design might enable simplification, safety, efficiency and resilience enhancements and/or provide respite opportunities.

**Outcome of PBN Arrival RWY27L Option B**

Option B significantly reduces the population above the Partial LOAEL (night) and the population experiencing at least one N60 (night) noise event when compared to the Baseline.

The option indicates significant increases in overflight of AONBs, NPs and Richmond Park and a number of biodiversity sites between 0-3000ft may experience a change in location overflown. It indicates an increase in track miles. This option will be explored further in Stage 3.

**OPTION CARRIED FORWARD TO STAGE 3**



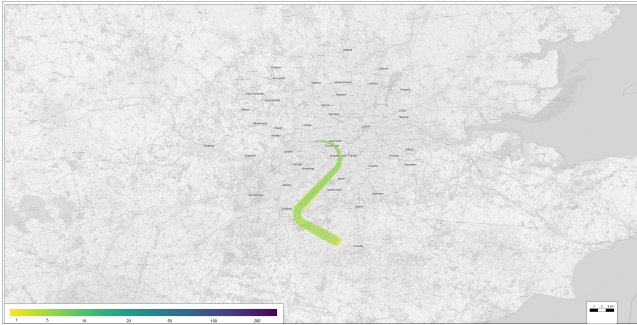
# CAP1616 - INITIAL OPTIONS APPRAISAL – SUPPLEMENTARY METRICS

## PBN Arrivals – RWY 27L Option B (Night)

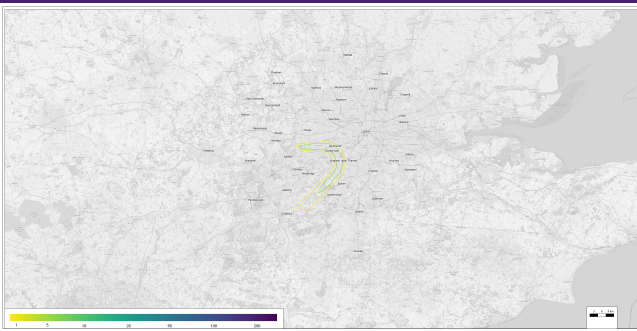


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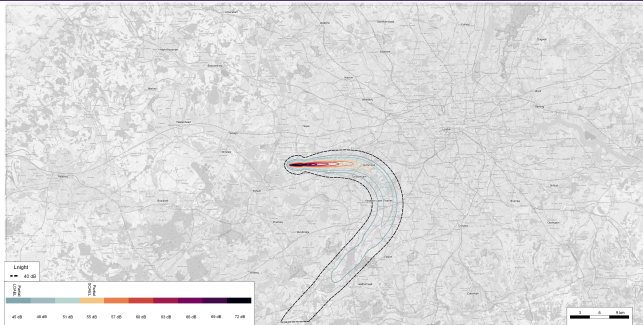
### Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option B	
≥ 1	873,200	135,800	
≥ 5	297,500	119,100	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	

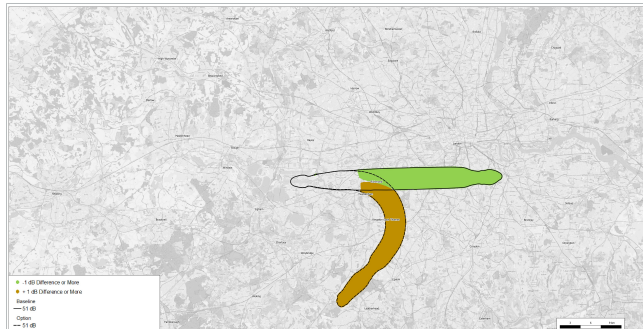
### Aircraft Noise Events

Rate	Population experiencing noise events above N60 each day		N60 events contour map
	Baseline	Option B	
≥ 1	1,131,900	428,700	
≥ 5	420,500	214,300	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	

### Noise Exposures

Population count	Baseline	Option B	Partial LOAEL contour map
Estimated total population above 40 dB $L_{Aeq,1.5h}$	1,283,300	477,800	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$ )	642,300	260,200	

### Noise Exposure Change

Change in Noise Exposure	Population experiencing at least 1 dB reduction within partial LOAEL or brought out of partial LOAEL	Population experiencing no change in noise exposure within partial LOAEL	Population experiencing at least 1 dB increase within partial LOAEL or brought into partial LOAEL	Change in noise exposure map
Partial LOAEL	258,300 (of which 242,800 brought out of Partial LOAEL by Option)	107,800	136,900 (of which 115,700 brought into Partial LOAEL by Option)	
				



PBN Arrivals – RWY 27L Option C

Option Description

This option was developed to address DP2. This option assumes a single PBN arrival track used for all RWY27L arrivals during the 0430-0600 period from ALESO, BEDEK, TOBID, LOGAN & BEGTO.



Communities – Noise impact on health & quality of life

Metric	Option Value	Difference to Baseline
Population above Partial LOAEL (daytime, LA <sub>eq</sub> , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA <sub>eq</sub> , 8h)	471,000	-171,300
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	816,200	-315,700

Communities - Air Quality

As there is no change to track distribution below 1000ft, there is no effect on Air Quality from this option.

Wider Society – Greenhouse Gas Impact

Metric	Difference to Baseline
Track Miles of the routes used (nm)	+3

Wider Society – Tranquillity & Biodiversity

Metric	Option Value	Difference to Baseline
Total Area of AONBs/National Parks (NPs) overflown between 0-7000ft once a day on average (night-time)	15km <sup>2</sup>	+15km <sup>2</sup>
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	6km <sup>2</sup>	+6km <sup>2</sup>
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	0km <sup>2</sup>	No change
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-1640ft which observe a potential change in location overflown	0	No change
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-3000ft which observe a potential change in location overflown	0	No change

Wider Society – Capacity/Resilience

Arrival throughput not of concern 0430-0600. A single or multiple PBN route could handle the low number of arrivals in this period if required.

There is no distinguishing difference between any option regards arrival throughput. Any aircraft not RNP-AR equipped would have another PBN route to rely on.

Heathrow's capacity for this ACP is limited by the existing 480,000 movement cap.

General Aviation – Access

No additional CAS required.

Option would not facilitate the release of CAS.

Option not expected to impact existing helicopter routes.



## General Aviation / Commercial Airlines – Economic impact from increased effective capacity

No economic effect expected on GA operations.

Arrival delay is not an issue during the 0430-0600 period. Use of PBN arrivals during this time would be for noise mitigation purposes only. PBN arrivals in this time will not affect delay performance. There is no distinguishing difference between any option regards arrival delay.

## General Aviation / Commercial Airlines – Fuel Burn

Change in Fuel Burn (compared to the Baseline - annual - tonnes)

Not able to quantify at this time, owing to uncertainty in new stack locations

## Commercial Airlines – Training costs

Option does not require any re-equipage or upgrade costs for airlines. No training costs required for airlines.

## Commercial Airlines – Other costs

None identified.

## Airport/Air Navigation Service Provider (ANSP) – Infrastructure costs

Option may require re-location and/or addition of Noise Monitoring Terminals.

## Airport/ANSP – Operational costs

This option is not anticipated to change airport nor ANSP operational costs. Heathrow will continue to require ILS and other ground based infrastructure even with the implementation of PBN arrival procedures.

Option may lead to a change in the number of properties eligible for the noise insulation scheme) which could lead to a change in operational costs for the airport.

## Airport/ANSP – Deployment costs

There will be considerable costs associated with deployment in terms of operational training and system upgrades which will be quantified in Stage 3. However, there is not expected to be any differences in these costs between the different options.

## Safety

There are already PBN to ILS procedures published in the UK. No IFP design issues are anticipated with this option.

Although new or revised safety assurances may be needed, an acceptable safety argument is envisaged to be achievable.

## Adherence to AMS

Supports the AMS through increased systemisation and meeting the Governments key environmental objectives by utilising PBN. The use of PBN arrivals has been appraised at this stage during periods where the landing rate is less critical. PBN arrivals in a system design might enable simplification, safety, efficiency and resilience enhancements and/or provide respite opportunities.

## Interdependencies, Conflicts & Trade-Offs

Option may result in conflicts/interdependencies with Gatwick's options.

## Outcome of PBN Arrival RWY27L Option C

Option C significantly reduces the population above the Partial LOAEL (night) and the population experiencing at least one N60 (night) noise event when compared to the Baseline. It indicates no overflight of Richmond Park and that no biodiversity sites between 0-3000ft may experience a change in location overflown.

The option indicates increases in overflight of AONBs and NPs and a small increase in track miles. This option will be explored further in Stage 3.

## OPTION CARRIED FORWARD TO STAGE 3





# CAP1616 - INITIAL OPTIONS APPRAISAL – SUPPLEMENTARY METRICS

## PBN Arrivals – RWY 27L Option C (Night)



23:00 - 07:00

### Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option C	
≥ 1	873,200	374,100	
≥ 5	297,500	323,000	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	

### Aircraft Noise Events

Rate	Population experiencing noise events above N60 each day		N60 events contour map
	Baseline	Option C	
≥ 1	1,131,900	816,200	
≥ 5	420,500	394,800	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	

### Noise Exposures

Population count	Baseline	Option C	Partial LOAEL contour map
Estimated total population above 40 dB $L_{Aeq,1.5h}$	1,283,300	877,500	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$ )	642,300	471,000	

### Noise Exposure Change

Change in Noise Exposure	Population experiencing at least 1 dB reduction within partial LOAEL or brought out of partial LOAEL	Population experiencing no change in noise exposure within partial LOAEL	Population experiencing at least 1 dB increase within partial LOAEL or brought into partial LOAEL	Change in noise exposure map
Partial LOAEL	328,400 (of which 310,700 brought out of Partial LOAEL by Option)	225,100	228,200 (of which 201,300 brought into Partial LOAEL by Option)	



PBN Arrivals – RWY 27L Option D

Option Description

This option was developed to address DP4. This option assumes a single PBN arrival track used for all RWY27L arrivals capable of of RNP-AR during the 0430-0600 period from BEDEK.



Communities – Noise impact on health & quality of life

Metric	Option Value	Difference to Baseline
Population above Partial LOAEL (daytime, LA <sub>eq</sub> , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA <sub>eq</sub> , 8h)	260,600	-381,700
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	477,800	-654,100

Communities - Air Quality

As there is no change to track distribution below 1000ft, there is no effect on Air Quality from this option.

Wider Society – Greenhouse Gas Impact

Metric	Difference to Baseline
Track Miles of the routes used (nm)	-37

Wider Society – Tranquillity & Biodiversity

Metric	Option Value	Difference to Baseline
Total Area of AONBs/National Parks (NPs) overflown between 0-7000ft once a day on average (night-time)	0km <sup>2</sup>	No change
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	0km <sup>2</sup>	No change
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	Less than 1km <sup>2</sup>	Less than 1km <sup>2</sup>
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-1640ft which observe a potential change in location overflown	0	No change
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-3000ft which observe a potential change in location overflown	5	+5

Wider Society – Capacity/Resilience

Arrival throughput not of concern 0430-0600. A single or multiple PBN route could handle the low number of arrivals in this period if required.

There is no distinguishing difference between any option regards arrival throughput. Any aircraft not RNP-AR equipped would have another PBN route to rely on.

Heathrow's capacity for this ACP is limited by the existing 480,000 movement cap.

General Aviation – Access

No additional CAS required.

Option would not facilitate the release of CAS.

Option may impact existing helicopter routes, further work is required to understand if there is an impact on route H3.



**General Aviation / Commercial Airlines – Economic impact from increased effective capacity**

No economic effect expected on GA operations.

Arrival delay is not an issue during the 0430-0600 period. Use of PBN arrivals during this time would be for noise mitigation purposes only. PBN arrivals in this time will not affect delay performance. There is no distinguishing difference between any option regards arrival delay.

**General Aviation / Commercial Airlines – Fuel Burn**

Change in Fuel Burn (compared to the Baseline - annual - tonnes)

Not able to quantify at this time, owing to uncertainty in new stack locations

**Commercial Airlines – Other costs**

None identified.

**Commercial Airlines – Training costs**

This option would require RNP-AR capability and approvals. This can come with significant costs for airlines, however, it is unknown at this time whether RNP-AR route options would be progressed in isolation i.e. without other arrival procedures being available. Should an RNP-AR arrival be mandatory, there may be additional costs for some operators. This will be quantified in Stage 3.

**Airport/Air Navigation Service Provider (ANSP) – Infrastructure costs**

Option may require re-location and/or addition of Noise Monitoring Terminals.

**Airport/ANSP – Operational costs**

This option is not anticipated to change airport nor ANSP operational costs. Heathrow will continue to require ILS and other ground based infrastructure even with the implementation of PBN arrival procedures.

Option may lead to a change in the number of properties eligible for the noise insulation scheme) which could lead to a change in operational costs for the airport.

**Airport/ANSP – Deployment costs**

There will be considerable costs associated with deployment in terms of operational training and system upgrades which will be quantified in Stage 3. However, there is not expected to be any differences in these costs between the different options.

**Safety**

There are no IFP design issues identified with this option however, there are no RNP-AR arrivals published in the UK at this time. Therefore additional considerations may arise through the regulatory approval process.

Although new or revised safety assurances may be needed, an acceptable safety argument is envisaged to be achievable.

**Adherence to AMS**

Supports the AMS through increased systemisation and meeting the Governments key environmental objectives by utilising PBN. The use of PBN arrivals has been appraised at this stage during periods where the landing rate is less critical. PBN arrivals in a system design might enable simplification, safety, efficiency and resilience enhancements and/or provide respite opportunities.

**Interdependencies, Conflicts & Trade-Offs**

Option not expected to interact with other airports' options.

**Outcome of PBN Arrival RWY27L Option D**

Option D significantly reduces the population above the Partial LOAEL (night), the population experiencing at least one N60 (night) noise event and the track miles. It indicates no overflight of AONBs or NPs.

The option indicates a small increase in Richmond Park overflight and a significant number of biodiversity sites between 0-3000ft may potentially experience a change in location overflown. This option will be explored further in Stage 3.

**OPTION CARRIED FORWARD TO STAGE 3**





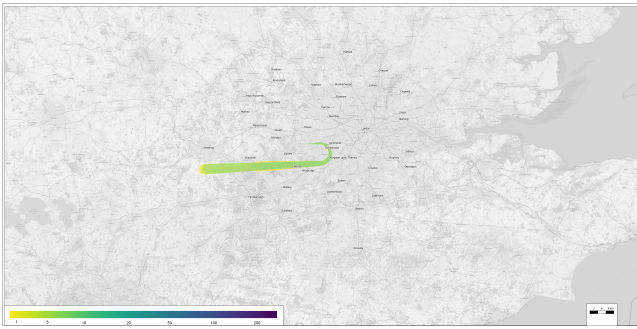
# CAP1616 - INITIAL OPTIONS APPRAISAL – SUPPLEMENTARY METRICS

## PBN Arrivals – RWY 27L Option D (Night)

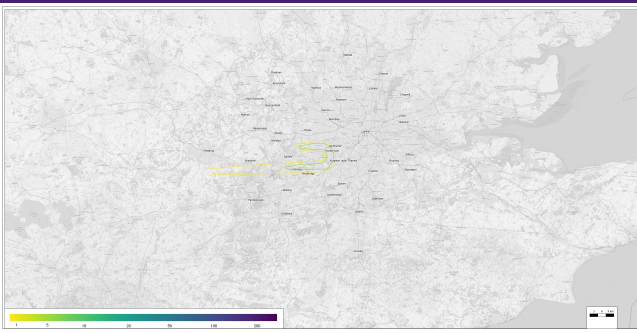


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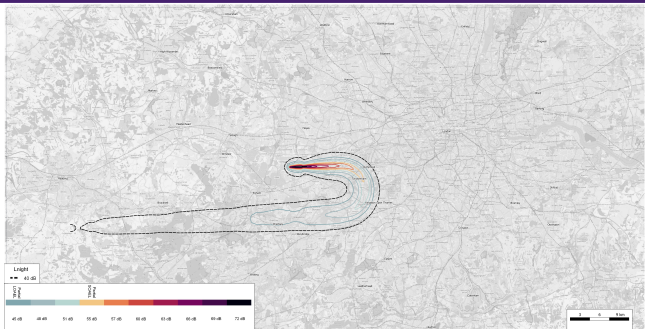
### Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option D	
≥ 1	873,200	210,100	
≥ 5	297,500	133,400	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	


### Aircraft Noise Events

Rate	Population experiencing noise events above N60 each day		N60 events contour map
	Baseline	Option D	
≥ 1	1,131,900	477,800	
≥ 5	420,500	224,900	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	

### Noise Exposures

Population count	Baseline	Option D	Partial LOAEL contour map
Estimated total population above 40 dB $L_{Aeq,1.5h}$	1,283,300	508,600	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$ )	642,300	260,600	

### Noise Exposure Change

Change in Noise Exposure	Population experiencing at least 1 dB reduction within partial LOAEL or brought out of partial LOAEL	Population experiencing no change in noise exposure within partial LOAEL	Population experiencing at least 1 dB increase within partial LOAEL or brought into partial LOAEL	Change in noise exposure map
Partial LOAEL	150,300 (of which 132,700 brought out of Partial LOAEL by Option)	86,200	156,800 (of which 115,000 brought into Partial LOAEL by Option)	
				





PBN Arrivals – RWY 27L Option E

Option Description

This option was developed to address DP4. This option assumes a single PBN arrival track used for all RWY27L arrivals capable of of RNP-AR during the 0430-0600 period from BEGTO.



Communities – Noise impact on health & quality of life

Metric	Option Value	Difference to Baseline
Population above Partial LOAEL (daytime, LA <sub>eq</sub> , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA <sub>eq</sub> , 8h)	241,700	-400,600
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	380,900	-751,000

Communities - Air Quality

As there is no change to track distribution below 1000ft, there is no effect on Air Quality from this option.

Wider Society – Greenhouse Gas Impact

Metric	Difference to Baseline
Track Miles of the routes used (nm)	-21

Wider Society – Tranquillity & Biodiversity

Metric	Option Value	Difference to Baseline
Total Area of AONBs/National Parks (NPs) overflown between 0-7000ft once a day on average (night-time)	45km <sup>2</sup>	+45km <sup>2</sup>
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	0km <sup>2</sup>	No change
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	Less than 1km <sup>2</sup>	Less than 1km <sup>2</sup>
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-1640ft which observe a potential change in location overflown	0	No change
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-3000ft which observe a potential change in location overflown	5	+5

Wider Society – Capacity/Resilience

Arrival throughput not of concern 0430-0600. A single or multiple PBN route could handle the low number of arrivals in this period if required.

There is no distinguishing difference between any option regards arrival throughput. Any aircraft not RNP-AR equipped would have another PBN route to rely on.

Heathrow's capacity for this ACP is limited by the existing 480,000 movement cap.

General Aviation – Access

No additional CAS required.

Option would not facilitate the release of CAS.

Option may impact existing helicopter routes, further work is required to understand if there is an impact on route H3.



**General Aviation / Commercial Airlines – Economic impact from increased effective capacity**

No economic effect expected on GA operations.

Arrival delay is not an issue during the 0430-0600 period. Use of PBN arrivals during this time would be for noise mitigation purposes only. PBN arrivals in this time will not affect delay performance. There is no distinguishing difference between any option regards arrival delay.

**General Aviation / Commercial Airlines – Fuel Burn**

Change in Fuel Burn (compared to the Baseline - annual - tonnes)

Not able to quantify at this time, owing to uncertainty in new stack locations

**Commercial Airlines – Other costs**

None identified.

**Commercial Airlines – Training costs**

This option would require RNP-AR capability and approvals. This can come with significant costs for airlines, however, it is unknown at this time whether RNP-AR route options would be progressed in isolation i.e. without other arrival procedures being available. Should an RNP-AR arrival be mandatory, there may be additional costs for some operators. This will be quantified in Stage 3.

**Airport/Air Navigation Service Provider (ANSP) – Infrastructure costs**

Option may require re-location and/or addition of Noise Monitoring Terminals.

**Airport/ANSP – Operational costs**

This option is not anticipated to change airport nor ANSP operational costs. Heathrow will continue to require ILS and other ground based infrastructure even with the implementation of PBN arrival procedures.

Option may lead to a change in the number of properties eligible for the noise insulation scheme) which could lead to a change in operational costs for the airport.

**Airport/ANSP – Deployment costs**

There will be considerable costs associated with deployment in terms of operational training and system upgrades which will be quantified in Stage 3. However, there is not expected to be any differences in these costs between the different options.

**Safety**

There are no IFP design issues identified with this option however, there are no RNP-AR arrivals published in the UK at this time. Therefore additional considerations may arise through the regulatory approval process.

Although new or revised safety assurances may be needed, an acceptable safety argument is envisaged to be achievable.

**Adherence to AMS**

Supports the AMS through increased systemisation and meeting the Governments key environmental objectives by utilising PBN. The use of PBN arrivals has been appraised at this stage during periods where the landing rate is less critical. PBN arrivals in a system design might enable simplification, safety, efficiency and resilience enhancements and/or provide respite opportunities.

**Interdependencies, Conflicts & Trade-Offs**

Option may result in conflicts/interdependencies with Gatwick's options.

**Outcome of PBN Arrival RWY27L Option E**

Option E significantly reduces the population above the Partial LOAEL (night), the population experiencing at least one N60 (night) noise event and track miles. It indicates a similar area of AONBs and NPs experiencing at least one N60 noise event when compared to the Baseline.

The option indicates significant increases in the total area of AONBs and NPs overflown and a significant number of biodiversity sites between 0-3000ft that may experience a change in location overflown. It indicates a small increase in Richmond Park overflown. This option will be explored further in Stage 3.

**OPTION CARRIED FORWARD TO STAGE 3**




# CAP1616 - INITIAL OPTIONS APPRAISAL – SUPPLEMENTARY METRICS

## PBN Arrivals – RWY 27L Option E (Night)

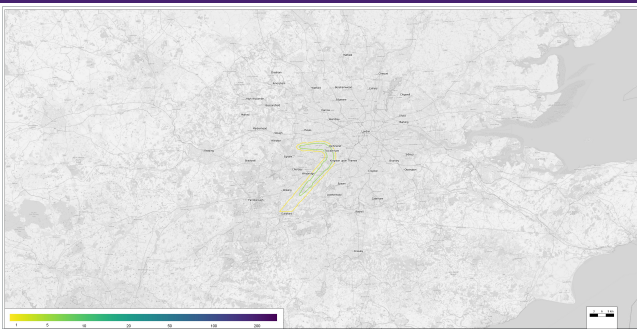


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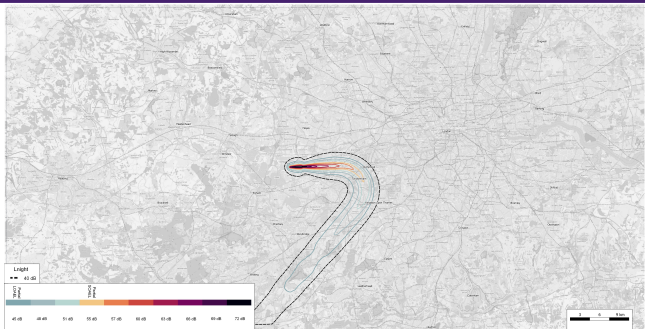
### Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option E	
≥ 1	873,200	181,900	
≥ 5	297,500	133,700	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	


### Aircraft Noise Events

Rate	Population experiencing noise events above N60 each day		N60 events contour map
	Baseline	Option E	
≥ 1	1,131,900	380,900	
≥ 5	420,500	208,400	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	

### Noise Exposures

Population count	Baseline	Option E	Partial LOAEL contour map
Estimated total population above 40 dB $L_{Aeq,1.5h}$	1,283,300	416,300	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$ )	642,300	241,700	

### Noise Exposure Change

Change in Noise Exposure	Population experiencing at least 1 dB reduction within partial LOAEL or brought out of partial LOAEL	Population experiencing no change in noise exposure within partial LOAEL	Population experiencing at least 1 dB increase within partial LOAEL or brought into partial LOAEL	Change in noise exposure map
Partial LOAEL	147,300 (of which 129,700 brought out of Partial LOAEL by Option)	85,900	138,100 (of which 110,900 brought into Partial LOAEL by Option)	
				



PBN Arrivals – RWY 27L Option F

Option Description

This option was developed to address DP4. This option assumes a single PBN arrival track used for all RWY27L arrivals during the 0430-0600 period from BEGTO.



Communities – Noise impact on health & quality of life

Metric	Option Value	Difference to Baseline
Population above Partial LOAEL (daytime, LA <sub>eq</sub> , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA <sub>eq</sub> , 8h)	561,800	-80,500
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	975,100	-156,800

Communities - Air Quality

As there is no change to track distribution below 1000ft, there is no effect on Air Quality from this option.

Wider Society – Greenhouse Gas Impact

Metric	Difference to Baseline
Track Miles of the routes used (nm)	-12

Wider Society – Tranquillity & Biodiversity

Metric	Option Value	Difference to Baseline
Total Area of AONBs/National Parks (NPs) overflown between 0-7000ft once a day on average (night-time)	52km <sup>2</sup>	+52km <sup>2</sup>
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	8km <sup>2</sup>	+8km <sup>2</sup>
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	0km <sup>2</sup>	No change
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-1640ft which observe a potential change in location overflown	0	No change
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-3000ft which observe a potential change in location overflown	0	No change

Wider Society – Capacity/Resilience

Arrival throughput not of concern 0430-0600. A single or multiple PBN route could handle the low number of arrivals in this period if required.

There is no distinguishing difference between any option regards arrival throughput. Any aircraft not RNP-AR equipped would have another PBN route to rely on.

Heathrow's capacity for this ACP is limited by the existing 480,000 movement cap.

General Aviation – Access

No additional CAS required.

Option would not facilitate the release of CAS.

Option not expected to impact existing helicopter routes.





## General Aviation / Commercial Airlines – Economic impact from increased effective capacity

No economic effect expected on GA operations.

Arrival delay is not an issue during the 0430-0600 period. Use of PBN arrivals during this time would be for noise mitigation purposes only. PBN arrivals in this time will not affect delay performance. There is no distinguishing difference between any option regards arrival delay.

## Commercial Airlines – Training costs

Option does not require any re-equipage or upgrade costs for airlines. No training costs required for airlines.

## Airport/Air Navigation Service Provider (ANSP) – Infrastructure costs

Option may require re-location and/or addition of Noise Monitoring Terminals.

## Airport/ANSP – Deployment costs

There will be considerable costs associated with deployment in terms of operational training and system upgrades which will be quantified in Stage 3. However, there is not expected to be any differences in these costs between the different options.

## Safety

There are already PBN to ILS procedures published in the UK. No IFP design issues are anticipated with this option.

Although new or revised safety assurances may be needed, an acceptable safety argument is envisaged to be achievable.

## Interdependencies, Conflicts & Trade-Offs

Option may result in conflicts/interdependencies with Gatwick's options.

## General Aviation / Commercial Airlines – Fuel Burn

Change in Fuel Burn (compared to the Baseline - annual - tonnes)

Not able to quantify at this time, owing to uncertainty in new stack locations

## Commercial Airlines – Other costs

None identified.

## Airport/ANSP – Operational costs

This option is not anticipated to change airport nor ANSP operational costs. Heathrow will continue to require ILS and other ground based infrastructure even with the implementation of PBN arrival procedures.

Option may lead to a change in the number of properties eligible for the noise insulation scheme) which could lead to a change in operational costs for the airport.

## Adherence to AMS

Supports the AMS through increased systemisation and meeting the Governments key environmental objectives by utilising PBN. The use of PBN arrivals has been appraised at this stage during periods where the landing rate is less critical. PBN arrivals in a system design might enable simplification, safety, efficiency and resilience enhancements and/or provide respite opportunities.

## Outcome of PBN Arrival RWY27L Option F

Option F reduces the population above the Partial LOAEL (night) and the population experiencing at least one N60 (night) noise event. It indicates a significant decrease in track miles, indicates no overflight of Richmond Park and that no biodiversity sites between 0-3000ft should experience a change in location overflown.

The option indicates a significant increase in overflight of AONBs and NPs. This option will be explored further in Stage 3.

**OPTION CARRIED FORWARD TO STAGE 3**




# CAP1616 - INITIAL OPTIONS APPRAISAL – SUPPLEMENTARY METRICS

## PBN Arrivals – RWY 27L Option F (Night)

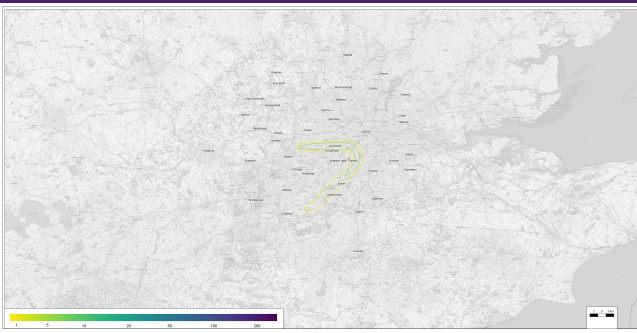


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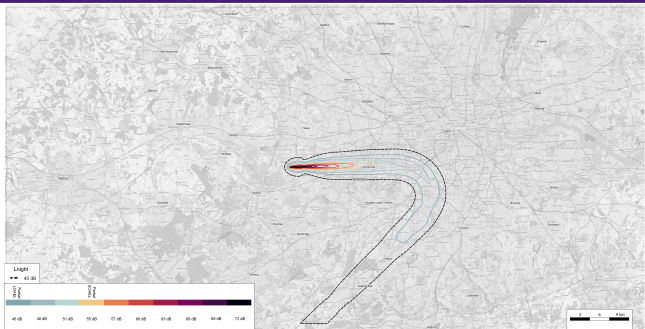
### Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option F	
≥ 1	873,200	497,100	
≥ 5	297,500	434,800	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	


### Aircraft Noise Events

Rate	Population experiencing noise events above N60 each day		N60 events contour map
	Baseline	Option F	
≥ 1	1,131,900	975,100	
≥ 5	420,500	450,000	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	

### Noise Exposures

Population count	Baseline	Option F	Partial LOAEL contour map
Estimated total population above 40 dB $L_{Aeq,1.5h}$	1,283,300	1,054,200	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$ )	642,300	561,800	

### Noise Exposure Change

Change in Noise Exposure	Population experiencing at least 1 dB reduction within partial LOAEL or brought out of partial LOAEL	Population experiencing no change in noise exposure within partial LOAEL	Population experiencing at least 1 dB increase within partial LOAEL or brought into partial LOAEL	Change in noise exposure map
Partial LOAEL	341,600 (of which 299,100 brought out of Partial LOAEL by Option)	257,600	261,700 (of which 239,800 brought into Partial LOAEL by Option)	
				



PBN Arrivals – RWY 27L Option G

Option Description

This option was developed to address DP4. This option assumes a single PBN arrival track used for all RWY27L arrivals capable of RNP-AR during the 0430-0600 period from ALESO.



Communities – Noise impact on health & quality of life

Metric	Option Value	Difference to Baseline
Population above Partial LOAEL (daytime, LA <sub>eq</sub> , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA <sub>eq</sub> , 8h)	361,700	-280,600
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	564,700	-567,200

Communities - Air Quality

As there is no change to track distribution below 1000ft, there is no effect on Air Quality from this option.

Wider Society – Greenhouse Gas Impact

Metric	Difference to Baseline
Track Miles of the routes used (nm)	-5

Wider Society – Tranquillity & Biodiversity

Metric	Option Value	Difference to Baseline
Total Area of AONBs/National Parks (NPs) overflown between 0-7000ft once a day on average (night-time)	55km <sup>2</sup>	+55km <sup>2</sup>
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	15km <sup>2</sup>	+15km <sup>2</sup>
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	3km <sup>2</sup>	+3km <sup>2</sup>
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-1640ft which observe a potential change in location overflown	0	No change
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-3000ft which observe a potential change in location overflown	6	+6

Wider Society – Capacity/Resilience

Arrival throughput not of concern 0430-0600. A single or multiple PBN route could handle the low number of arrivals in this period if required.

There is no distinguishing difference between any option regards arrival throughput. Any aircraft not RNP-AR equipped would have another PBN route to rely on.

Heathrow's capacity for this ACP is limited by the existing 480,000 movement cap.

General Aviation – Access

No additional CAS required.

Option would not facilitate the release of CAS.

Option may impact existing helicopter routes, further work is required to understand if there is an impact on route H3.



**General Aviation / Commercial Airlines – Economic impact from increased effective capacity**

No economic effect expected on GA operations.

Arrival delay is not an issue during the 0430-0600 period. Use of PBN arrivals during this time would be for noise mitigation purposes only. PBN arrivals in this time will not affect delay performance. There is no distinguishing difference between any option regards arrival delay.

**General Aviation / Commercial Airlines – Fuel Burn**

Change in Fuel Burn (compared to the Baseline - annual - tonnes)

Not able to quantify at this time, owing to uncertainty in new stack locations

**Commercial Airlines – Training costs**

This option would require RNP-AR capability and approvals. This can come with significant costs for airlines, however, it is unknown at this time whether RNP-AR route options would be progressed in isolation i.e. without other arrival procedures being available. Should an RNP-AR arrival be mandatory, there may be additional costs for some operators. This will be quantified in Stage 3.

**Airport/Air Navigation Service Provider (ANSP) – Infrastructure costs**

Option may require re-location and/or addition of Noise Monitoring Terminals.

**Airport/ANSP – Deployment costs**

There will be considerable costs associated with deployment in terms of operational training and system upgrades which will be quantified in Stage 3. However, there is not expected to be any differences in these costs between the different options.

**Safety**

There are no IFP design issues identified with this option however, there are no RNP-AR arrivals published in the UK at this time. Therefore additional considerations may arise through the regulatory approval process.

Although new or revised safety assurances may be needed, an acceptable safety argument is envisaged to be achievable.

**Interdependencies, Conflicts & Trade-Offs**

Option may result in conflicts/interdependencies with Gatwick's options.

**Commercial Airlines – Other costs**

None identified.

**Airport/ANSP – Operational costs**

This option is not anticipated to change airport nor ANSP operational costs. Heathrow will continue to require ILS and other ground based infrastructure even with the implementation of PBN arrival procedures.

Option may lead to a change in the number of properties eligible for the noise insulation scheme) which could lead to a change in operational costs for the airport.

**Adherence to AMS**

Supports the AMS through increased systemisation and meeting the Governments key environmental objectives by utilising PBN. The use of PBN arrivals has been appraised at this stage during periods where the landing rate is less critical. PBN arrivals in a system design might enable simplification, safety, efficiency and resilience enhancements and/or provide respite opportunities.

**Outcome of PBN Arrival RWY27L Option G**

Option G significantly reduces the population above the Partial LOAEL (night) and the population experiencing at least one N60 (night) noise event. It indicates a decrease in track miles compared to the Baseline.

The option indicates significant increases in overflight of AONBs, NPs and Richmond Park and a significant number of biodiversity sites between 0-3000ft that may experience a change in location overflown. This option will be explored further in Stage 3.

**OPTION CARRIED FORWARD TO STAGE 3**






# CAP1616 - INITIAL OPTIONS APPRAISAL – SUPPLEMENTARY METRICS

## PBN Arrivals – RWY 27L Option G (Night)




23:00 - 07:00

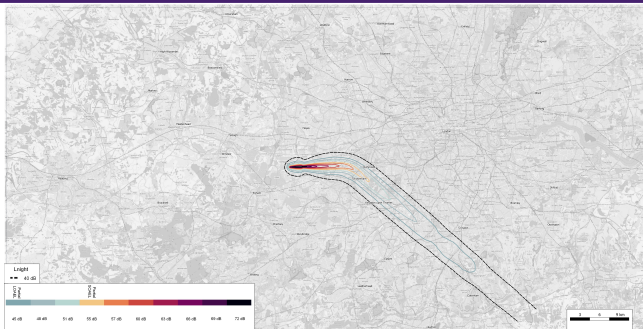
### Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option G	
≥ 1	873,200	236,400	
≥ 5	297,500	218,900	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	


### Aircraft Noise Events

Rate	Population experiencing noise events above N60 each day		N60 events contour map
	Baseline	Option G	
≥ 1	1,131,900	564,700	
≥ 5	420,500	291,700	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	

### Noise Exposures

Population count	Baseline	Option G	Partial LOAEL contour map
Estimated total population above 40 dB $L_{Aeq,1.5h}$	1,283,300	624,200	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$ )	642,300	361,700	

### Noise Exposure Change

Change in Noise Exposure	Population experiencing at least 1 dB reduction within partial LOAEL or brought out of partial LOAEL	Population experiencing no change in noise exposure within partial LOAEL	Population experiencing at least 1 dB increase within partial LOAEL or brought into partial LOAEL	Change in noise exposure map
Partial LOAEL	379,000 (of which 360,200 brought out of Partial LOAEL by Option)	85,500	257,400 (of which 232,900 brought into Partial LOAEL by Option)	
				



PBN Arrivals – RWY 27L Option H

Option Description

This option was developed to address DP4. This option assumes a single PBN arrival track used for all RWY27L arrivals during the 0430-0600 period from ALESO.



Communities – Noise impact on health & quality of life

Metric	Option Value	Difference to Baseline
Population above Partial LOAEL (daytime, LA <sub>eq</sub> , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA <sub>eq</sub> , 8h)	581,800	-60,500
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	959,800	-172,100

Communities - Air Quality

As there is no change to track distribution below 1000ft, there is no effect on Air Quality from this option.

Wider Society – Greenhouse Gas Impact

Metric	Difference to Baseline
Track Miles of the routes used (nm)	-4

Wider Society – Tranquillity & Biodiversity

Metric	Option Value	Difference to Baseline
Total Area of AONBs/National Parks (NPs) overflown between 0-7000ft once a day on average (night-time)	44km <sup>2</sup>	+44km <sup>2</sup>
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	1km <sup>2</sup>	+1km <sup>2</sup>
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	0km <sup>2</sup>	No change
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-1640ft which observe a potential change in location overflown	0	No change
Number of sites (RAMSAR, SAC, SPA, SSSI) overflown between 0-3000ft which observe a potential change in location overflown	0	No change

Wider Society – Capacity/Resilience

Arrival throughput not of concern 0430-0600. A single or multiple PBN route could handle the low number of arrivals in this period if required.

There is no distinguishing difference between any option regards arrival throughput. Any aircraft not RNP-AR equipped would have another PBN route to rely on.

Heathrow's capacity for this ACP is limited by the existing 480,000 movement cap.

General Aviation – Access

No additional CAS required.

Option would not facilitate the release of CAS.

Option not expected to impact existing helicopter routes.



**General Aviation / Commercial Airlines – Economic impact from increased effective capacity**

No economic effect expected on GA operations.

Arrival delay is not an issue during the 0430-0600 period. Use of PBN arrivals during this time would be for noise mitigation purposes only. PBN arrivals in this time will not affect delay performance. There is no distinguishing difference between any option regards arrival delay.

**General Aviation / Commercial Airlines – Fuel Burn**

Change in Fuel Burn (compared to the Baseline - annual - tonnes)

Not able to quantify at this time, owing to uncertainty in new stack locations

**Commercial Airlines – Other costs**

None identified.

**Commercial Airlines – Training costs**

Option does not require any re-equipage or upgrade costs for airlines. No training costs required for airlines.

**Airport/ANSP – Operational costs**

This option is not anticipated to change airport nor ANSP operational costs. Heathrow will continue to require ILS and other ground based infrastructure even with the implementation of PBN arrival procedures.

**Airport/Air Navigation Service Provider (ANSP) – Infrastructure costs**

Option may require re-location and/or addition of Noise Monitoring Terminals.

Option may lead to a change in the number of properties eligible for the noise insulation scheme) which could lead to a change in operational costs for the airport.

**Airport/ANSP – Deployment costs**

There will be considerable costs associated with deployment in terms of operational training and system upgrades which will be quantified in Stage 3. However, there is not expected to be any differences in these costs between the different options.

**Safety**

There are already PBN to ILS procedures in the UK. No IFP design issues are anticipated with this option.

Although new or revised safety assurances may be needed, an acceptable safety argument is envisaged to be achievable.

**Adherence to AMS**

Supports the AMS through increased systemisation and meeting the Governments key environmental objectives by utilising PBN. The use of PBN arrivals has been appraised at this stage during periods where the landing rate is less critical. PBN arrivals in a system design might enable simplification, safety, efficiency and resilience enhancements and/or provide respite opportunities.

**Interdependencies, Conflicts & Trade-Offs**

Option may result in conflicts/interdependencies with Gatwick's options.

**Outcome of PBN Arrival RWY27L Option H**

Option H reduces the population above the Partial LOAEL (night), the population experiencing at least one N60 (night) noise event and the track miles when compared to the Baseline. It indicates no overflight of Richmond Park and that no biodiversity sites between 0-3000ft should experience a change in location overflown.

The option indicates a significant increase in overflight of AONBs and NPs. This option will be explored further in Stage 3.

**OPTION CARRIED FORWARD TO STAGE 3**





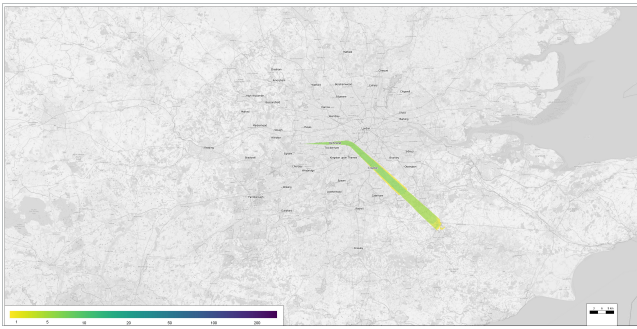
# CAP1616 - INITIAL OPTIONS APPRAISAL – SUPPLEMENTARY METRICS

## PBN Arrivals – RWY 27L Option H (Night)

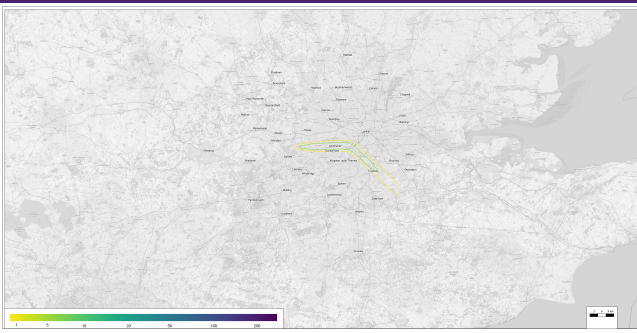


23:00 - 07:00

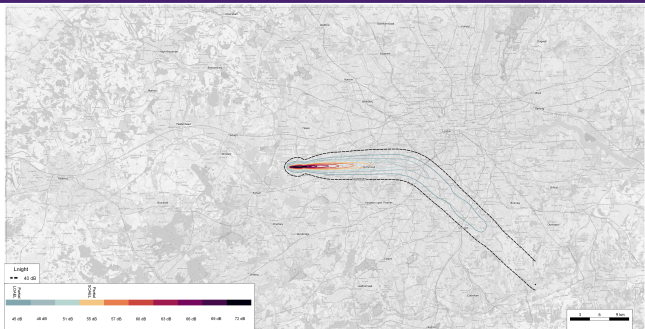
### Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option H	
≥ 1	873,200	447,000	
≥ 5	297,500	407,200	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	

### Aircraft Noise Events

Rate	Population experiencing noise events above N60 each day		N60 events contour map
	Baseline	Option H	
≥ 1	1,131,900	959,800	
≥ 5	420,500	471,800	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	

### Noise Exposures

Population count	Baseline	Option H	Partial LOAEL contour map
Estimated total population above 40 dB $L_{Aeq,1.5h}$	1,283,300	1,061,400	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$ )	642,300	581,800	

### Noise Exposure Change

Change in Noise Exposure	Population experiencing at least 1 dB reduction within partial LOAEL or brought out of partial LOAEL	Population experiencing no change in noise exposure within partial LOAEL	Population experiencing at least 1 dB increase within partial LOAEL or brought into partial LOAEL	Change in noise exposure map
Partial LOAEL	358,300 (of which 316,400 brought out of Partial LOAEL by Option)	260,100	279,800 (of which 255,900 brought into Partial LOAEL by Option)	
	