



AIRSPACE MODERNISATION AIRSPACE CHANGE PROPOSAL

STEP 2B INITIAL OPTIONS APPRAISAL

APPENDIX B

PBN ARRIVALS Runway 27R - Part 4



Table of Contents

1.	<i>Initial Options Appraisal - Runway 27R - Baseline.....</i>	4
2.	<i>Initial Options Appraisal - Runway 27R - Option A.....</i>	7
3.	<i>Initial Options Appraisal - Runway 27R - Option B.....</i>	10
4.	<i>Initial Options Appraisal - Runway 27R - Option C.....</i>	13
5.	<i>Initial Options Appraisal - Runway 27R - Option D.....</i>	16
6.	<i>Initial Options Appraisal - Runway 27R - Option E.....</i>	19
7.	<i>Initial Options Appraisal - Runway 27R - Option F.....</i>	22
8.	<i>Initial Options Appraisal - Runway 27R - Option G.....</i>	25
9.	<i>Initial Options Appraisal - Runway 27R - Option H.....</i>	28

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 27R



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) 27R Baseline
‘Do Nothing’



Option Description

This represents the baseline for Doing Nothing with 27R arrivals in the 0430-0600 period. The image represents the areas overflowed at least once per day on average by 27R 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 _{eq} , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA _{eq} , 8h)	425,100	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)	1,181,500	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	416	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 ²	N/A
Total Area of AONBs/NPs overflowed experiencing at least one event of N60 on average (night-time)	0km ²	N/A
Total Area of Richmond Park overflowed between 0-7000ft at least once a day on average (night-time)	0km ²	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.

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

Doing nothing means no changes to infrastructure costs.

Airport/ANSP – Deployment costs

Doing nothing mean no deployment costs.

Safety

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

Interdependencies, Conflicts & Trade-Offs

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

General Aviation / Commercial Airlines – Fuel Burn

Change in Fuel Burn (annual - tonnes)	No change
---------------------------------------	-----------

Commercial Airlines – Other costs

None identified.

Airport/ANSP – Operational costs

Doing nothing means no change to operational costs.

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.

Outcome of PBN Arrival RWY27R 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 27R Do Nothing (Night)



23:00 - 07:00

Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Do Nothing	
≥ 1	673,300	673,300	
≥ 5	0	0	
≥ 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	1,181,500	1,181,500	
≥ 5	0	0	
≥ 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 $L_{Aeq,1.5h}$	1,214,800	1,214,800	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$)	425,100	425,100	

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 27R Option A

Option Description

This option was developed to address DP2. This option assumes a single PBN arrival track used for all RWY27R arrivals capable of RNP-AR during the 0430-0600 period from TOBID & LOGAN.



Communities – Noise impact on health & quality of life

Metric	Option Value	Difference to Baseline
Population above Partial LOAEL (daytime, LA _{eq} , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA _{eq} , 8h)	199,900	-225,200
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	452,100	-729,400

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)	+27

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)	8km ²	+8km ²
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	0km ²	No change
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	1km ²	+1km ²
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 – 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 not expected to interact with other airports' 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 RWY27R Option A

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

The option indicates small increases in the total area of AONBs, NPs and Richmond Park overflown and a significant increase in the track miles. A number of biodiversity sites between 0-3000ft may experience a change in location overflown.

OPTION CARRIED FORWARD TO STAGE 3



CAP1616 - INITIAL OPTIONS APPRAISAL – SUPPLEMENTARY METRICS

PBN Arrivals – RWY 27R Option A (Night)



23:00 - 07:00

Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option A	
≥ 1	673,300	208,000	
≥ 5	0	0	
≥ 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	1,181,500	452,100	
≥ 5	0	0	
≥ 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 $L_{Aeq,1.5h}$	1,214,800	424,500	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$)	425,100	199,900	

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	153,600 (of which 144,700 brought out of Partial LOAEL by Option)	83,000	108,000 (of which 91,600 brought into Partial LOAEL by Option)	



PBN Arrivals – RWY 27R Option B

Option Description

This option was developed to address DP2. This option assumes a single PBN arrival track used for all RWY27R arrivals capable of RNP-AR during the 0430-0600 period from BEDEK & BEGTO.



Communities – Noise impact on health & quality of life

Metric	Option Value	Difference to Baseline
Population above Partial LOAEL (daytime, LA _{eq} , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA _{eq} , 8h)	189,600	-235,500
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	450,500	-731,000

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)	-38

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 ²	+49km ²
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	0km ²	No change
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	4km ²	+4km ²
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	3	+3

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 RWY27R Option B

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

The option indicates increases in the total areas of AONBs, NPs and Richmond Park overflown. A number of biodiversity sites between 0-3000ft 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 27R Option B (Night)

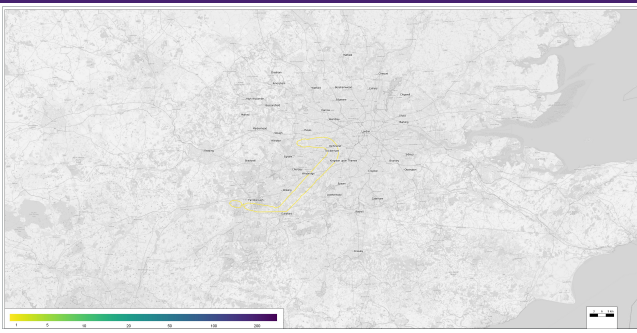


23:00 - 07:00

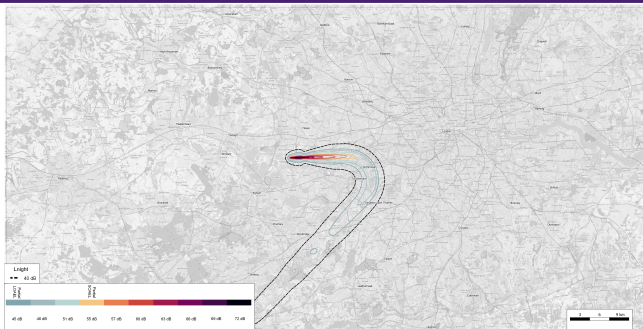
Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option B	
≥ 1	673,300	262,100	
≥ 5	0	0	
≥ 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	1,181,500	450,500	
≥ 5	0	0	
≥ 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 $L_{Aeq,1.5h}$	1,214,800	425,900	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$)	425,100	189,600	

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	124,600 (of which 118,000 brought out of Partial LOAEL by Option)	96,100	86,900 (of which 67,400 brought into Partial LOAEL by Option)	
				



PBN Arrivals – RWY 27R Option C

Option Description

This option was developed to address DP2. This option assumes a single PBN arrival track used for all RWY27R 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 _{eq} , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA _{eq} , 8h)	197,200	-227,900
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	450,800	-730,700

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)	+10

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)	48km ²	+48km ²
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	3km ²	+3km ²
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	4km ²	+4km ²
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 – 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.

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.

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 RWY27R 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 with the Baseline.

The option indicates increases in overflight of AONBs, NPs and Richmond Park and increases in track miles. It indicates a number of biodiversity sites between 0-3000ft 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 27R Option C (Night)



23:00 - 07:00

Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option C	
≥ 1	673,300	144,700	
≥ 5	0	0	
≥ 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	1,181,500	450,800	
≥ 5	0	0	
≥ 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 $L_{Aeq,1.5h}$	1,214,800	445,500	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$)	425,100	197,200	

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	202,400 (of which 191,400 brought out of Partial LOAEL by Option)	91,800	94,400 (of which 83,000 brought into Partial LOAEL by Option)	



PBN Arrivals – RWY 27R Option D

Option Description

This option was developed to address DP2. This option assumes a single PBN arrival track used for all RWY27R arrivals during the 0430-0600 period from ALESO & LOGAN.



Communities – Noise impact on health & quality of life

Metric	Option Value	Difference to Baseline
Population above Partial LOAEL (daytime, LA _{eq} , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA _{eq} , 8h)	320,800	-104,300
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	872,600	-308,900

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)	+32

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)	34km ²	+34km ²
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	9km ²	+9km ²
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	0km ²	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	1	+1

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 RWY27R Option D

Option D significantly reduces the population above the Partial LOAEL (night) and the population experiencing at least one N60 (night) noise event when compared with the Baseline. It indicates no overflight of Richmond Park.

The option indicates a number of biodiversity sites between 0-3000ft may experience a change in location overflown. It also indicates an increase in overflight of AONBs and NPs and a significant 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 27R Option D (Night)



23:00 - 07:00

Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option D	
≥ 1	673,300	383,800	
≥ 5	0	0	
≥ 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	1,181,500	872,600	
≥ 5	0	0	
≥ 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 $L_{Aeq,1.5h}$	1,214,800	845,100	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$)	425,100	320,800	

Noise Exposure Change

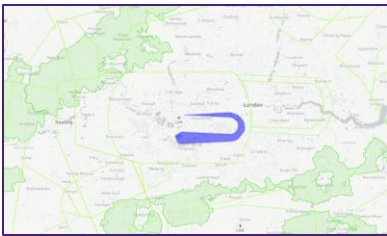
Change in Noise Exposure	Population experiencing at least 1 dB reduction within partial LOAEL or brought out of partial LOAEL	Population experiencing no change in noise exposure within partial LOAEL	Population experiencing at least 1 dB increase within partial LOAEL or brought into partial LOAEL	Change in noise exposure map
Partial LOAEL	234,500 (of which 210,200 brought out of Partial LOAEL by Option)	180,400	116,200 (of which 106,000 brought into Partial LOAEL by Option)	



PBN Arrivals – RWY 27R Option E

Option Description

This option was developed to address DP2. This option assumes a single PBN arrival track used for all RWY27R arrivals during the 0430-0600 period from BEDEK, TOBID & BEGTO.



Communities – Noise impact on health & quality of life

Metric	Option Value	Difference to Baseline
Population above Partial LOAEL (daytime, LA _{eq} , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA _{eq} , 8h)	322,800	-102,300
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	956,500	-225,000

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)	-26

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 ²	No change
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	0km ²	No change
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	Less than 1km ²	Less than 1km ²
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	1	+1

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 RWY27R Option E

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

The option indicates small increases in the overflight of Richmond Park and a 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 27R Option E (Night)



23:00 - 07:00

Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option E	
≥ 1	673,300	676,200	
≥ 5	0	0	
≥ 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	1,181,500	956,500	
≥ 5	0	0	
≥ 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 $L_{Aeq,1.5h}$	1,214,800	887,400	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$)	425,100	322,800	

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	233,900 (of which 209,600 brought out of Partial LOAEL by Option)	180,900	117,600 (of which 107,400 brought into Partial LOAEL by Option)	



PBN Arrivals – RWY 27R Option F

Option Description

This option was developed to address DP4. This option assumes a single PBN arrival track used for all RWY27R arrivals capable 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 _{eq} , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA _{eq} , 8h)	199,800	-225,300
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	466,000	-715,500

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)	0km ²	No change
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	0km ²	No change
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	1km ²	+1km ²
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 RWY27R Option F

Option F 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 the overflight of 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



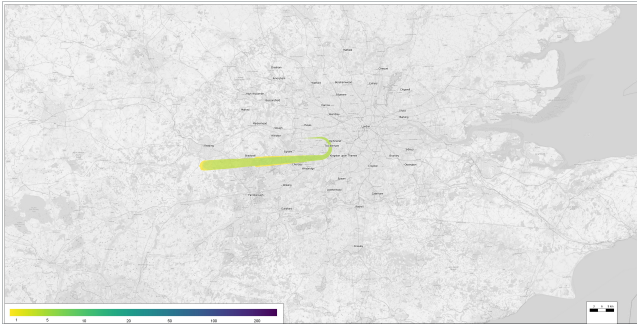
CAP1616 - INITIAL OPTIONS APPRAISAL – SUPPLEMENTARY METRICS

PBN Arrivals – RWY 27R Option F (Night)

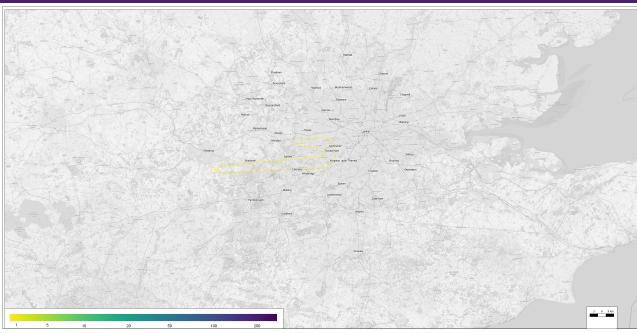


23:00 - 07:00

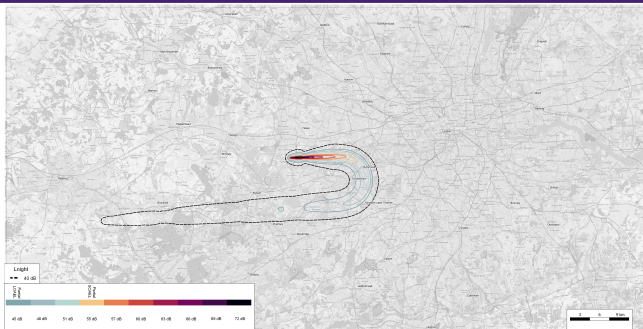
Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option F	
≥ 1	673,300	215,600	
≥ 5	0	0	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	

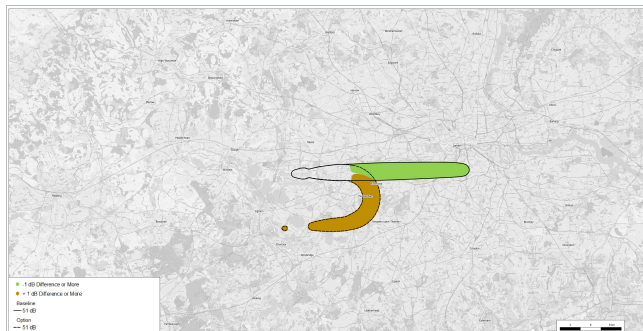
Aircraft Noise Events

Rate	Population experiencing noise events above N60 each day		N60 events contour map
	Baseline	Option F	
≥ 1	1,181,500	466,000	
≥ 5	0	0	
≥ 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 $L_{Aeq,1.5h}$	1,214,800	444,500	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$)	425,100	199,800	

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	99,300 (of which 90,400 brought out of Partial LOAEL by Option)	82,800	108,100 (of which 90,100 brought into Partial LOAEL by Option)	
				



PBN Arrivals – RWY 27R Option G

Option Description

This option was developed to address DP4. This option assumes a single PBN arrival track used for all RWY27R arrivals capable 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 _{eq} , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA _{eq} , 8h)	192,100	-233,000
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	367,700	-813,800

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)	-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)	47km ²	+47km ²
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	0km ²	No change
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	1km ²	+1km ²
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 – 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.

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.

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 RWY27R Option G

Option G significantly reduces the population above the Partial LOAEL (night), the population experiencing at least one N60 (night) noise event and the track miles when compared with the Baseline.

The option indicates a small increase in the overflight of Richmond Park and significant increases in AONB and NP overflight. A number of biodiversity sites between 0-3000ft 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 27R Option G (Night)



23:00 - 07:00

Overflight			
Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option G	
≥ 1	673,300	172,500	
≥ 5	0	0	
≥ 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	1,181,500	367,700	
≥ 5	0	0	
≥ 10	0	0	
≥ 20	0	0	
≥ 50	0	0	
≥ 100	0	0	
≥ 200	0	0	

Noise Exposures			Partial LOAEL contour map
Population count	Baseline	Option G	
Estimated total population above 40 dB $L_{Aeq,1.5h}$	1,214,800	369,800	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$)	425,100	192,100	

Noise Exposure Change				Change in noise exposure map
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	
Partial LOAEL	95,500 (of which 86,700 brought out of Partial LOAEL by Option)	82,700	100,500 (of which 71,000 brought into Partial LOAEL by Option)	



PBN Arrivals – RWY 27R Option H

Option Description

This option was developed to address DP4. This option assumes a single PBN arrival track used for all RWY27R 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 _{eq} , 16h)	N/A	N/A
Population above Partial LOAEL (night-time, LA _{eq} , 8h)	353,200	-71,900
Population experiencing at least one event of N65 (daytime)	N/A	N/A
Population experiencing at least one event of N60 (night-time)	1,036,100	-145,400

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)	-14

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)	36km ²	+36km ²
Total Area of AONBs/NPs overflown experiencing at least one event of N60 on average (night-time)	4km ²	+4km ²
Total Area of Richmond Park overflown between 0-7000ft at least once a day on average (night-time)	0km ²	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	1	+1

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 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 RWY27R Option H

Option H reduces the population above the Partial LOAEL (night) and the population experiencing at least one N60 (night) noise event. It significantly reduces the track miles when compared with the Baseline and indicates no overflight of Richmond Park.

The option indicates an increase in overflight of AONBs and NPs and a small 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 27R Option H (Night)



23:00 - 07:00

Overflight

Rate	Population Overflown		Overflight (0-7000 ft) contour map
	Baseline	Option H	
≥ 1	673,300	510,700	
≥ 5	0	0	
≥ 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	1,181,500	1,036,100	
≥ 5	0	0	
≥ 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 $L_{Aeq,1.5h}$	1,214,800	1,008,900	
Total population within Partial LOAEL (>45 dB $L_{Aeq,1.5h}$)	425,100	353,200	

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	198,700 (of which 177,500 brought out of Partial LOAEL by Option)	214,700	117,300 (of which 105,600 brought into Partial LOAEL by Option)	

