Heathrow Airport Ltd

Summary Note of Arrivals Workshop held 8 Nov 2016

Arrivals Airspace Change: Key Factors for Design Principles.

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Job number

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Contents

1 Purpose of Workshop

1.1 To obtain initial views from key stakeholders on:

i) the key factors for design principles that Heathrow should take into account when considering arrivals airspace changes.

ii) the prioritisation of the identified key factors.

1.2 To broaden Heathrow's general understanding of stakeholder views on arrivals.

2 Attendees

Representatives from 12 key stakeholder groups were invited to the workshop by Heathrow Airport Ltd (HAL). The stakeholders were chosen as a representative cross-section of the local community, airlines and air traffic control either from the Heathrow Community Noise Forum or Airline Operational Efficiency Stakeholder Group both of which consider matters on airspace. In addition, there were seven representatives from HAL's operations business.

At Heathrow's request the workshop was facilitated by two people from Arup, as independent facilitators.

The full list of workshop attendees is presented in Appendix A.

3 Workshop Programme

The agenda for the workshop was:

i) Welcome and introductions

ii) Scene setting:

   a. Overview of Heathrow arrivals operating procedures and the UK airspace change timetable.

   b. UK environmental policy landscape for air traffic management.

iii) Breakout sessions:

   a. Identify key factors for design principles that Heathrow should take into account when considering arrivals airspace changes

   b. Consider priorities for the identified key factors:

      i. Community perspective;

      ii. Industry perspective.

   c. Review and discuss findings.

iv) Next steps

v) Wrap up

4 Background

Heathrow Arrivals

Heathrow is the busiest two-runway airport in the world with about 1,300 combined take-offs and landings a day. On average there are around 650 arrivals into Heathrow each day.

Because Heathrow is so busy, most aircraft coming into land at Heathrow wait in 'holding stacks'. The stack acts as a waiting room, allowing air traffic controllers to efficiently organise planes for landing. There are four stacks around Heathrow named Bovingdon, Lambourne, Ockham and Biggin which have been in the same locations since the 1960s.

Once the planes leave the holding stack they are directed by NATS air traffic controllers to the final approach into Heathrow. For most of the time the controllers sequence the planes from all four stacks into a single stream of traffic and guide them safely onto one of Heathrow's two runways.

There are no published routes for aircraft moving from the holding stacks to the final approach for landing and so the position of aircraft in the skies will vary from day to day. Factors such as how busy the stack is, weather conditions, or the position of other aircraft on route into Heathrow will impact how aircraft are sequenced by air traffic controllers to leave the stack and make their way to the final approach. However, the overall patterns have remained similar for many years.

It is Government policy that Heathrow operates with a system of Westerly preference. This means that for approximately 70% of the time, aircraft depart from the runways in a Westerly direction, with arrivals from the East. Westerly preference was introduced in the 1960s to reduce the numbers of aircraft taking off in an easterly direction over London. This was when departures were considered to be more disruptive than arrivals to local communities.

Heathrow operates a system of runway alternation for daytime Westerly arrivals which provides periods of relief from aircraft noise for communities under the final approaches to landing. This is achieved by using one runway for arrivals and the other for departures until 3pm each day, and then switching them over. Runway alternation for Easterly arrivals during the day has not historically been possible due to Government policy (the Cranford Agreement). A separate alternation pattern operates at night time for both Westerly and Easterly operations. It applies from the time of the last departure until 06.00 hours local. The pattern of runway alternation is published in an annual Heathrow schedule which sets out which runway is planned to be used for arrivals any day or night of the year.

Continuous Descent Approaches (CDA) have been in operation at Heathrow for many years. This involves aircraft maintaining a steady angle of approach when

approaching to land at the airport, as opposed to approaches which involve prolonged periods of level flight. The intention of a CDA is to keep aircraft higher for longer, thereby reducing arrival noise. On average around 87% of aircraft coming into Heathrow use CDA.

The final approaches into Heathrow's runways are fixed flight paths that extend from the end of each of the airport's two runways, with aircraft following a radio beam named the Instrument Landing System (ILS). There is one beam aligned with the centrelines of each of the runways (northern and southern) to ensure aircraft approach in a straight line as they come into land, consequently these fixed approach paths haven't moved.

Once aircraft reach the final approach they cannot lose too much altitude as they need to be at a certain height when they join the final approach into Heathrow. The angle of landing for the final approach is set at 3° and as a result aircraft will be at a set height for distance from the runway. Heathrow and its airlines have in recent years been assessing the feasibility of using slightly steeper approaches to reduce ground based noise levels. A number of trials have been completed and the assessment work is progressing.

There are rules laid down in the Airport's Aeronautical Information Publication which states the minimum height at which aircraft can join the ILS. These differ for Westerly and Easterly operations:

Westerly Operations:
Between 06.00 – 23.30 hours local aircraft are required to be established on the ILS not below 2,500ft above mean sea level which equates to approximately eight nautical miles from Heathrow. Between 23.30 and 06.00 hours local the altitude is raised to 3,000ft above mean sea level, together with an additional requirement to join the ILS no closer to the runway than 10 nautical miles.

Easterly Operations:
Between 07.00 – 23.00 hours local aircraft are required to be established on the ILS not below 2,500ft above mean sea level which equates to approximately eight nautical miles from Heathrow. Between 23.00 and 07.00 hours local the altitude is raised to 3,000ft above mean sea level, together with an additional requirement to join the ILS no closer to the runway than 10 nautical miles.

As the ILS beam extends about 29 miles out from each of the airport's two runways, aircraft can join the final approach at any point after the distances mentioned above. However, this will vary depending on how aircraft are sequenced each day by the controllers.

Modernisation of UK Airspace

The south east of England is one of the busiest airspaces in the world with five major airports in close proximity – Heathrow, Gatwick, Stansted, City and Luton. The airspace that these airports use, along with the rest of the UK, has barely changed in 40 years, while the number of aircraft movements has doubled. This

airspace was also designed for an age when aircraft were fewer and less efficient, and navigation was much less sophisticated. For these reasons the UK's entire airspace requires modernisation and the Government has implemented the "Future Airspace Strategy" to modernise the UK's airspace.

The Future Airspace Strategy is part of a Europe-wide modernisation project known as the Single European Sky (SES), launched by the European Commission in 1999 to make the skies above Europe more efficient. The Single European Sky initiative provides the overarching framework for the modernisation of the European airspace system.

Since all the airspaces above Europe are connected, SES sets out to simplify and harmonise the way that the skies are used throughout Europe. To that end it has divided Europe into a series of zones known as functional airspace blocks. Each block has to produce its own strategy for modernisation and harmonisation, hence the UK's FAS project.

The Government's Future Airspace Strategy 2011-2030 aims to make the UK airspace safer and more efficient than it is today. The strategy applies to Heathrow and all other airports within the UK. Its aims include:

- Saving fuel through more direct routings and improved flight efficiencies
- Saving time for passengers and airlines through more direct routings and the provision of extra capacity when and where needed
- Cutting CO_2 emissions through more direct routings and improved flight efficiencies
- Reducing noise from fewer aircraft holding at low levels.

The Civil Aviation Authority (CAA) has set the initial direction for the development of Future Airspace Strategy. As the strategy moves into implementation, the CAA will play a central role, producing the policies and regulation needed throughout the implementation process.

The CAA has set out that one of the key aims of the Future Airspace Strategy is to make airspace more efficient – saving time and fuel as well as reducing emissions. Key to achieving this is improving the accuracy of where aircraft fly and a move to use satellite based navigation rather than flying from ground beacon to ground beacon. The level of accuracy, safety and integrity that these satellite navigation systems must reach is set out in the international requirements for Performance Based Navigation (PBN). PBN is being adopted worldwide and countries are expected to develop their airspace to use it. Therefore, as airspace and the routes aircraft fly are redesigned they will move to PBN satellite navigation. This will inevitably lead to changes to how and where aircraft fly.

NATS has developed a major programme for terminal airspace redesign. It aims to increase airspace capacity and efficiency through a range of airspace operational improvements, while reducing CO_2 emissions. For airports in the south-east of England, this is set out in The London Airspace Management

Programme (LAMP). The programme is being implemented in phases from 2016 to 2024.

The original timescale for full completion of airspace modernisation was set for 2020. However, the full implementation of PBN in the UK and the associated changes to airspace are now unlikely to be implemented until the early to mid-2020's.

While the implementation of airspace changes in the vicinity of Heathrow will require almost a decade to complete, the airport is proposing to consult extensively with local residents and stakeholders to ensure people have their say on the airport's proposed options, in accordance with the CAA's guidance and policies.

Workshop on Key Factors for Design Principles

Heathrow is developing a work programme for the implementation of airspace change. Although at an early stage in the process, the Group has identified the need for workshops with stakeholders to identify key environmental and operational factors informing the design principles, together with their prioritisation. This approach is consistent with the CAA's emerging guidance on airspace change processes. The work will also help inform the airport's evaluation of potential 'early' airspace changes, which could benefit both communities and industry.

Heathrow has organised engagement workshops for departures, arrivals and night flights. Arup was appointed to support and independently facilitate the arrivals workshop, held on 8 November 2016, which is the subject of this Summary Note.

5 Scope of the Workshop

The framework established for the workshop is described in Section 1. The scope of this workshop was to consider:

i) Heathrow arrivals in isolation, ahead of LAMP completion.
ii) That options for improving arrivals cannot compromise compliance with any existing departure routes.

6 Methodology

Workshop delegates were briefed on the purpose and scope of the workshop, including the role of Arup as independent facilitator. An overview presentation[1]

[1] Heathrow Arrivals – Workshop with stakeholders about possible airspace change. 8 November 2016.

was given to delegates setting out the operational and UK environmental policy aspects of arrivals air traffic management, including trade-offs and constraints.

A break-out session was held with all delegates to discuss what key factors for design principles they considered were most important in the decision making process for redesign of arrivals procedures. This was supported by some suggested key factors on printed cards (including blanks) to assist discussion.

A second break-out session was then held to determine the rank order of the identified key factors by priority. Delegates were divided into two groups for this purpose - Community and Airlines/Air Navigation Service Providers (ANSP) - as shown in Table 1. Representatives from Arup and HAL were on hand to support group discussions and respond to queries where needed. The delegates then reconvened and a representative of each group reported back their findings and observations to the whole group.

Group	Name
1 - Airlines and ANSP	Geoff Clark; Spencer Norton; Dave Wood; John Crook; Harri Howells; Adrian Dolan; Jane Dawes; Rick Norman.
2 – Community	Graham Young; Cllr Wendy Matthews; Peter Willan; John Coates; Margaret Majumdar; John Stewart; Rachel Thomas, Laura Jones.

7 Findings of the Workshop

The key factors for design principles identified in the second breakout session have been collated by Arup and are presented as a table in Appendix B, and summarised as a slide in Appendices C and D.

Both breakout groups identified safety and compliance with international regulatory frameworks as the highest priorities. Summary points noted in the feedback from the break-out sessions include:

- The importance of the concept of respite. That is, providing predictable relief from aircraft noise for periods of time. This is likely to be different for ‘close in’ communities compared to those further out and will require negotiation with affected communities.

- Communities newly overflown as a result of airspace change will require particular consideration.

- Airspace change should not adversely affect airport runway throughput.

- The need to consider the particular context of Heathrow when interpreting the Government's generic guidance on altitude based environmental priorities.

- The potential to introduce airspace changes before 2024 where they will benefit both communities and industry.

- The need to better understand community capacity to accommodate environmental change (particularly noise) when considering the implementation rate for airspace changes.

- The value of a strategic plan for airspace change implementation, providing clarity on the long term vision and the intermediate steps required to achieve it.

8 Next Steps

Arup concluded the workshop by explaining the next steps were as follows:

i) HAL will circulate the 'overview presentation' to the delegates.
ii) Arup will produce a summary note of the workshop. (This document)
iii) HAL will circulate the summary note to the delegates.
iv) The findings of the workshop will be used by HAL to develop questions that will form part of a formal consultation on the principles of airspace design for arrivals.
v) HAL will inform delegates how the workshop findings have been used to inform the arrivals redesign.

Appendix A

Workshop Attendees

1. Graham Young, Richings Park Residents Association
2. Councillor Wendy Matthews, South Bucks DC
3. Peter Willan, Richmond Heathrow Campaign
4. John Coates, London Borough of Richmond upon Thames
5. Margaret Majumdar, Ealing Aircraft Noise Action Group
6. John Stewart, HACAN
7. Geoff Clark, Virgin
8. Spencer Norton, BA
9. Dave Wood, BA
10. John Crook, NATS
11. Harri Howells, NATS
12. Adrian Dolan, NATS
13. Laura Jones, Heathrow Airport Ltd
14. Rick Norman, Heathrow Airport Ltd
15. Rachel Thomas, Heathrow Airport Ltd
16. Pete Rafano, Heathrow Airport Ltd
17. Jane Dawes, Heathrow Airport Ltd
18. Lizzie Cryan, Heathrow Airport Ltd
19. Xavier Oh, Heathrow Airport Ltd
20. David Twine, Arup (Workshop Facilitator)
21. Brendan Creavin, Arup (Workshop Facilitator).

Appendix B

Arrivals Airspace Change: Identified Key Factors for Design Principles and their Priorities

B1 Heathrow Arrivals: Identified Key Factors for Design Principles and their Priorities

Rank Order (High to Low)	ANSP and Airlines	Community
1	Safety	Safety
2	Comply with international regulatory frameworks Any solution must not adversely affect runway throughput	Comply with international regulatory frameworks Equitable distribution of noise (close in; further out) Provide predictable periods of relief from aircraft noise Minimise arrivals in 'sensitive' time periods (eg 23.00-23.30; 23.30-06.00; 06.00-07.00) irrespective of the passenger utility impacts. (NB: all times are Heathrow local).
3	Minimise aircraft fuel burn and CO_2 emissions through operational optimisation: climb gradient, minimised route length etc. Minimise CO_2 emissions up to 7000ft	Introduce PBN routes with multiple routes
4	Introduce PBN routes with multiple routes Descent gradient 3.0 degrees Keep as high as possible for as long as possible.	Minimise population number exposed in the medium to higher noise contours (e.g. >63 dB LAeq16hr) Any solution must not affect runway throughput

Rank Order (High to Low)	ANSP and Airlines	Community
5	Provide predictable periods of relief from aircraft noise Review noise policy: concentrate or disperse?	Minimise total population number exposed to aircraft noise (e.g. >57 dB LAeq16hr or 55 dB Lden) Descent gradient 3.5 degrees Take account of noise health effects in airspace planning Equality: take account of community socio-economic factors in determining the distribution of flight tracks.
6	Take account of baseline community noise levels in airspace planning Rural versus urban Explore options to remain within existing airspace boundaries (RMA/ CTA) No change in the distribution of departures Minimise population number newly exposed to aircraft noise (e.g. >57 dB LAeq16hr or 55 dB Lden) Equality: take account of community socio-economic factors in determining the distribution of flight tracks. Prioritise noise below 7000ft or higher	Minimise aircraft fuel burn and CO_2 emissions through operational optimisation: climb gradient, minimised route length etc. Minimise population number newly exposed to aircraft noise (e.g. >57 dB LAeq16hr or 55 dB Lden) Descent gradient 3.2 degrees Prioritise minimisation of NOx emissions below 1000ft Prioritise noise below 7000ft or higher

Rank Order (High to Low)	ANSP and Airlines	Community
7	Take account of noise health effects in airspace planning Maximise predictability of aircraft overflight Retain daily runway alternation Minimise frequency of aircraft overflight (alternation of arrivals tracks etc). Minimise arrivals in 'sensitive' time periods (eg 23.00-23.30; 23.30-06.00; 06.00-07.00) irrespective of the passenger utility impacts. (NB: all times are Heathrow local). Minimise population number exposed in the medium to higher noise contours (e.g. >63 dB LAeq16hr) Minimise total population number exposed to aircraft noise (e.g. >57 dB LAeq16hr or 55 dB Lden)	Maximise predictability of aircraft overflight Review noise policy: concentrate or disperse? Keep as high as possible for as long as possible Segmented approach gradient Descent gradient 3.0 degrees Rural versus urban Minimise CO_2 emissions up to 7000 ft Take account of baseline community noise levels in airspace planning No change in the distribution of departures
8	Equitable distribution of noise (close in; further out) Noise versus CO_2 Descent gradient 3.2 degrees	Retain daily runway alternation Minimise changes to existing pattern of noise exposure until LAMP is introduced in 2024 Explore options to remain within existing airspace boundaries (RMA/ CTA)

Rank Order (High to Low)	ANSP and Airlines	Community
		Noise versus CO_2 Minimise frequency of aircraft overflight (alternation of arrivals tracks etc).
9	Minimise changes to existing pattern of noise exposure until LAMP is introduced in 2024 Descent gradient 3.5 degrees Segmented approach gradient Prioritise minimisation of NOx emissions below 1000ft	

Appendix C

Arrivals Airspace Change: Identified Key Factors for Design Principles and their Priorities.

ANSP and Airlines

KEY FACTORS – ANSP and Airlines

Reducing Priority

Safety

Comply with international regulatory frameworks

Any solution must not adversely affect runway throughput

Minimise aircraft fuel burn and CO2 emissions through operational optimisation

Minimise CO2 up to 7000ft

Introduce PBN routes with multiple routes

Descent gradient 3.0 degrees

Keep as high as possible for as long as possible

Provide predictable periods of relief from aircraft noise?

Review noise policy: Concentrate or disperse

Take account of baseline community noise levels in airspace planning.

Rural versus Urban

Explore options to remain within existing airspace boundaries (RMA / CTA)

No change to distribution of departures

Minimise population number newly exposed to aircraft noise (eg >57 dB LAeq16hr or 55 dB(A) Lden).

Equality: take account of community socio-economic factors in determining the distribution of flight tracks.

Prioritise noise below 7000ft or higher

Take account of noise health effects in airspace planning.

Maximise predictability of aircraft overflight

Retain daily runway alternation.

Minimise frequency of aircraft overflight (alternation of arrivals tracks etc).

Minimise arrivals in 'sensitive' time periods(eg 23.00-23.30; 23.30-06.00; 0600-0700*) irrespective of passenger utility impacts.

Minimise population number exposed in the medium to higher noise contours (eg >63 dB LAeq, 16hr).

Minimise total population numbers exposed to noise (eg >57 dB LAeq16hr or 55 dB(A) Lden).

Equitable distribution of noise (close in; further out)

Noise versus CO2

Descent gradient 3.2 degrees

Minimise changes to existing pattern of noise exposure until LAMP is introduced in 2024

Descent gradient 3 .5 degrees

Segmented approach gradient

Prioritise minimisation of NOx emissions below 1000ft

Heathrow

*All times are Heathrow local

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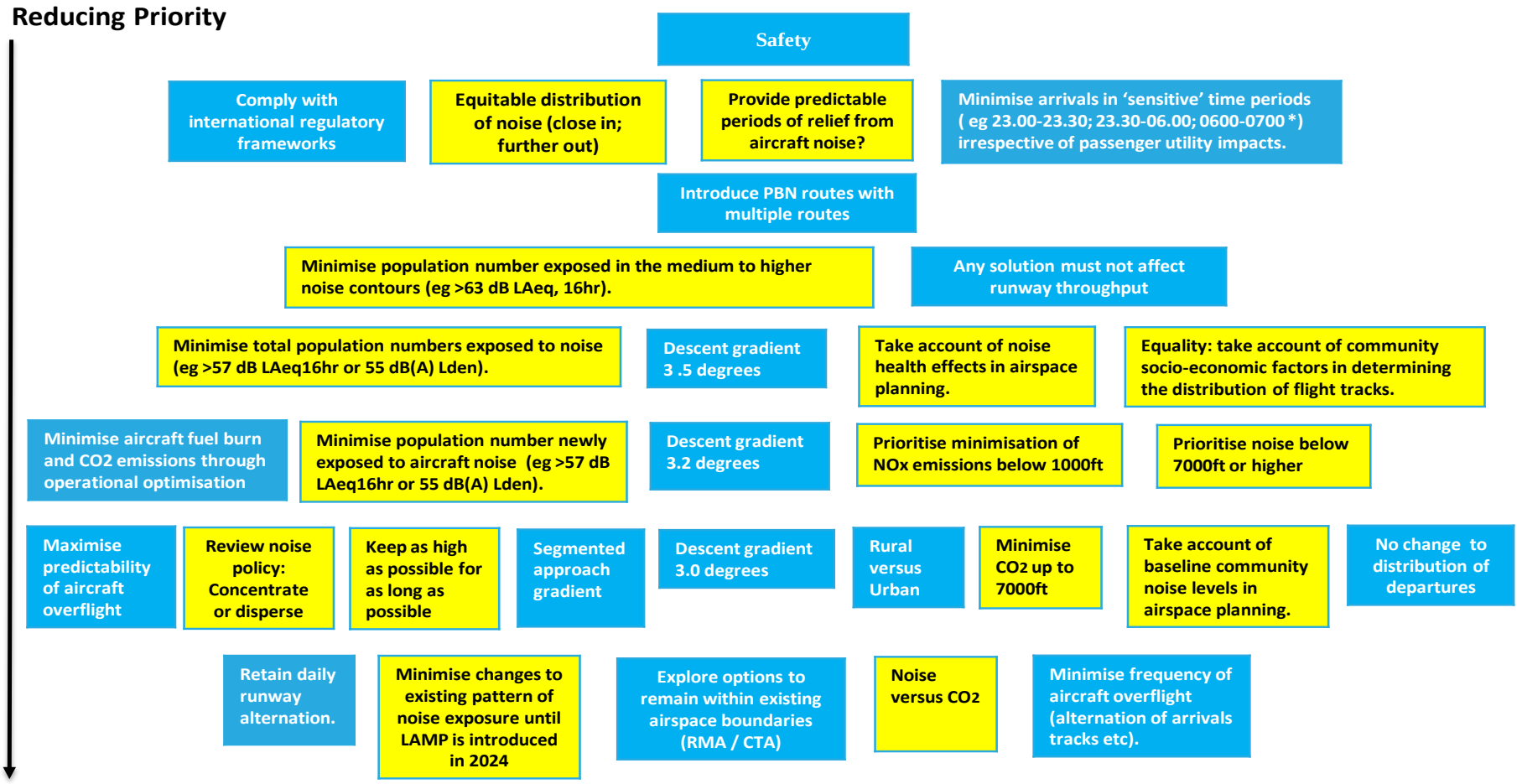
Appendix D

Arrivals Airspace Change: Identified Key Factors for Design Principles and their Priorities.

Community

KEY FACTORS – Community



Heathrow

*All times are Heathrow local

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