AIRSPACE PRINCIPLES

APPENDIX 2 – REPORTS ON AIRSPACE DESIGN PRINCIPLES WORKSHOPS, 2016

1. Compton 09 workshop (July 2016)
2. Arrivals workshop (November 2016)
3. Night Flights workshop (December 2016)

Heathrow

Heathrow Airport Ltd

Summary Note of Initial Stakeholder Workshop

Compton 09R/L CPT Standard Instrument Departures Route

| 23 September 2016

ARUP

Contents

1 Purpose of Workshop

1.1 To obtain initial views from key stakeholders on:

i) the key design principles that Heathrow should consider for the airspace change options when developing a new easterly Compton departure route (09R/L CPT) in the short term.

ii) the prioritisation of the identified key design principles.

1.2 To broaden Heathrow's general understanding of stakeholder views on 09R/L CPT.

2 Attendees

Representatives from 11 key stakeholders 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 four 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 air traffic compliance with 09R/L Compton SID

   b. UK environmental policy landscape for air traffic management.

iii) Breakout sessions:

   a. Identify key factors in the decision making process for redesign of 09R/L Compton.
   b. Consider priorities for the identified key factors:
      i. Community perspective;
      ii. Airline perspective.
   c. Review and discuss findings.

iv) Next steps

v) Wrap up

4 Background

All aircraft departing from Heathrow use one of a number of Standard Instrument Departures (SID). Each SID has a noise preferential route (NPR) associated with it. Each NPR has a three kilometre wide swathe. Unless required for safety reasons, aircraft must remain within the NPR until they reach an altitude of 4,000ft above mean sea level (AMSL). Once above 4,000ft AMSL, aircraft may be directed off the NPR by Air Traffic Control (NATS) as required.

The 09R/L Compton (09R/L CPT) SID is currently used by approximately 16% of departing aircraft when Heathrow is on easterly departure operations, and equates to around 6% of total departures. The 09L CPT departure route is used only in exceptional circumstances, in accordance with the Government's former Cranford Agreement, which was revoked in 2010. The 09R CPT route involves a 180° turn to the west, which is extremely difficult for modern large aircraft to negotiate within the swathe of the NPR. In addition, traffic departing on this route generally has to be directed by Air Traffic Control to avoid traffic arriving from the holding stacks to the south of the airport (for example, Ockham). As a consequence 09R CPT NPR has for many years not achieved the same level of aircraft track keeping and vectoring compliance as other Heathrow NPRs.

Since 2009, the current 09R/L CPT SID has included an ongoing vectoring trial based on a standardised heading. NATS introduced a new separate tactical vectoring procedure on 27 June 2014 which resulted in a change in the distribution of air traffic on 09R CPT, concentrating it closer to the inside of the turn and more to the north.

Heathrow has previously sought to introduce a new departure procedure to address the compliance shortcomings of 09R/L CPT. A new conventional procedure was designed and submitted to CAA in March 2015 but was not accepted by DfT as the procedure was not compliant with the UK's Future Airspace Strategy. The Government endorses the adoption of Performance Based Navigation (PBN) as part of the UK's Future Airspace strategy.

In November 2014, the CAA requested an update from Heathrow as to how it intended to address the 09R/L CPT SID performance deficiencies, and remove the need for operational workarounds (i.e. the current trial). In response, Heathrow's Airspace Governance Group determined to investigate procedural design solutions for 09R/L CPT in consultation with the airport's Community Noise Forum (HCNF). A work programme was established to develop potential design options that can be implemented as a short term solution and engage with key stakeholders, with project oversight being undertaken by a sub-group of HCNF. As part of the review process for design options, the project group noted the need for a workshop to identify key design principles and their prioritisation. Arup was appointed to support and independently facilitate this workshop, held on 28 July 2016.

5 Scope of the Workshop

The framework established for the workshop is described in Section 1. That is:

i) To obtain initial views from key stakeholders on:

   a. the key design principles that Heathrow should consider for the airspace change options when developing a new easterly Compton departure route (09R/L CPT) in the short term.

   b. the prioritisation of the identified key design principles.

ii) To broaden Heathrow's general understanding of stakeholder views on 09R/L CPT.

It was noted that there are wider strategic imperatives that will drive a complete redesign of Heathrow's airspace by 2024. These include Single European Skies, UK Future Airspace Strategy and the London Airspace Management Programme. In this context, the scope of this workshop was to consider 09R/L CPT in isolation, such that:

i) the implementation of a design solution can be undertaken independently from, and in advance of, these other initiatives.
ii) the design solution does not compromise other existing SID or standard arrival routes (STAR).

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

A break-out session was held with all delegates to discuss what design principles they considered were most important in the decision making process for redesign of 09R/L CPT. This was supported by some suggested design principles on printed cards (including blanks) to assist discussion.

A second break-out session was then held to determine the rank order of the identified principles 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 for discussion.

[1] Compton 09R/L Departure Route – Workshop with stakeholders about possible airspace change. 28 July 2016

Group	Name
1 - Airlines and ANSP	[redacted]
2 – Community	[redacted]

7 Findings of the Workshop

The key 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. Both groups also identified noise aspects amongst the highest priorities.

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. (Completed)
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 in conjunction with Arup to pose questions that will form part of a formal consultation on the principles of airspace design for 09R/L CPT.
v) HAL will consider the findings of the formal consultation and their implications for redesign of 09R/L CPT. This may lead to a subsequent formal consultation on redesign options for 09R/L CPT.
vi) HAL will inform delegates how the workshop findings have been used, prior to commencement of any formal consultations for 09R/L CPT redesign.

Appendix A

Workshop Attendees

1. [redacted], Resident of Englefield Green
2. [redacted] Resident of Surrey Heath
3. [redacted] Royal Borough of Windsor and Maidenhead
4. [redacted] London Borough of Hounslow.
5. [redacted]
6. [redacted] Virgin Atlantic Airways
7. [redacted] International Air Transport Association (IATA)
8. [redacted] NATS
9. [redacted] NATS
10. [redacted] NATS
11. [redacted] Heathrow Airport Ltd
12. [redacted] Heathrow Airport Ltd
13. [redacted] Heathrow Airport Ltd
14. [redacted] Heathrow Airport Ltd
15. [redacted]Heathrow Airport Ltd
16. [redacted]Heathrow Airport Ltd
17. [redacted] Arup (Workshop Facilitator)
18. [redacted] Arup (Workshop Facilitator).

Appendix B

Compton 09R/L CPT Redesign: Key Design Principles and Priorities Identified from the Workshop

B1 09R/L CPT Redesign: Identified Key Design Principles and Priorities

Rank Order (High to Low)	ANSP, Airlines and Airport	Community and Airport
1	Safety	Safety
2	Introduce PBN Routes Comply with international regulatory frameworks Any solution must not affect runway throughput Climb gradients must not prevent any departing aircraft from achieving height requirements given local weather, temperature and max weight.	Comply with international regulatory frameworks
3	Be a good neighbour Minimise total population numbers exposed to noise Minimise aircraft fuel burn and CO2 emissions through operational optimisation: climb gradient, minimised route length etc. Minimise vectoring below 4000ft or higher Not change distribution of arrivals	Review policy: concentrate or disperse? Take account of noise health effects in airspace planning (Noise Policy Statement for England)

Rank Order (High to Low)	ANSP, Airlines and Airport	Community and Airport
4	Climb gradient 4 percent Stay within existing NPR (short term) or develop a new NPR Maximise NPR track keeping compliance Provide predictable periods of relief from aircraft noise.	Prioritise noise up to 7000ft or higher
5	Review policy: concentrate or disperse?	Stay within existing NPR (short term) or develop a new NPR Climb rate: higher quicker.
6	Prioritise noise up to 7000ft or higher Remain within existing airspace boundaries (RMA/ CTA)	Explore PBN routes first to establish possible benefits Provide predictable periods of relief from aircraft noise. Maximise predictability of aircraft overflight Minimise vectoring below 4000ft or higher
7	Minimise changes to existing pattern of noise exposure until LAMP is introduced in 2024 Prioritise NOx emissions below 1000ft	Minimise frequency of aircraft overflight Minimise population number newly exposed to aircraft noise (e.g. >57 dB LAeq16hr or 55 dB Lden)

Rank Order (High to Low)	ANSP, Airlines and Airport	Community and Airport
8	N/A	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)
	<u>Design principles not used</u> Minimise population number exposed in the medium to higher noise contours (e.g. >63 dB LAeq16hr) Minimise population number newly exposed to aircraft noise (e.g. >57 dB LAeq16hr or 55 dB Lden) Maximise predictability of aircraft overflight Minimise frequency of aircraft overflight	<u>Design principles "Parked"</u> Remain within existing airspace boundaries (RMA/ CTA) Maximise NPR track keeping compliance Any solution must not affect runway throughput No change in distribution of arrivals Prioritise NOx emissions below 1000ft Minimise changes to existing pattern of noise exposure until LAMP is introduced in 2024 Minimise aircraft fuel burn and CO_2 through operational optimisation: climb gradient, minimised route length etc.

Appendix C

Key Design Principles and Priorities Identified by ANSP, Airlines and Airport

Design Principles – ANSPs, Airlines and Airport

Safety

Introduce PBN routes

Comply with international regulatory frameworks

Any solution must not affect runway throughput

Climb gradients must not prevent any departing aircraft from achieving high requirement given in local weather, temperature and max weight

Good Neighbour

Minimise total population numbers exposed:

- to noise (e.g. >57dB LAeq16hr or 55dB Lden).
- in the medium to higher noise contours (e.g. >63 dB LAeq, 16hr).

Minimise aircraft fuel burn and CO2 emissions through operational optimisation: climb gradient, minimised route length etc.

Minimise vectoring below 4000ft or higher

Not change distribution of arrivals

Climb Gradient

4%?

Stay within existing NPR (short term) or develop a new NPR?

Maximise NPR track keeping compliance.

Provide predictable periods of relief from aircraft noise

Reducing priority

Review Policy:
Concentrate or disperse?

Prioritise noise up to 7000ft or higher

Within existing airspace boundaries (RMA / CTA)

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

Prioritise minimisation of NOx emissions below 1000 ft.

Not Used

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

Maximise predictability of aircraft overflight

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

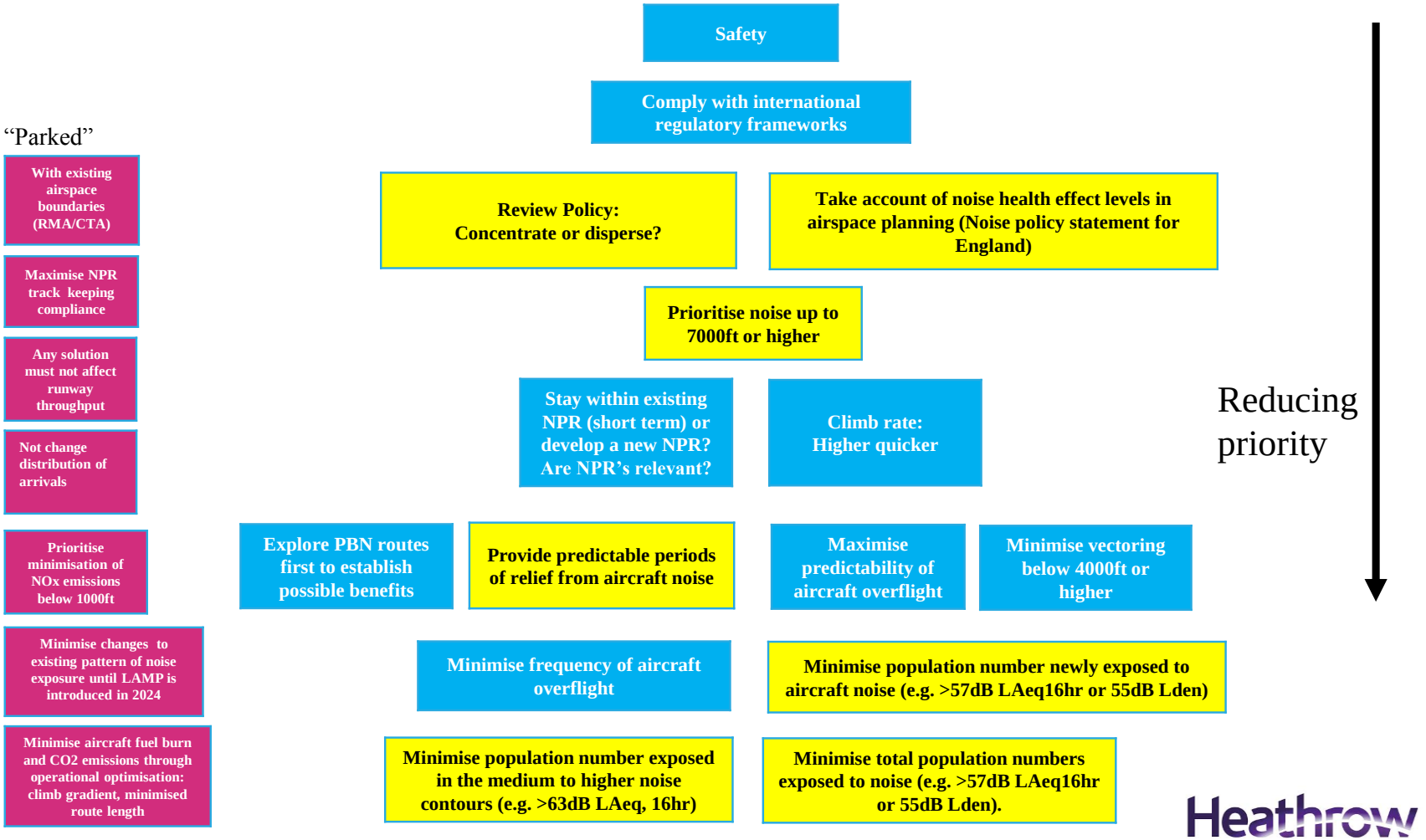
Minimise frequency of aircraft overflight

Heathrow

Appendix D

Key Design Principles and Priorities Identified by Community and Airport

Design Principles – Community and Airport



Heathrow

Heathrow Airport Ltd

Summary Note of Arrivals Workshop held 8 Nov 2016

Arrivals Airspace Change: Key Factors for Design Principles.

| 9 January 2017

ARUP

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	[redacted]
2 – Community	[redacted]

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. [redacted] Richings Park Residents Association
2. [redacted] South Bucks DC
3. [redacted] Richmond Heathrow Campaign
4. [redacted] London Borough of Richmond upon Thames
5. [redacted] Ealing Aircraft Noise Action Group
6. [redacted], HACAN
7. [redacted], Virgin
8. [redacted], BA
9. [redacted], BA
10. [redacted], NATS
11. [redacted], NATS
12. [redacted], NATS
13. [redacted], Heathrow Airport Ltd
14. [redacted], Heathrow Airport Ltd
15. [redacted], Heathrow Airport Ltd
16. [redacted], Heathrow Airport Ltd
17. [redacted], Heathrow Airport Ltd
18. [redacted], Heathrow Airport Ltd
19. [redacted], Heathrow Airport Ltd
20. [redacted], Arup (Workshop Facilitator)
21. [redacted], 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)

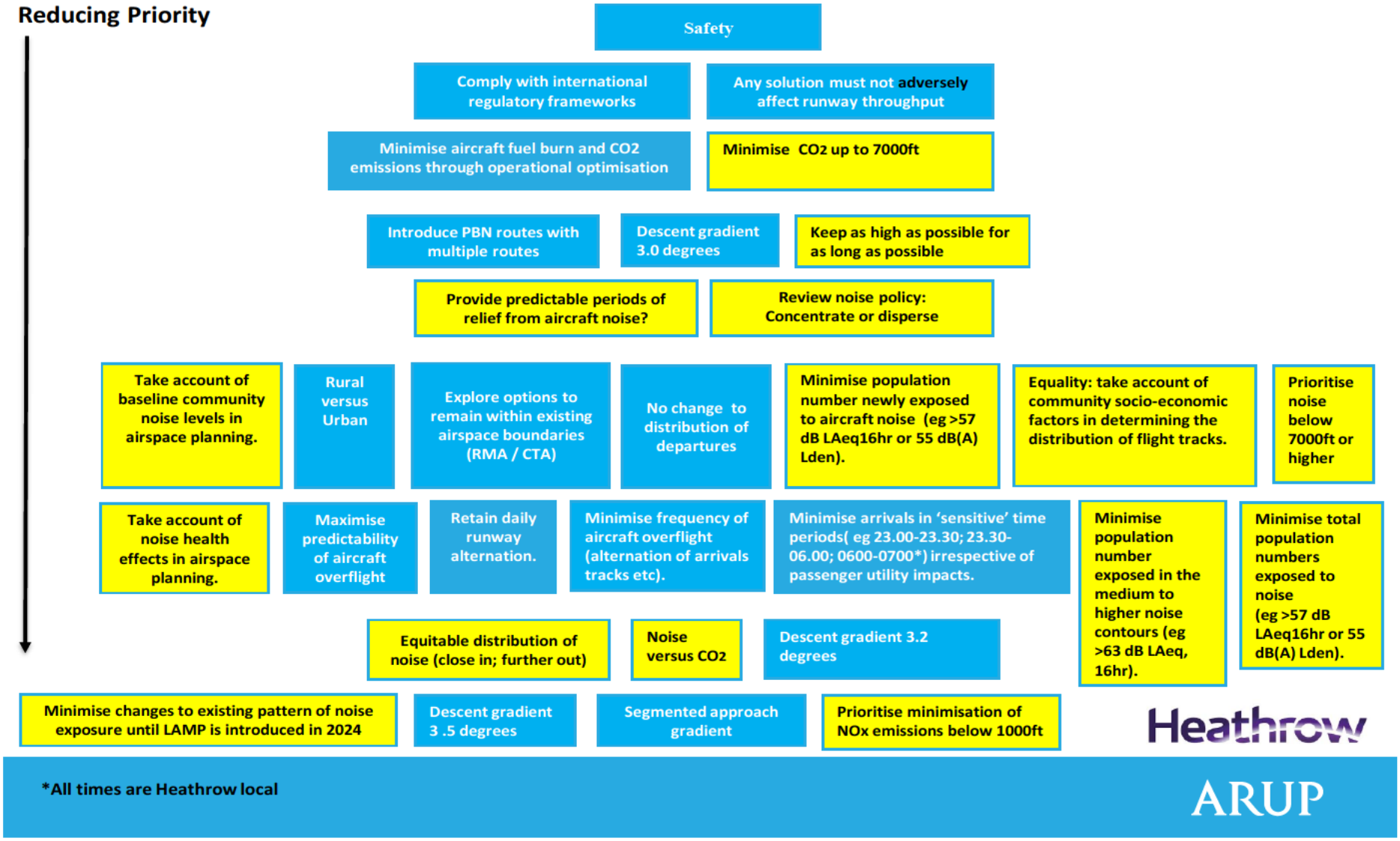
Rank Order (High to Low)	ANSP and Airlines	Community
		Noise versus CO_2 Minimise frequency of aircraft overflight (alternation of arrivals tracks etc).
9	Minimise changes to existing pattern of noise exposure until LAMP is introduced in 2024 Descent gradient 3.5 degrees Segmented approach gradient Prioritise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



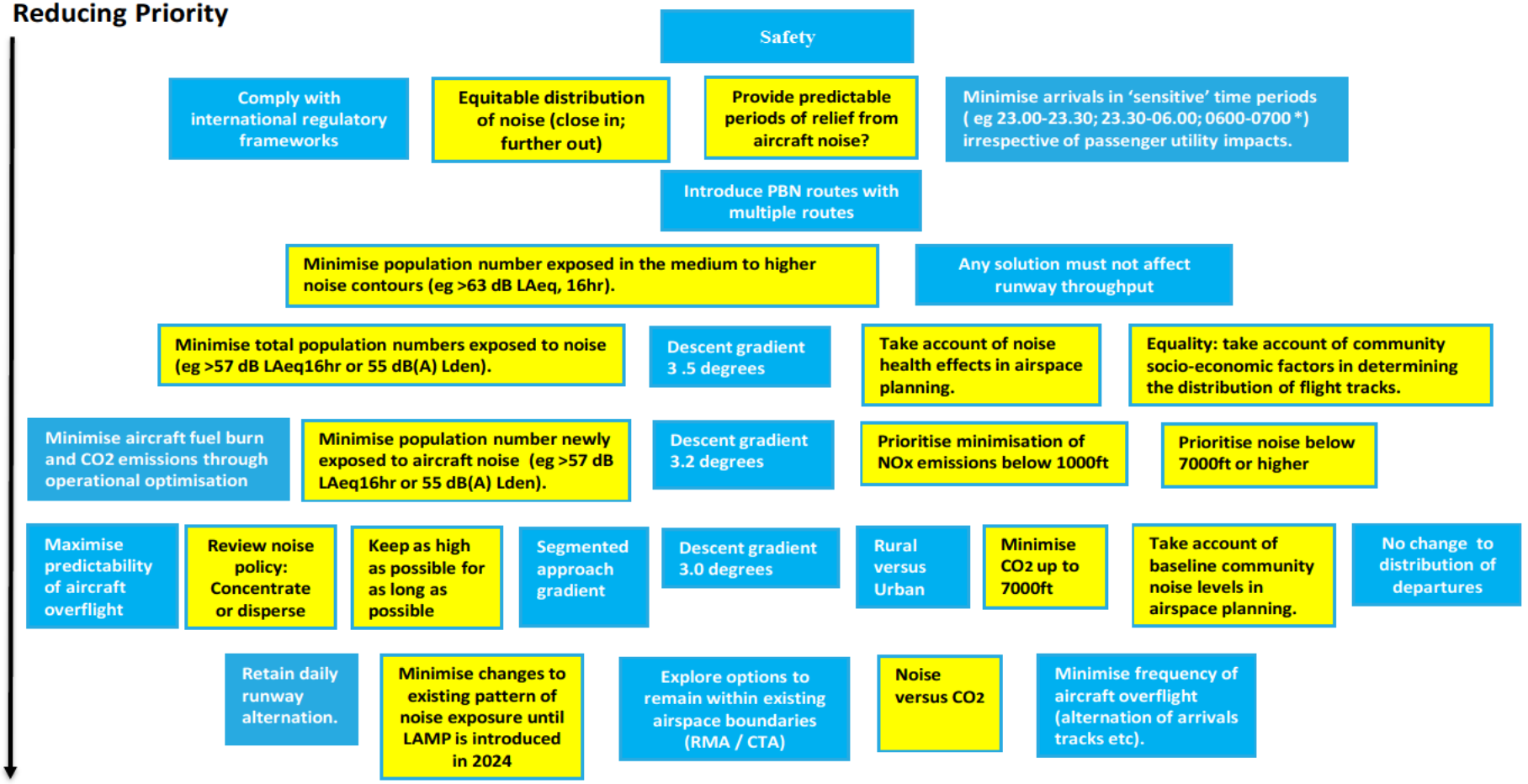
Appendix D

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

Community

KEY FACTORS – Community

Reducing Priority



Heathrow

*All times are Heathrow local

ARUP

Heathrow Airport Ltd

Summary Note of Night Flights Workshop held 1 Dec 2016

Night Flights: Key Factors for Operating Principles.

| 9 January 2017

Job number

ARUP

Contents

1 Purpose of Workshop

1.1 To obtain initial views from key stakeholders on:

i) The key factors that Heathrow should take into account when considering operating principles for late evening and night flights.

ii) The prioritisation of the identified key factors.

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

2 Attendees

Representatives from 14 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 night flights. 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 night flights.

   b. Heathrow's proposed voluntary Quiet Nights Charter.

iii) Breakout sessions:

   a. Identify key factors for operating principles that Heathrow should take into account on night flights.
   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 Night Flights

Night flights at the UK's noise designated airports (Heathrow, Gatwick and Stansted) are strictly controlled by the Department of Transport (DfT) under Section 78 of the Civil Aviation Act 1982, which sets restrictions on the amount of aircraft noise that can be made at night. These restrictions are established within the framework of the ICAO Balanced Approach to airport noise management.

The structure of the DfT night flying restrictions has been in place since October 1993 and established movement limits and noise quotas between 23.30 – 06.00 hours local (the 'night quota period'). There are also restrictions on the noisiest types of aircraft between 23.00-23.30 hours and 06.00-07.00 hours (the 'shoulder periods') based on the aircraft quota count (QC). The QC system assigns quota points to each aircraft based on its individual certificated noise data. This will differ depending on whether it is arriving or departing.

The night flying restrictions are divided into summer and winter seasons, with movement limits and total noise quota limits assigned to each. Rules are established for the extent that movements or noise quota can be carried over from one season to the next. There are also rules on the special circumstances in which individual flights may be dispensed or exempted from the night flight controls.

The DfT's night flight controls at Heathrow are amongst the strictest of any hub airport in Europe between 23.00 and 06.00hours[1] local. Heathrow is restricted by the Government to 5,800 night-time take-offs and landings a year between 23.30 and 06.00 hours. This equates on average to about 16 movements per night in the night quota period, of which 85-90% comprise scheduled early morning arrivals. The restrictions on the type of aircraft that can be scheduled to operate during the night at Heathrow according to their QC number are as follows:

- Between 11.00 and 07.00 hours local, aircraft in the two highest bands (QC8 and QC16) cannot be scheduled to take off or land.
- Between 11:30 and 06.00 hours local, aircraft in the three highest bands (QC4, QC8 and QC16) cannot be scheduled to take off or land.

Most of Heathrow's night flights comprise arrivals after 04.30 hours, with the majority taking place after 05.00 hours. They are mainly long-haul arrivals passenger services, with over 70% originating from Asia and the Middle East. Other night flight services operate for a number of reasons. With current runway capacity constraints at Heathrow, any runway disruption or flight delays can accumulate throughout a day with the result that a number of late running aircraft, primarily departures, need to operate during the first part of the night quota

[1] Faber et al (2012) Night Flight Restrictions and Airline Responses at Major European Airports. Report by CE Delft for ADVOCNAR.

period. Furthermore, during periods of widespread and prolonged air traffic disruption, for example due to inclement weather (fog, snow) or air traffic controller strikes, flights may need to operate at night to avoid serious hardship being caused to passengers.

The Government sets a weekly rotation pattern for westerly and easterly Heathrow runway operations. This has the effect that at night, when there is little or no wind, one week arrivals are from the west, and the next they are from the east.

Since 1993 the number of movements permitted at Heathrow has remained constant whilst developments in aircraft technology have enabled the QC limits to be reduced. This progress is reflected in the size of the Lnight (6.5 hour) 48 dB(A) contour which has reduced from 56.4km^2 in 2006 to 33.0 km^2 in 2014.

The Government consults on the night flight restrictions at the noise designated airports every five years or so, striking a balance between the economic and social benefits and the environmental disbenefits. Its current night flights regime was set in July 2014 and the Government is expected to be consulting in early 2017 on a new regime, to commence in 2017.

Voluntary Quiet Nights Charter

In 2016 Heathrow published its second Blueprint for Noise Reduction, setting out ten practical steps the airport will take to reduce aircraft noise in response to feedback received from local communities. One of the commitments is to reduce the impact of night flights through the development of a voluntary Quiet Night Charter.

The key principles for the Charter are being developed in partnership with airlines and the Heathrow Community Noise Forum (HCNF), particularly Working Group 3 on Night Operations. Building on analysis and discussions with HCNF during 2016, Heathrow's primary focus for the Charter became late running departures during normal operations (that is, non-dispensed aircraft). In particular, the practical measures Heathrow and airlines could take to reduce late running and its community impacts. This includes aspects such as the distribution of aircraft across different departure routes and the operational procedures prior to the night quota period which could reduce the risk of late running departures.

Heathrow, airlines, NATS, industry representatives and the HCNF are currently reviewing a range of operating principles to inform the development of the Charter. These include:

- Whether to optimise the noise environment for communities closer in or further out;
- Whether to accept more noise in some communities in order to reduce for others;
- How to share planned respite;

- Whether to provide more respite before 23.30 if this introduces a greater risk of running post 23.30hrs;
- Whether to have fewer late running departures at the expense of more early arrivals;
- How to trade impacts of late departures on community and passengers.

Workshop on Key Factors for Operating Principles

To help inform the development of the voluntary Quiet Nights Charter and more broadly to improve Heathrow's understanding of key stakeholder priorities for night flights operating principles, the airport committed to hosting an engagement workshop on night flights.

Arup was appointed to support and independently facilitate the workshop, held on 1 December 2016 at the Heathrow Compass Centre.

5 Scope of the Workshop

The framework for the workshop is described in Section 1 and the scope of this workshop was to consider Heathrow night flights in isolation.

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[2] was given to delegates by HAL and Helios setting out the regulatory and policy context for Heathrow night flights, together with the work underway to develop the voluntary Quiet Nights Charter.

A break-out session was held with all delegates to discuss what key factors for operating principles they considered were most important in the management of night fights. 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 for discussion.

[2]Workshop with stakeholders about Heathrow Night Flights. 1 December 2016.

Group	Name
1 - Airlines and ANSP	[redacted]
2 – Community	[redacted]

7 Findings of the Workshop

The key factors for operating principles identified in the second breakout session have been collated by Arup and are summarised as a slide in Appendices B and C.

Both breakout groups identified safety and compliance with international regulatory frameworks amongst 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:
  - Any respite scheme for night time will likely need to differ from that during the day.
  - A respite scheme could help reduce the impacts of late running departures.
  - The duration of a respite scheme time interval at night is important for communities. One suggestion was for a two day duration of respite.
  - A ‘creative’ concept of respite at night may be attractive for communities, based on the smaller number of flights involved compared to day time.
  - The need to consider communities located in between flight routes when setting the spatial separation of any respite tracks.

- For Heathrow night flights, noise should be accorded priority over NOx emissions and CO_2/ fuel burn when interpreting the Government's generic guidance on altitude based environmental priorities below 7000ft. Furthermore, application of these priorities should not compromise operational capabilities.

- Community representatives commented that where new capacity becomes available, flights should be allocated to the daytime (07.00-23.00) in preference to the shoulder periods (23.00-23.30 and 06.00-07.00).

- There was no consensus position amongst the community representatives on whether late running aircraft or early morning arrivals should be accorded highest priority.

- For late running departures, airlines need to achieve a balance between impacts on passengers and impacts on communities. Community representatives commented that they believed late departures affect fewer passengers than members of the community.

- Both communities and industry representatives identified the need for night flights policy to be informed by robust evidence on the economic, social and environmental/ health benefits and disbenefits.

- Aircraft are required to comply with international regulatory frameworks, so global consistency in airport operating requirements is important to airlines.

- The importance of coherent land use planning policy to help reduce impacts on noise sensitive properties, as per the ICAO's Balanced Approach. This would help ensure that the improvements delivered by quieter aircraft and operating practices are not eroded by the encroachment of new noise sensitive properties, particularly in higher noise exposed areas.

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 inform the ongoing management of night flights and the formulation of the voluntary Quiet Nights Charter.

Appendix A

Workshop Attendees

1. [redacted], Richings Park Residents Association
2. [redacted], South Bucks DC
3. [redacted], Richmond Heathrow Campaign
4. [redacted], Ealing Aircraft Noise Action Group
5. [redacted], London Borough of Hounslow
6. [redacted], HACAN
7. [redacted], Englefield Green
8. [redacted], Englefield Green
9. [redacted], Elmbridge Borough Council
10. [redacted], Teddington Action Group
11. [redacted], Virgin
12. [redacted], BA
13. [redacted], NATS
14. [redacted], NATS
15. [redacted], IATA
16. [redacted], LACC
17. [redacted], Heathrow Airport Ltd
18. [redacted], Heathrow Airport Ltd (in part)
19. [redacted], Heathrow Airport Ltd
20. [redacted], Heathrow Airport Ltd
21. [redacted], Heathrow Airport Ltd
22. [redacted], Heathrow Airport Ltd
23. [redacted], Heathrow Airport Ltd
24. [redacted], Helios (Workshop Presenter)
25. [redacted], Arup (Workshop Facilitator)
26. [redacted], Arup (Workshop Facilitator).

Appendix B

Night Flights: Identified Key Factors for Operating Principles and their Priorities.

Airlines and ANSP

KEY FACTORS – Airlines and ANSP

Reducing Priority

1. Operational

- Safety
- Comply with international regulatory frameworks
- Prioritise needs of passengers alongside community for late running departures
- Prioritise needs of community alongside passengers for late running departures
- Minimise aircraft fuel burn and CO2 emissions through operational optimisation: CDA; final joining altitude etc
- More early arrivals to reduce the risk of late running departures
- Introduce multiple PBN routes in order to provide respite
- Keep as high as possible for as long as possible
- Prioritise noise over CO2 and NOx at night below 7000ft or higher
- Minimise QC count of night flying aircraft
- Minimise frequency of aircraft overflight (alternation of departure tracks etc).
- Maximise predictability of aircraft overflight
- No flights between 23.00-07.00 (scheduled and unscheduled)
- More respite before 23.30hrs with greater risk of running post 23.30hrs
- Statutory requirement to achieve WHO noise guidelines according to an agreed timetable
- Voluntary QC4 aircraft operating ban by 2020 (and some QC2s eg A380, A320)
- Operational restrictions on noisiest aircraft to be based on in-use noise levels

2. Balancing Effects

- Take account of population density in night flights policy
- Communities exposed to higher noise levels or overflight numbers should receive more mitigation/ compensation
- Provide predictable periods of relief from aircraft noise
- Take account of community socio-economic factors in determining the distribution of flight tracks.
- Optimise noise environment for communities further out (on departures)
- Accept more noise in some communities in order to reduce for others
- Optimise noise environment for communities closer in (on departures)
- Rural versus urban
- Review noise policy: concentrate or disperse
- Two day rolling planned respite

3. Process Aspects

- Airspace to be designed to objective quantitative noise standards
- Take account of economic and social benefits and disbenefits of night flights in night flights policy
- Take account of noise health effects in airspace planning (including monetisation)

Heathrow

All times are Heathrow local

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Appendix C

Night Flights: Identified Key Factors for Operating Principles and their Priorities.

Community

KEY FACTORS – Community