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1. **THE PURPOSE OF THIS DOCUMENT**

1.1.1 This document describes our approach to delivering predictable relief from noise through two separate but linked systems; runway alternation and airspace alternation.

1.1.2 This document contains technical information and has been written for stakeholders with an interest in understanding the content of the *Airspace and Future Operations: Consultation Document* on the provision of respite through alternation in more detail, as well as those more familiar with the operation of Heathrow. If you would like to read a summary of all the proposals in this consultation, please see the *Airspace and Future Operations Consultation Document*.

1.1.3 The structure of this document is as follows:

- This is a technical document and so in sections 2 and 3 we have included an explanation of some of the key terms used in exploring and explaining this topic.

- In section 4 we explain how runway alternation works today.

- In section 5 we summarise the feedback we have had on alternation in the past, including from the consultation we held in January 2018, and how this has informed our work.

- In section 6 we describe how runway alternation could be provided in the future, including describing our emerging thinking and the options we have considered. Section 6 also introduces the key issues we are consulting on in this consultation.

- In section 7 we present how, with three runways, we can extend respite to areas located further from Heathrow, using airspace alternation.

- Section 8 summarises the key issues where we are asking for your feedback in this consultation.
2. **WHAT IS RUNWAY ALTERNATION?**

2.1.1 Runway alternation is a system where the runways in use for departures and arrivals are switched on a scheduled basis.

2.1.2 This is to give those people living and working under the final approach and initial departure flight paths a predictable break from noise.¹ This predictable break is called respite, which is recognised as being important to local communities.

2.1.3 Heathrow has operated a runway alternation scheme during westerly operations² since 1972 and we recognise that this is a valued system.

2.2 **Alternation & Expansion**

2.2.1 We are committed to continuing to use a system of runway alternation for an expanded airport and have always been clear that expansion will allow us to continue to provide predictable respite for communities who are affected by noise. It is crucial that the new runway alternation scheme is developed in close consultation with our communities, airlines, and other interested parties.

2.2.2 The Airports National Policy Statement (Airports NPS) requires us to “...put forward plans for a runway alternation scheme that provides communities affected with predictable periods of respite (though the Government acknowledges that the duration of periods of respite that currently apply will be reduced). Predictability should be afforded to the extent that this is within the airport operator’s control. The details of any such scheme, including timings, duration and scheduling, should be defined in consultation with local communities and relevant stakeholders, and take account of any independent guidance such as from the Independent Commission on Civil Aviation Noise”³.

2.2.3 In addition, we have prepared draft proposals for a noise objective that we are consulting on as part of this consultation which acknowledges the importance of breaks from noise. The draft noise objective is designed to be the guiding principle for how we minimise the impacts of noise at Heathrow in the future. The role of the draft noise objective and

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¹ Today, the final approach is approximately 7 -10 nautical miles from the end of the runway, and the initial departures flight paths extend to approximately 2-3 miles from the end of each runway before they merge.

² For an explanation of what westerly operations is, please see the Airspace and Future Operations Consultation Document or the longer more technical paper entitled Runway Operations – Directional Preference

³ Paragraph 5.61
the process we are going through to develop it is explained in more
detail in the document *Developing our approach to noise management*.

2.2.4 The draft Noise Objective as it currently stands explicitly recognises the
importance of respite to communities:

*To limit and, where possible, reduce the effects of noise on health and
quality of life and deliver regular breaks from scheduled flights for our
communities during the day and night. We need to do this whilst making
sure the measures we put in place are proportionate and cost effective.*

2.2.5 We have explained in *Developing our approach to noise management*
how we propose to measure success against this objective, including
the metrics.

2.2.6 A runway and airspace alternation scheme (airspace alternation is
explained in Section 7) is a method of delivering regular breaks from
flights for communities.

2.2.7 Our emerging thinking indicates that, with expansion, we will be able to
provide predictable periods of respite to communities over a much wider
area than today for both easterly and westerly operations. We can do
this by alternating how airspace is used alongside the alternation of the
runways. We are interested in views on runway and airspace alternation
and specifically the frequency with which the operating patterns should
be alternated.

2.2.8 There are a number of variables in developing an alternation scheme,
such as the length and timing of the changes. This means there are
many different ways that a runway or airspace alternation pattern could
work.

2.2.9 However, overall each method would result in broadly the same long-
term average noise exposure for the communities affected when
measured using standard noise exposure metrics. This is explained in
section 6.4.3 below.

2.2.10 As a result, in order for us to determine the best alternation pattern, we
have to look beyond noise assessments to understand the views of
communities about variables such as the duration of a period of respite
and how often this respite is experienced. This consultation is designed
to support that.
3. WHAT IS RESPITE?

3.1.1 By respite, we mean predictable **relief from aircraft noise for a period of time for local communities**.

3.1.2 We know from community feedback that, for residents affected by aircraft noise, scheduled breaks offered by runway alternation are highly valued. We have been engaging with community groups for several years and a common request is whether we can extend predictable relief (respite) to those communities further away from the airport, who benefit less from runway alternation but would benefit from alternation of airspace or flight paths.

3.1.3 Heathrow identified a need to improve its understanding of respite from aviation noise and in October 2014 set up an independently chaired Respite Working Group (RWG) to investigate and advise. The RWG has produced two reports: the first on best practice (or state of the art) in relation to respite and the second on the perceived benefits that respite provides to communities and whether the benefits are perceived differently at different times of the day. The RWG is currently conducting further research on the value of respite which will be published in 2019. Further information on the respite research including details of the RWG is available on the Heathrow website.

3.1.4 As part of its first report the RWG offered the following working definition of the difference between respite and relief from aircraft overflight:

- **Relief** can be defined as a break from or a reduction in aircraft noise.
- **Respite** can be defined as a predictable relief from aircraft noise for a period of time.

3.1.5 When we use these terms in this document, they refer to the definitions above.

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4. **RUNWAY ALTERNATION TODAY**

4.1.1 In this section we describe how runway alternation works at Heathrow today, during the day and night, and how this varies when the wind direction changes.

4.2 **Daytime runway alternation**

4.2.1 Our current “Daytime alternation” starts at 06:00 and continues until the last scheduled aircraft departs at the end of the day.

4.2.2 Our current daytime runway alternation pattern runs on a two-week cycle. In the “morning” Heathrow uses one runway for take-offs and the other for landings. At 15:00 (roughly halfway through Heathrow’s working day), we swap over. We continue this “morning” (until 15:00) and “evening” pattern (until 23:00) for one week, and the following week we switch. In other words, what we did in the evening during the previous week, we now do in the morning - and vice versa. This is illustrated below in figure 1. This schedule is published on a yearly basis and is available on our website 5.

4.2.3 At present, runway alternation only occurs during the day when Heathrow is operating on westerly operations, which is approximately 70% of the time. 6 On easterly operations, Heathrow does not alternate the runways during the day because of the legacy of the ‘Cranford Agreement’ which prevented us from using the northern runway for departures during the day.

4.2.4 Although the Cranford Agreement has now ended, Heathrow needs to undertake works to the airport's infrastructure before runway alternation on easterly operations is possible. 7 The specific infrastructure we need will be delivered through the Development Consent Order (DCO) process. For more information please visit our website: www.heathrow.com/cranford

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5 [https://www.heathrow.com/noise/heathrow-operations/runway-alternation](https://www.heathrow.com/noise/heathrow-operations/runway-alternation)
6 For more information on Westerly & Easterly operations, please see our other consultation document Runway Operations – Directional Preference
7 Changes to airspace would also be required.
We make every effort to adhere to the published runway alternation schedule. However, sometimes during busy periods there may be a build-up of flights being held in holding stacks. When this happens, the Government has set rules permitting NATS (the sole provider of air traffic services for London Approach) to land aircraft ‘out of alternation’, i.e. to land aircraft on the departures runway. In these circumstances,
both runways will be used for arrivals for a temporary period. This is allowed, for instance, immediately after 07:00 when severe inbound congestion occurs, or is anticipated to occur.

4.2.6 The hour between 06:00 and 07:00 is the busiest time of the day at Heathrow for arrivals so we are permitted to use both runways for landing during that time. More details of how aircraft land out of alternation are set out in the consultation document 'Making Better Use of Our Existing Runways'.

4.2.7 Typically, the daytime alternation pattern is adhered to for around 94% of the time. Table 1 summarises the adherence to the published daytime alternation pattern in the last 5 years.

**Table 1 – Adherence to daytime alternation pattern**

<table>
<thead>
<tr>
<th>Year</th>
<th>Runway Alternation Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>93%</td>
</tr>
<tr>
<td>2014</td>
<td>93%</td>
</tr>
<tr>
<td>2015</td>
<td>93%</td>
</tr>
<tr>
<td>2016</td>
<td>95%</td>
</tr>
<tr>
<td>2017</td>
<td>94%</td>
</tr>
</tbody>
</table>

4.3 Night-time runway alternation

4.3.1 Since there are relatively few aircraft taking-off or landing before 06:00 there is more scope for runway alternation whether we are on easterly or westerly operations. This is because at night there is more time to space out the flights and allow them to taxi around the airfield.

4.3.2 We can switch landings between the northern and southern runways and, if the wind allows it, we can bring in aircraft from the east or the west.

4.3.3 Those four options allow us to operate night-time runway alternation or rotation pattern on a four-weekly cycle.

- Week 1: Westerly operations on the southern runway
- Week 2: Easterly operations on the northern runway
- Week 3: Westerly operations on the northern runway
- Week 4: Easterly operations on the southern runway

4.3.4 Since the wind direction and strength can have an impact on this pattern, we always specify a primary and a secondary (alternative) runway in our schedule.

4.3.5 More information on current alternation is available on our website.  

4.4 Who benefits from runway alternation today?

4.4.1 Runway alternation today primarily benefits those living closer to the airport. This is because, further out, aircraft overfly the same areas regardless of which runway they are operating to or from.

4.4.2 For arrivals, Air Traffic Control (ATC) currently directs arriving aircraft towards Heathrow from both the north and south holding stacks to join the final approach into both of Heathrow's northern and southern runways. The point at which aircraft join the final approach will vary depending on how they are sequenced by air traffic controllers - other factors such as weather conditions or the position of other aircraft on route into Heathrow also impact how aircraft are directed to the final approach. All aircraft will be on the final approach by 7 - 10 miles from the end of the runway. This results in a spread of aircraft over a wide area which means some areas (beyond 7-10 miles) will experience aircraft overhead regardless of which runway we are landing on.

4.4.3 Similarly, some departure routes from each runway today join up after around 2-3 miles into a single route. This means that communities below the routes beyond this 2 - 3 mile point, experience departing aircraft overhead regardless of which runway we are departing from. This limits respite for those communities.

4.4.4 This spreading and joining of routes is illustrated in Figure 2.

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8 [https://www.heathrow.com/noise/heathrow-operations/runway-alternation](https://www.heathrow.com/noise/heathrow-operations/runway-alternation)
4.4.5 Our ability to change this today is limited, because the basic structure of the UK’s airspace was developed over 50 years ago when there were fewer aircraft in the air, and air traffic controller tools were much less sophisticated. Britain’s airspace network is now out of date and this limits the flexibility we have to provide respite for communities located further away from Heathrow. With expansion, we will change this. This is explored further below in section 7, Extending Respite with Three Runways.
5. **FEEDBACK SO FAR ON RUNWAY ALTERNATION**

5.1.1 This section describes previous consultation and engagement that has taken place on respite previously, and how this has shaped our proposals ahead of our application for development consent for expansion.

5.2 **Historical Engagement**

5.2.1 We know from community feedback that for residents affected by aircraft noise the scheduled breaks provided by westerly runway alternation are highly valued. We have been actively engaging with community groups for several years and a common request is how we can extend the concept of predictable breaks or respite into areas beyond those impacted during the final stages of westerly arrivals.

5.2.2 Historically, on the occasions when we have to break the published alternation pattern, we will regularly receive complaints from residents expecting a period of respite which demonstrates how important these breaks are to them. A consistent theme from respondents to our expansion related consultations has been the need to provide respite through runway alternation. This was recognised in our runway design submission to the Airports Commission, was subsequently supported by the Airports Commission and is reflected in the Airport NPS.

5.3 **Consultation One**

5.3.1 At our Airport Expansion Consultation One (Consultation One) we acknowledged that the draft Airports NPS\(^9\) identified that for those affected by aircraft noise today, the periods of respite may be reduced with expansion. We also noted the draft Airports NPS requirements that: the details of a runway alternation scheme should be defined in consultation with local communities and relevant stakeholders; and that it should take account of any independent guidance such as from Independent Commission on Civil Aviation Noise (ICCAN) a body being set up by the Government.

5.3.2 We explained that a runway alternation scheme at expanded Heathrow could, based on our recent respite research, still result in sound level

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\(^9\) Which, at the time of Consultation One, was the Government's revised draft Airports NPS.
differences that would be valued, particularly by those communities within areas most exposed to noise today.

5.3.3 We said that in applying the outcomes of the respite research to the development of a runway alternation scheme, we had been able to identify a number of factors associated with the valued provision of respite.\(^\text{10}\) We also said that we would consider results and conclusions as they emerge from the ongoing respite research being undertaken by the RWG.

5.3.4 In Consultation One, we asked for views on the following:

_The importance and value of predictable periods of respite through runway alternation; and any specific factors (from the list identified) that you would consider more important and valued than others. Are there other factors that you feel we should consider?_

_If you are aware that you receive respite through the current runway alternation scheme we would like your views on what aspects of that scheme you value - are there particular aspects that would be considered essential?_

### 5.4 Consultation One Responses

5.4.1 A summary of the feedback received in relation to these questions at Consultation One is included at Appendix 1 to this document. Heathrow's interim responses to these issues are also set out the Consultation One Interim Feedback Report, primarily Chapter 19 (Noise) and Chapter 7 (Runways), which is also provided as part of this consultation.

5.4.2 All comments received have been considered and the following themes emerged:

- There was widespread support for measures which help to deliver respite.
- Provision of respite should be strictly enforced.
- Concern that the amount of respite would decrease compared to today.
- Respite should be provided to more communities further away from the airport, compared to the current situation.

\(^\text{10}\) Page 33, Our Approach to Noise, Heathrow Airport Expansion Consultation, January 2018.
5.5 Engagement Feedback

5.5.1 Ahead of this consultation, Heathrow sought to engage stakeholders and local residents, presenting information on the draft Noise Objective and current and potential future runway operations through targeted focus groups. This engagement took place during October and November 2018. A report on these focus groups entitled "Noise Objective and Runway Operations - Report from Stakeholder and Community Engagement", prepared by the consultancy Stonehaven, is available to view on our website alongside the consultation materials.

5.5.2 There was agreement across all groups that respite was a necessary and important aspect of noise mitigation.

5.5.3 Participants in all groups agreed that respite should have three qualities:

- It has to be meaningful, i.e. lasting for a sufficient amount of time to be useful and appreciable.
- It should be regular, i.e. there was no use in respite that only lasted briefly every few weeks
- It should be predictable, i.e. the simpler the better, and it should be easy to intuit the pattern.

5.5.4 In the community groups workshop it was suggested that the airspace design should take account of the reduction in respite for some communities compared to today and that it should be a goal to compensate communities for the loss of respite from runway alternation with greater respite through airspace and flight path alternation where possible.

5.5.5 In discussing the pattern of runway rotation there was no clear consensus on how long a period of respite needed to be to be meaningful, but many felt that a '1 week rotation' which could result in up to three weeks of overflight, would be intolerable.
6. **RUNWAY ALTERNATION IN THE FUTURE**

6.1.1 Compared to the relatively simple runway alternation pattern in place at today’s two-runway airport, operating three runways creates both potential opportunities and increased complexity in the provision of respite through runway alternation.

6.1.2 We are testing a range of options to provide respite through runway alternation. All of the runway alternation patterns we are testing are built from four main components:

- Component One - a runway mode allocation e.g. arrivals, departures or mixed mode
- Component Two - the sequence in which the runway mode allocation will move around the runways
- Component Three - the duration for which a runway mode allocation is in place
- Component Four - the time of day (or point in a week) when the runway mode allocation changes over to the next in the sequence

6.1.3 The options for Component One are fixed and Component Two is primarily determined by operational and safety reasons, as we explain at paragraph 6.4.1 onwards, below. However, we have a choice about Components Three and Four. These four key components of a runway alternation pattern are explained and summarised in this section, addressing options in relation to Component Three (duration) and presenting ideas in relation to Component Four (time), which are the...
main focus of this consultation. Appendix 2 also explains Components One and Two in more detail, setting out how runway modes are allocated to runways, and how those allocations can change in sequences. The key points to take away from Appendix 2 are however summarised in this section 6.

6.2 Option 'Test Cases'

6.2.1 Appendix 3 to this document explains at a high level the process we have gone through so far to create ‘test case’ runway alternation patterns for testing and evaluation, and describes the options we are considering. Some of the early findings and key parameters of the work are described in this section 6 to help inform responses to this consultation.

6.2.2 The test cases we have been evaluating to date are not a definitive list of all of the options we may consider. As explained in Appendix 3, they are simply tools to allow us to test different components of a runway alternation pattern - for example different duration of breaks starting at different times of the day, and different mode allocations (explained below). We will revisit and amend the test cases after this consultation as required, as described in Appendix 3.

6.3 Allocating modes to runways (Component One)

6.3.1 To build options for a runway alternation pattern, it is first necessary to consider which runway modes are available and how they could be allocated at an expanded Heathrow. The concept of runway modes and their allocation is explained in detail in Appendix 2.
6.3.2 In summary, a **runway mode** means whether a runway is used for landings or departures, or both. If a runway is used for either landings or departures, we call this **segregated mode**. If it is used for both landings and departures at the same time, we call this **mixed mode**.

6.3.3 Where the runway is in mixed mode, the nature of use is different than when it is in segregated mode. Arriving aircraft using a runway in mixed mode would typically be spaced (in miles) further apart than they would be when they are using a runway in arrivals mode (meaning less flights overhead), although on occasion, the frequency of flights on the mixed mode runway may be similar to the arrivals and departures, for example in the early morning period when there are expected to be more arrivals than departures. Similarly, departing aircraft from a runway in mixed mode would typically be further apart than aircraft departing from a departures runway, although again there will be some occasions when the spacing will be more similar.

6.3.4 The reason for the typically wider spacing between aircraft on a mixed mode runway is because aircraft departing from the mixed mode runway must wait for aircraft that have landed on that runway to leave the runway before it can take off. Communities affected by overflight relating to a runway in mixed mode will therefore generally perceive the overflight to be less than when a runway is in a segregated mode (e.g. arrivals and departures).

6.3.5 With three runways in operation at an expanded Heathrow, we would need to operate one runway in mixed mode at all times. This is because the airport needs to provide capacity that is balanced between departures and arrivals over a day. This is explained in more detail in Appendix 2.

6.3.6 At an expanded Heathrow, mixed mode cannot be operated on the centre runway during three runway operations, primarily for safety reasons. Appendix 4 explains why this is the case. This is why none of the alternation patterns we are considering for an expanded Heathrow will ever have the centre runway operating in mixed mode.

6.3.7 **Mode allocation** is how we describe how runway modes are used together across all the runways at one time. For example, the new third runway might be allocated to a mixed mode (labelled ‘M’), the centre runway on a segregated arrivals mode (labelled ‘L’ (for landings) and the southern runway on a segregated departures mode (labelled ‘D’). We would call this mode allocation ‘MLD’. This mode allocation is illustrated in Figure 3 below.
6.3.8 As the middle runway cannot be used for mixed mode, there are four possible mode allocations\textsuperscript{11}: MLD, MDL, LDM, DLM.

6.3.9 The mode allocation can be changed over time. It is necessary to do this in order to provide respite for those communities living closest to the airport. This is because the type of noise a community experiences will depend on which mode the runway nearest to them is operating in, and which direction the airport is operating in.\textsuperscript{12}

6.3.10 Figure 4 below illustrates, in broad terms, which communities will receive respite under different mode allocations.

\textsuperscript{11} Further illustration of this concept is given Appendix 2 below.

\textsuperscript{12} Today we only alternate our runways on westerly operations. With expansion the final alternation patterns will be deliverable under easterly as well as westerly operations. For more information on the direction of operations please see Appendix 2 and the Runway Operations – Directional Preference document.
### Mode Allocation 1

**Westerly Operations**

<table>
<thead>
<tr>
<th>Mode allocation 1</th>
<th>Westerly operations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Northern runway</strong></td>
<td>Area A would experience departing aircraft but typically less frequently as they are spaced further apart. Area D would experience arriving aircraft but typically less frequently as they are spaced further apart.</td>
</tr>
<tr>
<td><strong>Middle runway</strong></td>
<td>Area B would have no planes overhead (respite). Area E would experience the stream of arriving aircraft.</td>
</tr>
<tr>
<td><strong>Southern runway</strong></td>
<td>Area C would experience the stream of departing aircraft. Area F would have no planes overhead (respite).</td>
</tr>
</tbody>
</table>
Easterly Operations

<table>
<thead>
<tr>
<th>Mode Allocation 1</th>
<th>Easterly operations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Northern runway</strong></td>
<td>Area A would experience arriving aircraft but typically less frequently as they are spaced further apart. Area D would experience departing aircraft but typically less frequently as they are spaced further apart.</td>
</tr>
<tr>
<td><strong>Middle runway</strong></td>
<td>Area B would experience the stream of arriving aircraft. Area E would have no planes overhead (respite).</td>
</tr>
<tr>
<td><strong>Southern runway</strong></td>
<td>Area C would have no planes overhead (respite). Area F would experience the stream of departing aircraft.</td>
</tr>
</tbody>
</table>
Model Allocation 2

Westerly Operations

<table>
<thead>
<tr>
<th>Mode allocation 2</th>
<th>Westerly operations</th>
</tr>
</thead>
</table>
| **Northern runway** | Area A would experience departing aircraft but typically less frequently as they are spaced further apart.  
Area D would experience arriving aircraft but typically less frequently as they are spaced further apart. |
| **Middle runway** | Area B would experience the stream of departing aircraft.  
Area E would have no planes overhead (respite). |
| **Southern runway** | Area C would have no planes overhead (respite).  
Area F would experience the stream of arriving aircraft. |
### Easterly Operations

<table>
<thead>
<tr>
<th>Mode allocation 2</th>
<th>Easterly operations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Northern runway</strong></td>
<td>Area A would experience arriving aircraft but typically less frequently as they are spaced further apart. Area D would experience departing aircraft but typically less frequently as they are spaced further apart.</td>
</tr>
<tr>
<td><strong>Middle runway</strong></td>
<td>Area B would have no planes overhead (respite). Area E would experience the stream of departing aircraft.</td>
</tr>
<tr>
<td><strong>Southern runway</strong></td>
<td>Area C would experience the stream of arriving aircraft. Area F would have no planes overhead (respite).</td>
</tr>
</tbody>
</table>
Mode Allocation 3

Westerly Operations

### Mode allocation 3

<table>
<thead>
<tr>
<th>Mode allocation 3</th>
<th>Westerly operations</th>
</tr>
</thead>
</table>
| **Northern runway** | Area A would have no planes overhead (respite).  
Area D would experience the stream of arriving aircraft |
| **Middle runway** | Area B would experience the stream of departing aircraft.  
Area E would have no planes overhead (respite). |
| **Southern runway** | Area C would experience departing aircraft but typically less frequently as they are spaced further apart.  
Area F would experience arriving aircraft but typically less frequently as they are spaced further apart. |
Easterly Operations

### Mode allocation 3 | Easterly operations
---|---
**Northern runway** | Area A would experience the stream of arriving aircraft.  
Area D would have no planes overhead (respite).

**Middle runway** | Area B would have no planes overhead (respite)  
Area E would experience the stream of departing aircraft.

**Southern runway** | Area C would experience arriving aircraft but typically less frequently as they are spaced further apart.  
Area F would experience departing aircraft but typically less frequently as they are spaced further apart.
**Mode Allocation 4**

**Westerly Operations**

<table>
<thead>
<tr>
<th>Mode allocation 4</th>
<th>Westerly operations</th>
</tr>
</thead>
</table>
| **Northern runway** | Area A would experience the stream of departing aircraft.  
                      | Area D would have no planes overhead (respite). |
| **Middle runway**  | Area B would have no planes overhead (respite).  
                      | Area E would experience the stream of arriving aircraft. |
| **Southern runway**| Area C would experience departing aircraft but typically less intensely as they are spaced further apart.  
                      | Area F would experience arriving aircraft but typically less intensely as they are spaced further apart. |
Mode allocation 4

**Northern runway**

Area A would have no planes overhead (respite).
Area D would experience the stream of departing aircraft.

**Middle runway**

Area B would experience the stream of arriving aircraft.
Area E would have no planes overhead (respite).

**Southern runway**

Area C would experience arriving aircraft but typically less frequently as they are spaced further apart.
Area F would experience departing aircraft but typically less frequently as they are spaced further apart.
6.4 **Sequencing through runway mode allocation (Component Two)**

6.4.1 Runway alternation requires moving from one mode allocation to another. The order in which mode allocations move from one to the other can be described as a 'sequence'. For example, moving from ‘MDL’ to ‘DLM’ might be the first step in a sequence. Further illustration of this concept is given in Appendix 2.

6.4.2 We are undertaking evaluation to determine which sequences of mode allocation changes work well and which do not. Some mode allocation sequences are more complex than others because they involve more complex redistribution of aircraft in airspace and around the airfield. We are evaluating the impact of moving between mode allocation sequences and this will inform the final runway alternation pattern. We are considering options which would ensure that, where possible, when the direction of operations changes, the pattern changes at the same time to ensure that respite periods are not interrupted. For example, when moving from Westerlies to Easterlies, MLD (W) would change to MDL (E).

6.4.3 Regardless of how we change between mode allocations, the overall noise impact for each affected community, and total amount of respite, will be the same over time. This is because, over a long-term period, such as a whole summer or year, an even use of the four proposed modes would be expected. As a result, over the long-term, the proportion of respite from overflight and overall noise exposure would
be expected to be the same (or at least very similar) for any particular community location regardless of the sequence of modes.\textsuperscript{13}

6.4.4 Whilst noting that the amount of respite and noise exposure should be the same over the long term for any particular community, the experience of both will vary between communities depending on proximity to flight paths and distance from the airport.

6.4.5 For example, those underneath the approach to the centre runway should, over a long period, experience a degree of respite from overflight during westerly operations for 50% of the time. However, depending on distance from the airport, some of these communities may be able to see, and in some cases hear, aircraft approaching either the approach to the new northern runway or to the southern runway when this centre runway is not actually in use for arrivals (the noise level from aircraft on approach to other runways will be significantly less than when overhead).

6.4.6 We are not considering any mode allocations which have all of the runways in segregated arrivals mode ('LLL') or all of the runways departures mode ('DDD'). To provide an alternation pattern using those mode allocations, it would be necessary to adjust the schedule of flights so that all arrivals are scheduled in a block for a period of time (while the mode allocation is in LLL) and then all departures are scheduled for a period of time (while the mode allocation is in DDD'). These are known as 'schedule modal demand' options. We are not considering these kinds of options because the airport and schedule design does not support waves of only arrivals or departures. This is explained in more detail in Appendix 6.

If you have any comments on the mode allocations or sequences we are testing, (which are described in detail in Appendix 2) and in the test cases in Appendix 3, please provide these comments as part of your response to question 2(c) in our feedback questionnaire.

6.4.7 Within our test cases in Appendix 3 we have considered mode allocation options which had the new runway always operating on mixed mode (the option named RA1), and options which had the southern runway always operating on mixed mode (the option named RA2). In both these options, only the remaining two runways would alternate during the day. Based on the information available to date, we

\textsuperscript{13} The mode sequence will make a difference to noise exposure and the respite experienced over a shorter-term period, such as a day or a week.
do not propose to take these options forward for further consideration. This is because, during the day, they do not provide any respite for the communities affected by the operation of the runway that would be permanently operating on a mixed mode. Those communities would only receive respite at night. We explored whether this 'missing' respite could instead be provided through airspace alternation (which is explained further below). However, we have determined that the airspace design components necessary to make this possible are overly complex, and have therefore not been taken forward into the macro design being used to develop the airspace for an expanded Heathrow.

If you have any comments on our discontinuation of these runway alternation pattern options, please provide these comments as part of your response to question 2(c) in our feedback questionnaire.

6.5 Duration of mode allocation - the length & frequency of breaks (Component Three)

6.5.1 Another key component of an alternation pattern is how long a particular mode allocation pattern should be in place for. For example, how long should the pattern 'MDL' be in place before it changes to 'LDM'? As explained earlier in this document, changes to mode allocation are essential to providing respite.
6.6 **Daily respite, short periods**

6.6.1 We know that with three runways, we would need to change the mode allocation 3 times a day in order to provide respite for every community close to the airport on a daily basis. This is to ensure each of the four mode allocations (MDL, MLD and LDM, DLM - although the order is to be determined and might change each day) are in place each day. Covering each mode allocation each day would be necessary to give daily respite to the communities affected by operations from the southern and new northern runway, as each of those runways needs to have experienced a segregated arrival or departure mode. This requires 4 mode allocations and three changes in the day.

6.6.2 If 4 different mode allocations are required over the day (3 changes), and then if each allocation was of equal length the maximum length of the respite break during the period when scheduled flights are operating¹⁴ (the **core operational day**) would be:

- 4 to 5 hours for those living under or near routes to and from the southern or new northern runway; and
- 8-9 for those living under or near routes to and from the centre runway, on days when they receive two consecutive periods of respite.

6.6.3 This is because core operational day is likely to be approximately 17 hours. When this is divided into four it creates 4 periods of 4-5 hours.

6.6.4 For this reason, it is not possible to provide all communities living closer to the airport with a daily break that is longer than 4-5 hours within the core operational day.

6.6.5 An explanation of how a runway alternation pattern provides a shorter period of respite for every community living closer to the airport during the core operational day is shown in **Example 1A – Short Daily Breaks (Runway Alternation)**, and Figure 5 below.

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¹⁴ The length of this period will be determined by the scheduled night flight ban. For example, if the ban was in place from 2300 to 0530, the operational day for scheduled flights would be 0530 to 2300.
### Example 1A – Short Daily Breaks (Runway Alternation)

<table>
<thead>
<tr>
<th>Example 1: Shorter breaks, every day</th>
<th>Pattern type</th>
<th>Periods without overflight</th>
<th>Runway alteration: what this means for communities overflown by flights to/from the new northern runway</th>
<th>Runway alteration: what this means for communities overflown by flights to/from the centre runway</th>
<th>Runway alteration: what this means for communities overflown by flights to/from the southern runway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uniformed length of time alternation pattern in use meaning communities receiving at least 1 period in 4 over a single core operational day without overflight i.e. 1/4</td>
<td>Short consistent time periods (4-5 hours) across 1 core operational day.</td>
<td>Over the course of 1 day: 1/4 periods of the day with no overflight 2/4 periods of the day with moderate overflight (which may not be consecutive) 1/4 periods of the day with high levels of overflight</td>
<td>Over the course of 1 day: 2/4 periods of the day with no overflight 2/4 periods of the day with moderate overflight (which may not be consecutive)</td>
<td>Over the course of 1 day: 1/4 periods of the day with no overflight 2/4 periods of the day with moderate overflight (which may not be consecutive) 1/4 periods of the day with high levels of overflight (which may not be consecutive)</td>
<td></td>
</tr>
</tbody>
</table>
Figure 5 – Short daily breaks illustrated (Runway Alternation)
However, when this 'short daily breaks' alternation pattern is combined with a scheduled night flight ban, some communities could benefit from longer periods of respite. We are seeking feedback at this consultation on the use of runways in the early morning period (see the Airspace and Future Operations Consultation Document and the Runway Operations - Night Flights document). By combining the delayed runway opening (as a result of ban on scheduled night flights) with the 4-5 hour respite period provided by the 'short daily breaks' alternation pattern, at least two communities around the airport could experience longer periods of respite, even if we used two runways for arrivals in the early morning period.

This concept of combining runway alternation and the ban on scheduled night flights to provide longer periods of respite is illustrated below in Example 1B - Short Daily Breaks + Scheduled Ban (Runway Alternation). It illustrates that if a 4 hour break was the shortest break provided in the runway alternation pattern, when this pattern was combined with a ban on scheduled night flights it could result in an average respite period of approximately 10 hours for all between the hours of 19:00 and 06:00.

Please note that Example 1B is an illustration only:

- It applies a 4 hour daily respite pattern (as described above), and shows an easterly operation\(^\text{15}\)
- It illustrates changing from mode allocation MDL to mode allocation DLM.
- It combines this with a ban on scheduled night flights from 23:00 to 05:30 (which would have the first arriving flights landing on the runway at approximately 05:15)\(^\text{16}\).
- It assumes only one runway is being used for arrivals between 05:15 and 06:00. It assumes there would be no departures until 06:00.
- It assumes two runways would be in operation during the recovery period – one for arrivals and one for departures.\(^\text{17}\)

\(^{15}\) The same could apply for westerly operations. We have not factored in Directional preference at night, at this stage.

\(^{16}\) Further explanation of the meaning of 'scheduled' and how this relates to the use of the runway is provided in the document Runway Operations – Night Flights. More information on the early morning part of a ban on scheduled night flights is also set out in the document Runway Operations – Night Flights.

\(^{17}\) For more information on the recovery period, please see the document Runway Operations – Night Flights.
6.6.9 Please note that all of the assumptions used in Example 1B are used only to help explain the concept and are not yet confirmed.

Example 1B – Short Daily Breaks + Ban on Scheduled Night Flights (Runway Alternation)
6.6.10 In looking at daily breaks, we have done some work to consider whether it is possible or helpful to change the allocation more than 3 times a day.

6.6.11 If we did this, breaks would be shorter than 4-5 hours.

6.6.12 We have concluded that changing the mode allocation more than 3 times a day is not operationally feasible. This is because the degree of complexity of changing more than 3 times in a day results in an unacceptable increase in complexity for ATC, especially the wider network. In addition, when mode allocation is changed, capacity at the airport is lost while air traffic control re-distribute the traffic. Further information on changing more than 3 times a day is set out in more detail in Appendix 5.

6.6.13 We have also done some testing on options where the mode allocation changes 4 times in a core operational day. Our early findings are that this would perform badly against all they key operational criteria we are considering as we develop a proposed runway alternation pattern.

6.6.14 Further, it is Heathrow's view that a change that takes place more than 3 times a day may be confusing for communities and therefore may not be deemed predictable. This view is taken having regard to ongoing feedback from residents about the complexity of today's runway alternation pattern, plus feedback from our most recent focus groups (see paragraph 5.1.10 onwards).

6.7 Longer breaks but not daily respite

6.7.1 For operational reasons, it is better for an airport to have fewer mode allocation changes to allow the airport to maintain a smoother, simpler and more consistent operation. The fewer changes there are in the core operational day, the more resilient the airport is to delays and other issues. This is because longer periods without change allow ATC, airlines and the airport to plan further ahead, meaning last minute disruptions such as technical and weather issues are much less likely to impact the operation. This reduces the chance of extending the operation into the recovery period at the end of core operational day (i.e. past the time of the last scheduled departure).

6.7.2 We must always consider safety in all our operations. Whenever ATC are required to change a runway mode allocation, they build in a significant margin for error to ensure safety is maintained. This is

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18 For more information on the 'recovery period', please the document Runway Operations – Night Flights
achieved by many different techniques and procedures which include reducing the number of aircraft using the runway or preparing to use the runway. It is easier for ATC to make these changes when there are lower levels of air traffic, for example at night.

6.7.3 As such, for reasons it is operationally preferable to have only one change within 24 hours, ideally outside of the core operational day (i.e. at night).

6.7.4 For this reason, and because a 'short daily break' of 4-5 hours would be shorter than the daily break we provide to communities today, we are also considering options which have fewer mode allocation changes each day. Fewer changes would provide breaks that are longer than 4-5 hours, but not every community would experience these longer breaks every day. Longer breaks are necessarily accompanied by long periods with overflight for other areas. **Example 2 Longer Breaks, but not every day (Runway Alternation)** below illustrates longer breaks of 24 hours. This is also shown in Figure 6 and Table 2 below.

**Example 2 - Longer Breaks, but not every day (Runway Alternation)**

<table>
<thead>
<tr>
<th>Pattern type</th>
<th>Periods without overflights</th>
<th>Runway alteration: what this means for communities overflown by flights to/from the new northern runway</th>
<th>Runway alteration: what this means for communities overflown by flights to/from centre runway</th>
<th>Runway alteration: what this means for communities overflown by flights to/from the southern runway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example 2: Longer breaks, but not every day</td>
<td>Consistent length of time alternation pattern in use with at least a 24-hour period for communities without overflight across a 4 day period</td>
<td>Consistent 24-hour period across 4 days</td>
<td>1 x 24-hour period with no overflight - 2 x 24-hour periods with moderate overflight (not necessarily consecutively) - 1 x 24-hour period with high levels of overflight</td>
<td>Over the course of 4 days: - 1 x 24-hour period with no overflight - 2 x 24-hour periods with moderate overflight (not necessarily consecutively) - 1 x 24-hour period with high levels of overflight</td>
</tr>
</tbody>
</table>
Figure 6 – Longer Breaks, but not every day – 4 day example (Runway Alternation)
In this example we change every day, once a day at Midnight. The mode allocation sequence used is MLD, MDL, LDM, DLM. It then repeats itself after 4 days. The sequence of mode allocation changes does not have to be in this order and could even cycle through all the different sequences shown in Appendix 2.

An illustration of how Example 2 - Longer Breaks, but not every day could provide respite to communities over a longer, 28 day period is shown in the Table 2 below.

**Table 2 – Longer Breaks, but not every day over 28 days (Runway Alternation)**

<table>
<thead>
<tr>
<th>Week commencing xx</th>
<th>Community A</th>
<th>Community B</th>
<th>Community C</th>
<th>Community D</th>
<th>Community E</th>
<th>Community F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>M</td>
<td>M</td>
<td>Respite Day</td>
<td>D</td>
<td>L</td>
<td>Respite Day</td>
</tr>
<tr>
<td>Tuesday</td>
<td>M</td>
<td>M</td>
<td>L</td>
<td>Respite Day</td>
<td>D</td>
<td>Respite Day</td>
</tr>
<tr>
<td>Wednesday</td>
<td>L</td>
<td>Respite Day</td>
<td>Respite Day</td>
<td>D</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Thursday</td>
<td>Respite Day</td>
<td>D</td>
<td>L</td>
<td>Respite Day</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Friday</td>
<td>M</td>
<td>M</td>
<td>Respite Day</td>
<td>D</td>
<td>L</td>
<td>Respite Day</td>
</tr>
<tr>
<td>Saturday</td>
<td>M</td>
<td>M</td>
<td>L</td>
<td>Respite Day</td>
<td>D</td>
<td>Respite Day</td>
</tr>
<tr>
<td>Sunday</td>
<td>L</td>
<td>Respite Day</td>
<td>Respite Day</td>
<td>D</td>
<td>M</td>
<td>M</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week commencing xx</th>
<th>Community A</th>
<th>Community B</th>
<th>Community C</th>
<th>Community D</th>
<th>Community E</th>
<th>Community F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>Respite Day</td>
<td>D</td>
<td>L</td>
<td>Respite Day</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Tuesday</td>
<td>M</td>
<td>M</td>
<td>Respite Day</td>
<td>D</td>
<td>L</td>
<td>Respite Day</td>
</tr>
<tr>
<td>Wednesday</td>
<td>M</td>
<td>M</td>
<td>L</td>
<td>Respite Day</td>
<td>Respite Day</td>
<td>D</td>
</tr>
<tr>
<td>Thursday</td>
<td>L</td>
<td>Respite Day</td>
<td>Respite Day</td>
<td>D</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Friday</td>
<td>Respite Day</td>
<td>D</td>
<td>L</td>
<td>Respite Day</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Saturday</td>
<td>M</td>
<td>M</td>
<td>Respite Day</td>
<td>D</td>
<td>L</td>
<td>Respite Day</td>
</tr>
<tr>
<td>Sunday</td>
<td>M</td>
<td>M</td>
<td>L</td>
<td>Respite Day</td>
<td>D</td>
<td>Respite Day</td>
</tr>
</tbody>
</table>
Our early engagement identified that being able to plan around a whole day of respite would be perceived as a positive by some people. It is also important that the alternation pattern can be easily understood by local communities, pilots and ATC, and that the pattern is predictable. It is also important that the alternation pattern can be easily understood by local communities, pilots and ATC, and that the pattern is predictable. Mode allocations which only change once a day (and perhaps even overnight) would support this and would be easier to follow and plan around. However, we acknowledge that others may prefer regular, shorter breaks and would not like long periods of overflight, even if those longer periods of overflight were followed by longer breaks.

19 Like today’s operation there will be occasions when the pattern cannot be followed, but (like today) these are expected to be rare.
6.7.8 Although we are considering longer breaks, we do not propose to assess in detail those alternation patterns which would result in more than three days without respite. For example, we do not propose to consider any options in which a community might receive a whole week of respite, followed by 3 weeks of overflight.

*If you think we should consider these kinds of options, please provide these comments as part of your response to question 2(C) in our feedback questionnaire.*

6.7.9 It is important to note that, no matter how long the breaks are, over time, the total amount of respite offered is the same whether an alteration pattern providing for longer or shorter breaks is selected.

6.7.10 This is because, over a long-term period, such as a whole summer or year, an even use of the four proposed modes would be expected. As a result, over the long-term, the proportion of respite from overflight and overall noise exposure would be expected to be the same (or at least very similar) for any particular community location regardless of whether a mode operates for a longer or shorter period. 20

6.7.11 The duration for which any mode is operating will have an effect on the experience of respite and noise exposure over the shorter term, such as a day or a week.

6.7.12 We want your feedback on whether you would prefer shorter, daily breaks or longer periods of respite, but less often. Our questions on this are set out in section 8.

20 As explained at paragraph 6.4.3 onwards, the experience of respite and noise exposure, whilst being consistent for any particular community, will vary between communities depending on proximity to flight paths and distance from the airport.
6.8 The timing of changes & breaks of varied lengths (Component Four)

6.8.1 Uniform periods of the same duration (of whatever length) are simpler to understand and are therefore more predictable. However, we have had feedback that uniform breaks may not provide the flexibility that communities want. For example, changing over the mode allocation in the middle of the school day can make planning outdoor activities harder for schools. An alternative is to vary the length of breaks that are experienced over a period of time. We are considering the extent to which this is possible as part of our assessment of options for alternation patterns and will test this through the engagement we have planned between now and our Airport Expansion Consultation planned for June 2019.

6.8.2 We want to understand what times of the day are important to people, and therefore what points in the day should be prioritised or avoided for changes to mode allocation. As far as practical we will try to build these times onto our proposed alternation pattern, which we will consult on in our Airport Expansion Consultation planned for June 2019.

If you have any comments on these engagement topics, please provide these comments as part of your response to question 2(C) in our feedback questionnaire.
7. **EXTENDING RESPITE WITH THREE RUNWAYS**

7.1.1 At Heathrow Expansion Consultation One, and through our previous and ongoing engagement, we have had significant feedback requesting that respite should be provided to more communities further away from the airport, compared to the current situation. As we redesign our airspace for an expanded Heathrow, we will have an opportunity to do this.

7.1.2 Since Consultation One we have developed an underlying structure for our future airspace that provides 'airspace alternation', in line with our design principles. This structure will mean the flight paths from each runway will each be in their own distinct area (up to 7000ft). This means that when a runway is not being used for departures, its departure flight paths will effectively switch off and so there would be no overflights in the corresponding area. Likewise for arrivals. This means we will provide periods of respite from overflight much further out from Heathrow than we do today. We call this 'airspace alternation'.

7.1.3 This section explains further what airspace alternation is, why airspace alternation is not possible today and what might be possible in the future.

7.1.4 This section also briefly explains the concept of "flight path alternation", which could be applied within airspace alternation, to provide additional relief. Flight path alternation is different to airspace alternation and will be considered through the airspace change process at a later date.

7.1.5 Both airspace alternation and flight path alternation will be governed by the airspace change process.

7.2 **Why we cannot alternate our airspace today**

7.2.1 We are limited today in the extent to which we can use the routing of flights to provide respite for those communities which live further away from the airport. This is because the basic structure of the UK’s airspace was developed over 50 years ago when there were fewer aircraft in the air, and air traffic controller tools were much less sophisticated. Britain’s airspace network is now out of date and this limits the flexibility we have to provide respite for communities located further away from Heathrow.

7.2.2 ATC currently directs arriving aircraft towards Heathrow from both the
north and south holding stacks to join the final approach into both of Heathrow’s northern and southern runways. The point at which aircraft join the final approach will vary depending on how they are sequenced by air traffic controllers - other factors such as weather conditions or the position of other aircraft on route into Heathrow also impact how aircraft are directed to the final approach. This results in a spread of aircraft over a wide area which means some areas will experience aircraft overhead regardless of which runway we are landing on.

7.2.3 Similarly, some departure routes from each runway today join up after 2-3 miles into a single route. This means that communities below the routes beyond this 2-3 mile point, experience aircraft overhead regardless of which runway we are departing from consequently limiting respite for those communities.

7.2.4 Figure 7 below illustrates the concepts described in 7.2.2 and 7.4.3.

**Figure 7 – How aircraft currently arrive and depart from Heathrow (illustrative)**
7.3 **Airspace alternation with an expanded Heathrow**

7.3.1 As explained above, Heathrow’s current airspace does not allow for airspace alternation.

7.3.2 However, our airspace design process has developed an underlying structure for future flight paths that will provide respite for areas much further away Heathrow, that currently don’t experience predictable respite from aircraft overhead.

7.3.3 This underlying structure has generated design envelopes, which are broad geographic areas within which future paths could be positioned. We are consulting on design envelopes as part of this consultation. For detail of these envelopes please refer to the consultation document entitled *Heathrow’s airspace design envelopes for expansion*.

7.3.4 Those envelopes are a conceptual tool to identify which areas of our airspace will be used by arrivals and departures for each runway. **Airspace alternation is relevant to all of those people who live under any of the areas currently identified by the airspace design envelopes that we are consulting on in this consultation – this includes people who are currently overflown as well as new areas which are not overflown today.**

7.3.5 Airspace alternation means we will use specific areas of airspace for specific runways, both on arrivals and departures. As we change the mode allocation of the runways (runway alternation), we will also alternate the corresponding areas of airspace that are in use at any particular time. This will allow us to provide periods of respite from overflight to areas much further away from the airport than we do today.

7.3.6 This concept is illustrated in Figure 8.
7.4 Combining Runway Alternation and Airspace Alternation

7.4.1 This section describes how airspace alternation, when combined with runway alternation, would generate respite that extends to areas well beyond that offered by our current two runway alternation pattern. This would operate during both westerly and easterly operations.

7.4.2 For arrivals, the underlying airspace structure we are proposing involves having two sets of arrival routes for each runway (one set for easterlies and one set for westerlies). Each set has at least one arrival flight path for use when a runway is operating in a mixed mode and at least one flight path for when a runway is operating as the main landing runway. We don’t yet know where these flight paths will be positioned, we are asking for information about that in this consultation on design envelopes – please see the consultation document entitled Heathrow’s airspace design envelopes for expansion. However, we do know that, for safety reasons, the mixed mode flight paths will join final approach relatively near the airport and the landing runway flight paths will join further away.

7.4.3 In designing these flight paths, we aim to ensure that these sets of routes do not go over the same areas below 7000ft. This will mean that, unlike today, runway alternation will deliver a corresponding airspace alternation and result in large areas that benefit from respite. This is illustrated in Figure 9 below.
Figure 9 – Example that illustrates the effect of a mode allocation change from MLD to LDM has on the airspace

7.4.4 Figure 9 above shows that when we alternate the runway (runway alternation) there is a corresponding airspace alternation pattern. The pattern of alternation in the airspace would be dictated by the runway alternation pattern. This is why the questions in section 8 are relevant to those communities further out that could benefit from airspace alternation, as well as those further in who benefit from runway alternation.

7.4.5 Another benefit of redesigning our airspace is that the departure routes and the arrival routes for any direction of operations can be separate from each other. This would be different from today, as during current operations some communities experience both arrival and departure overflights at the same time below 7000ft. Our aim is that this will no
longer happen below 7000ft with the new airspace design.

7.4.6 More information about our airspace design can be found in the document *Our approach to redesigning our airspace network for an expanded Heathrow.*

**Flight Path Alternation**

7.4.7 The airspace design envelopes also have potential to provide further opportunities for respite and relief by using additional flight paths *within* the arrival and departure areas to share aircraft over a wider area. We call this "flight path alternation". At this stage in our airspace design development, we do not know where the flight paths will be situated within the design envelopes and the extent to which flight path alternation will be possible. As such, we are not consulting on flight path alternation as part of this consultation.

**Length, regularity and timing of breaks**

7.4.8 As airspace alternation corresponds to runway alternation, decisions made about the length and regularity of breaks provided by runway alternation also affect airspace alternation, and so the consultation issues we introduced in section 6 and the questions in section 8 apply equally to those communities who are likely to benefit from airspace alternation.

7.4.9 Using the examples referred to above, we have illustrated, in *Example 3 - Short Daily Breaks – Further Out Communities (Airspace Alternation)* below, how the options could benefit communities impacted by airspace alternation to help inform their responses to this consultation.
**Example 3 – Short Daily Breaks – Further Out Communities (Airspace Alternation)**

<table>
<thead>
<tr>
<th>Pattern type</th>
<th>Periods without overflights</th>
<th>Airspace alternation: what this means for further out communities overflown by departures:</th>
<th>Airspace alternation: what this means for communities overflown by <strong>arrivals</strong>:</th>
</tr>
</thead>
</table>
| **Example 3: Shorter breaks, every day**                                      | Short consistent time periods (4-5 hours) across 1 core operational day.                      | **For communities overflown by departures from the northern and southern runways:**  
  - 1/4 periods of the day with no overflight  
  - 2/4 periods of the day with moderate overflight (which may not be consecutive)  
  - 1/4 periods of the day with high levels of overflight  
  **For communities overflown by departures from the centre runway:**  
  - 2/4 periods of the day with no overflight (which may not be consecutive)  
  - 2/4 periods of the day with high levels of overflight  
  - 2/4 periods of the day with moderate overflight (which may not be consecutive)  
  Depending on the arrivals **airspace area** the community is under, either:  
  - 2/4 periods of the day with no overflight (which may not be consecutive)  
  - 2/4 periods of the day with high levels of overflight (which may not be consecutive)  
  **OR**  
  - 2/4 periods of the day with no overflight  
  - 2/4 periods of the day with moderate overflight |
| Uniformed length of time alternation pattern in use meaning further out communities receiving 1 period in 4 over a single core operational day without overflight i.e. 1/4 |                                                                              |                                                                                                                                                                                                                                                                                                                                 |

7.4.10 We have also prepared an example of how longer breaks, but not every day could benefit further our communities has also been prepared.
Example 4 - longer breaks, but not every day – Further Out Communities (Airspace Alternation)

<table>
<thead>
<tr>
<th>Pattern type</th>
<th>Periods without overflights</th>
<th>Airspace alternation: what this means for further out communities overflown by departures:</th>
<th>Airspace alternation: what this means for communities overflown by arrivals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example 2: Longer breaks, but not every day</td>
<td>Consistent length of time alternation pattern in use with at least a 24-hour period for communities without overflight across a 4 day period</td>
<td>Consistent 24-hour period across 4 days</td>
<td>Depending on the arrivals airspace area the community is under, either:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-- 2 x 24-hour periods with no overflight (not necessarily consecutively)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>-2 x 24-hour periods with moderate overflight (not necessarily consecutively)</td>
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<td></td>
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<td></td>
<td>1 x 24-hour period with high levels of overflight</td>
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<td>OR</td>
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<td></td>
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<td>-- 2 x 24-hour periods with no overflight (not necessarily consecutively)</td>
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<td>-2 x 24-hour periods with moderate overflight (not necessarily consecutively)</td>
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<td>For communities overflown by departures from the northern and southern runways:</td>
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<td>-1 x 24-hour period with no overflight</td>
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<td>-2 x 24-hour periods with moderate overflight (not necessarily consecutively)</td>
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<td></td>
<td></td>
<td>1 x 24-hour period with high levels of overflight</td>
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<td>For communities overflown by departures from the centre runway:</td>
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<td></td>
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<td>-- 2 x 24-hour periods with no overflight (not necessarily consecutively)</td>
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<tr>
<td></td>
<td></td>
<td>-2 x 24-hour periods with moderate overflight (not necessarily consecutively)</td>
<td></td>
</tr>
</tbody>
</table>
8. SUMMARY AND WHERE WE NEED YOUR HELP

8.1.1 With three runways we plan to revise our approach to runway alternation to make sure that all communities get respite from noise. We are also proposing to provide respite for communities further away from the airport by using airspace alternation.

8.1.2 Our evaluation of options is ongoing, and we are specifically seeking feedback in relation to Component Three of an alternation pattern, that is the duration for which a mode allocation is in place.

8.1.3 We also welcome any other comments you may have on this document.

8.1.4 The questions in the feedback questionnaire form are as follows:

2a. Would you prefer to have longer periods of respite less frequently (all day on some days but no relief on other days) or a shorter period of respite (e.g. for 4-5 hours) every day?

   In the consultation feedback questionnaire form respondents are asked to tick one of the options:
   - A longer period of respite, but not every day
   - A shorter period of respite every day
   - I don’t know

2b. Please tell us the reasons for your preference:

2c. Please provide any other comments or suggestions you have on runway and airspace alternation.
APPENDIX 1 – CONSULTATION ONE
FEEDBACK SUMMARY - RESPITE

1.1.1 A number of Local Authorities expressed concern that periods of respite would be reduced under the proposals (e.g. Windsor and Maidenhead, Hounslow), with some specifically concerned about the reduced respite for those affected by the runway new third runway and southern runway will be offered less respite than those affected by the central runway which cannot operate on mixed mode.

1.1.2 Colnbrook with Poyle Parish Council highlighted the importance of respite and alternating the direction and timing of aircraft noise. They welcomed Heathrow's increased commitment to respite but suggested night noise fines should be raised to more punitive levels.

1.1.3 Cholesbury-Cum-St-Leonards Parish Council stated that departures should be fanned out over a wider area.

1.1.4 The Heathrow Strategic Planning Group highlighted the need for predictable and meaningful respite.

1.1.5 The most frequent positive comment from members of the public was a general comment in favour of respite.

1.1.6 There were a number of comments which said respite must be enforced. Concerns were raised about the ability to alternate runways and the predictability of respite because of the direction of the wind.

1.1.7 Respondents also considered that the approach was inadequate, insufficient and/or would not make a difference. Some did not favour respite because they were opposed to expansion and considered that it would be reduced because of the additional runway. They also did not believe that respite would be enforced or considered it realistic.

1.1.8 Many responses from community groups stated that respite was essential. Egham Residents Association approved the proposals in principle. Harrow U3A Sustainability Group suggested that invoking respite shows a lack of proper planning over many years and Dover House Estate Residents’ Association stated that the concept of insulation implies harm in the first place.

1.1.9 Heathrow Association for the Control of Aircraft Noise requested guaranteed respite for all communities within 25 miles. AN3V suggested that Heathrow's noise nuisance is vast and should include all of London and communities within a 30-mile radius. St Albans Quieter Skies stated that respite is essential for affected residents.
1.1.10 Ealing Aircraft Noise Action Group considered that as two runways would be used for take-off at the same time, respite for departures was unlikely or limited.

1.1.11 Richmond Heathrow Campaign, Local Conversation in Stanwell, Stanwell’s Green Lungs and AN3V considered that Heathrow had been disingenuous in its approach and that respite would be reduced from 50% to 33% through the introduction of an additional runway.

1.1.12 The Local Authorities Aircraft Noise Council queried why the consultation omitted reference to the report “Respite from Aircraft Noise: Overview of Recent Research”.

1.1.13 Dominic Raab MP stated that predictable and regular periods of respite including a strictly enforced night-time ban must be provided.

1.1.14 Justine Greening MP stated that any proposals which reduce the number of hours of respite for her community are unacceptable.

1.1.15 West London Friends of the Earth, the Liberal Democrats and the Hounslow Green Party considered the consultation was misleading as respite would be reduced from half to a third and residents would be expected to sacrifice periods of peace for greater predictability. Noise should be reduced overall and that mitigation should not be used to justify expansion.

1.1.16 The London Parks and Garden’s Trust expressed concern that impacts were not being considered. The London Wildlife Trust and the Colne Valley Regional Park requested respite be increased during weekends, public holidays, and when daylight hours are at their longest.

1.1.17 The Chartered Institute of Logistics and Transport and Lambeth/Herne Hill Green Party agreed that having multiple flight paths, rotated to give each community a break from noise each day was important.

1.1.18 The Mayor of London said the noise measures appeared largely unchanged and the proposed respite would mean communities under the final approaches would have no aircraft flying overhead for just a quarter of the day, half of what is offered today.
APPENDIX 2 – MODE ALLOCATION AND SEQUENCES (COMPONENTS ONE & TWO)

1.1 Introduction

1.1.1 Unlike today where we only alternate our runways on westerly operations, the final alternation patterns for expansion will be deliverable under easterly as well as westerly operations.

1.1.2 To build options for a runway alternation pattern, it is first necessary to consider which runway modes and mode allocations would be available at an expanded Heathrow.

1.1.3 This Appendix uses and explains the following key terms:

<table>
<thead>
<tr>
<th>Runway mode</th>
<th>This means how a runway is used for landing and departures. If a runway is used for either landings or departures, we call this segregated mode. If it is used for both landings and departures at the same time, we call this mixed mode.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode allocation(^2)</td>
<td>This is how runway modes are used together across all the runways at one time. For example, the new third runway might be allocated to a mixed mode, the centre runway on a segregated arrivals mode and the southern runway on a segregated departures mode. We would call this mode allocation 'MDL'. There are four possible mode groupings. The mode allocation can be changed over time. The order in which this happens is described as a 'sequence'. For example, from moving from 'MDL' to 'DLM'.</td>
</tr>
<tr>
<td>Runway alternation pattern</td>
<td>This is the combination of: the mode allocation + the sequence in which the runway mode allocation will move around the runways + the duration for which the mode allocation is place +the time of day (or point in a week or month) when the runway mode allocation changes over to the next in the sequence</td>
</tr>
<tr>
<td>Westerly operations</td>
<td>Aircraft take off and land towards the west. This means arrivals are over west London and departures are to the west of the airport. Further information on the direction of operational is available in this consultation as part of the Runway Operations – Directional Preference document.</td>
</tr>
<tr>
<td>Easterly operations</td>
<td>Aircraft take off and land towards the east. This means departures are over west London and arrivals are from the west of the airport. Further information on the direction of operational is available in this consultation as part of the Runway Operations – Directional Preference document.</td>
</tr>
</tbody>
</table>

\(^2\) For ease of comprehension, in the Consultation Document mode allocations have been referred to as a ‘Runway Alternation Pattern’.
1.2 Runway modes

1.2.1 Mixed mode is how airports with a single runway operate. In mixed mode, both departures and arrivals are using the same runway with appropriate spacing between the movements to allow arriving aircraft to taxi off the runway before the departure takes off, and vice versa.

1.2.2 The intensity of overflight by landings will typically be less during mixed mode as there needs to be sufficient gaps to accommodate departures on the same runway – so they are spaced further apart than operations on segregated mode. The same is true for the intensity of departures. On occasion, the frequency of flights on the mixed mode runway may be similar to the arrivals and departures, for example in the early morning period when there are expected to be more arrivals than departures.

1.2.3 With three runways in operation at an expanded Heathrow, we would need to operate either one or three runways in mixed mode. This is because the airport needs to provide capacity that is balanced between departures and arrivals over a day, to ensure an optimum amount of aircraft are available at the airport at any one time.

1.2.4 Operating three runways in mixed mode would deliver the most capacity for the expanded airport but would not provide any opportunity for respite through runway alternation. For this reason, no scenarios with three runways operating in mixed mode have been considered. All options must instead have one runway in mixed mode. A consequence of this is that all of the options for runway alternation that we are considering have one runway operating in mixed mode, and two runways operating in segregated mode.

1.2.5 At an expanded Heathrow, mixed mode cannot be operated on the centre runway during three runway operations (other than in the circumstances considered but ruled out in the paragraph above), primarily for safety reasons. The technical note at Appendix 4 explains the reasons why this is the case.

1.2.6 This is why none of the mode allocations we are considering (explained below) have the centre runway operating in mixed mode.
1.3 **Mode allocation**

1.3.1 How runway modes are used together across all the runways at one time is called a mode allocation. For example, one allocation might have the new third runway on a mixed mode (M), the centre runway on a segregated arrivals/landings mode (L) and the southern runway on a segregated departures mode (D). We would call this mode allocation 'MLD'.

1.3.2 Figure 10 illustrates this MLD pattern.

*Figure 10 – Mode allocation – an illustration*

1.3.3 Figure 10 shows the MLD runway allocation for westerly operations this is indicated by the 'wind direction' arrow on the top left of the diagram and the 'W' within the mode allocation name.

1.3.4 When we switch the direction of operations because of a change in wind direction, this is known as a runway directional change – and this is not the same as runway alternation. For more information on direction of operations within this consultation, please see the document *Runway Operations - Directional Preference*. As explained above, with expansion our final runway alternation pattern will be designed to work on both westerly and easterly operations.

1.3.5 Figure 10 shows the MLD runway allocation for westerly operations. This will be referred to as 'Mode Allocation 1W – MLD'. In the allocation name, the first letter always refers to how the new runway will be operating, the next the centre runway and the third letter the southern runway. For example:
Mode Allocation 1W – New runway: M (mixed)
Centre runway: L (landing)
Southern runway: D (departing)

1.3.6 There are only possible four mode allocation for each runway operating direction (i.e. 4 for westerly and 4 for easterly)

Mode allocation 1 = MLD
Mode allocation 2 = MDL
Mode allocation 3 = LDM
Mode allocation 4 = DLM

1.3.7 These are shown in Figure 11 below for westerly operations and Figure 12 for easterly operations
Figure 11 – Westerly Operations
Figure 12 – Easterly Operations
1.3.8 Each mode allocation provides respite for different communities as illustrated in Figures 13 – 16 below.
Figure 13 - Mode Allocation 1

Westerly Operations

<table>
<thead>
<tr>
<th>Mode allocation 1</th>
<th>Westerly operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern runway</td>
<td>Area A would experience departing aircraft but typically less frequently as they are spaced further apart. Area D would experience arriving aircraft but typically less frequently as they are spaced further apart.</td>
</tr>
<tr>
<td>Middle runway</td>
<td>Area B would have no planes overhead (respite). Area E would experience the stream of arriving aircraft.</td>
</tr>
<tr>
<td>Southern runway</td>
<td>Area C would experience the stream of departing aircraft. Area F would have no planes overhead (respite).</td>
</tr>
</tbody>
</table>
Easterly Operations

<table>
<thead>
<tr>
<th>Mode Allocation 1</th>
<th>Easterly operations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Northern runway</strong></td>
<td>Area A would experience arriving aircraft but typically less frequently as they are spaced further apart.</td>
</tr>
<tr>
<td></td>
<td>Area D would experience departing aircraft but typically less frequently as they are spaced further apart.</td>
</tr>
<tr>
<td><strong>Middle runway</strong></td>
<td>Area B would experience the stream of arriving aircraft.</td>
</tr>
<tr>
<td></td>
<td>Area E would have no planes overhead (respite).</td>
</tr>
<tr>
<td><strong>Southern runway</strong></td>
<td>Area C would have no planes overhead (respite).</td>
</tr>
<tr>
<td></td>
<td>Area F would experience the stream of departing aircraft.</td>
</tr>
</tbody>
</table>
Figure 14 - Mode Allocation 2

Westerly Operations

<table>
<thead>
<tr>
<th>Mode allocation 2</th>
<th>Westerly operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern runway</td>
<td>Area A would experience departing aircraft but typically less frequently as they are spaced further apart. Area D would experience arriving aircraft but typically less frequently as they are spaced further apart.</td>
</tr>
<tr>
<td>Middle runway</td>
<td>Area B would experience the stream of departing aircraft. Area E would have no planes overhead (respite).</td>
</tr>
<tr>
<td>Southern runway</td>
<td>Area C would have no planes overhead (respite). Area F would experience the stream of arriving aircraft.</td>
</tr>
</tbody>
</table>
Easterly Operations

**Mode allocation 2** | **Easterly operations**
---|---
**Northern runway** | Area A would experience arriving aircraft but typically less frequently as they are spaced further apart. 
Area D would experience departing aircraft but typically less frequently as they are spaced further apart.

**Middle runway** | Area B would have no planes overhead (respite). 
Area E would experience the stream of departing aircraft.

**Southern runway** | Area C would experience the stream of arriving aircraft. 
Area F would have no planes overhead (respite).
Westerly Operations

Figure 15 - Mode Allocation 3

<table>
<thead>
<tr>
<th>Mode allocation 3</th>
<th>Westerly operations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Northern runway</strong></td>
<td>Area A would have no planes overhead (respite).</td>
</tr>
<tr>
<td></td>
<td>Area D would experience the stream of arriving aircraft</td>
</tr>
<tr>
<td><strong>Middle runway</strong></td>
<td>Area B would experience the stream of departing aircraft.</td>
</tr>
<tr>
<td></td>
<td>Area E would have no planes overhead (respite).</td>
</tr>
<tr>
<td><strong>Southern runway</strong></td>
<td>Area C would experience departing aircraft but typically less frequently as they are spaced further apart.</td>
</tr>
<tr>
<td></td>
<td>Area F would experience arriving aircraft but typically less frequently as they are spaced further apart.</td>
</tr>
</tbody>
</table>
## Easterly Operations

### Mode allocation 3

<table>
<thead>
<tr>
<th>Northern runway</th>
<th>Easterly operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area A would experience the stream of arriving aircraft. Area D would have no planes overhead (respite).</td>
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</table>

<table>
<thead>
<tr>
<th>Middle runway</th>
<th>Easterly operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area B would have no planes overhead (respite) Area E would experience the stream of departing aircraft.</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Southern runway</th>
<th>Easterly operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area C would experience arriving aircraft but typically less frequently as they are spaced further apart. Area F would experience departing aircraft but typically less frequently as they are spaced further apart.</td>
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</table>
Figure 16 - Mode Allocation 4

Westerly Operations

<table>
<thead>
<tr>
<th>Mode allocation 4</th>
<th>Westerly operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern runway</td>
<td>Area A would experience the stream of departing aircraft.</td>
</tr>
<tr>
<td></td>
<td>Area D would have no planes overhead (respite).</td>
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<tr>
<td>Middle runway</td>
<td>Area B would have no planes overhead (respite).</td>
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<td></td>
<td>Area E would experience the stream of arriving aircraft.</td>
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<tr>
<td>Southern runway</td>
<td>Area C would experience departing aircraft but typically less intensely as they are spaced further apart.</td>
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<tr>
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<td>Area F would experience arriving aircraft but typically less intensely as they are spaced further apart.</td>
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Easterly Operations

<table>
<thead>
<tr>
<th>Mode allocation 4</th>
<th>Easterly operations</th>
</tr>
</thead>
</table>
| Northern runway   | Area A would have no planes overhead (respite).  
                    | Area D would experience the stream of departing aircraft. |
| Middle runway     | Area B would experience the stream of arriving aircraft.  
                    | Area E would have no planes overhead (respite). |
| Southern runway   | Area C would experience arriving aircraft but typically less frequently as they are spaced further apart.  
                    | Area F would experience departing aircraft but typically less frequently as they are spaced further apart. |
1.4 Changing the mode allocation

1.4.1 In order to provide respite using runway alternation, we have to vary the mode allocation that is in use. For example, starting with Allocation 1W and changing to Allocation 3W, different communities get respite. This illustrated in Figure 17 below.

Figure 17 – Example of changing mode allocation
1.4.2 It is theoretically possible to move through the 4 mode allocation discussed in 24 different sequences. These 24 sequences are illustrated in Figure 18 and apply to both easterly and westerly operations. As an example, sequence 10 highlighted red below illustrates the change from Mode Allocation 1W MLD to mode Allocation 3 LDM to mode Allocation 4 DLM to mode Allocation 2 MDL.

**Figure 18 – Mode allocation sequences**

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>MDL</td>
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</table>

1.4.3 We are undertaking evaluation to determine which sequences of allocation changes work well and which do not. Switching runway mode allocations requires corresponding changes to how aircraft taxi around the airport and fly through the airspace. Some of these changes are more complex than others. This makes some mode allocation sequences more complex than others. We are evaluating the impact of moving between mode allocation sequences and this will inform the final runway alternation pattern.

1.4.4 Regardless of how we change between mode allocations, the overall noise impact for affected communities, and total amount of respite, will be the same over time. This is explained at paragraph 6.4.1 of the main document *Runway Operations – Respite Through Alternation*.

1.4.5 We are considering options which would ensure that, when the direction of operations changes, the pattern changes at the same time to ensure that respite periods are not interrupted. This is not illustrated in these diagrams.
1.1 Introduction

1.1.1 This Appendix explains how we are developing and testing options for runway alternation patterns.

1.2 Developing options

1.2.1 Aside from the runway alternation pattern we put forward as part of the Airports Commission process, we are examining other patterns that might be feasible and adhere to policy and legal requirements; create the required necessary capacity for the airport; and minimise impacts for local communities.

1.2.2 In considering the possibilities for a future runway alternation pattern it became clear that the number of options was far too large to meaningfully assess - our initial generation of options and ideas resulted in over 10,000 options. Given the range and complexity of the options, we decided on a staged process to identify options to take forward.

1.2.3 At the first stage, to narrow the scope further, we applied some basic rules and principles to develop a more manageable list to take forward for evaluation.

1.2.4 For stage 1, we defined the following discontinuation criteria:

- A proposal that does not allow for alternation is not sustainable.
- A proposal that does not allow for alternation in airspace is not sustainable.
- An alternation pattern determined by the schedule alone is not acceptable (see paragraph 6.4.6 of the main document Runway Operations – Respite Through Alternation).
- The centre runway at expanded Heathrow cannot be used as a mixed mode runway during routine operations, for safety reasons. See Appendix 4.
- Triple arrival streams are not available for use in routine operations at this stage of the design.
- Triple departure streams are not available for use in routine operations.
operations at this stage of the design.

- Alternative patterns that include more than three changes/alternations during the operational day are not sustainable. See Appendix 5.

1.2.5 Applying these criteria allowed us to narrow our options, but the list was still extensive.

1.2.6 In order to begin a more detailed evaluation and further our understanding, we devised ‘test’ cases to allow us to evaluate different choices for the 4 core components of a runway alternation pattern:

- Component One - a runway mode allocation e.g. arrivals, departures or mixed mode
- Component Two - the sequence in which the runway mode allocation will move around the runways
- Component Three - the duration for which a runway mode allocation is in place
- Component Four - the time of day (or point in a week) when the runway mode allocation changes over to the next in the sequence

1.2.7 The test cases provide a framework to evaluate and compare different component options.

1.2.8 The test cases we have developed and what we are aiming to test through evaluating them is described in Table 1 below.
<table>
<thead>
<tr>
<th>Test Case No.</th>
<th>Description</th>
<th>Example (using modes shown in Figure 5 and 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RA1</td>
<td>What is being tested:</td>
<td>What timings are being used:</td>
</tr>
<tr>
<td></td>
<td><strong>MDL/MLD</strong></td>
<td><strong>Day 1</strong></td>
</tr>
<tr>
<td></td>
<td>Fixed mixed mode on the <strong>new northern runway</strong>, L/D change at 15:00. Sequence changes on alternate days.</td>
<td>06:00 Mode Allocation 1, 15:00 Mode Allocation 2</td>
</tr>
<tr>
<td></td>
<td>What it is testing:</td>
<td><strong>Day 2</strong></td>
</tr>
<tr>
<td></td>
<td>• This tests a concept that preserves the current runway alternation respite for the centre/southern runways at 50%.</td>
<td>06:00 Mode Allocation 2, 15:00 Mode Allocation 1</td>
</tr>
<tr>
<td></td>
<td>• It tests the effect of a fixed mixed mode runway on the new northern runway. The new runway would not be open from 23:00 – 06:00 and would have no night flights at all during that period.</td>
<td>Why these times have been chosen:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>These times have been chosen to reflect current practice following feedback in Consultation One in January 2018 that respite for existing communities should not be reduced. No flights before 06:00 tested at this stage to allow comparison to the mixed mode runway concept. If taken forward early morning flights would need to be added to centre and southern runways.</td>
</tr>
<tr>
<td>RA2</td>
<td>What is being tested:</td>
<td>What timings are being used:</td>
</tr>
<tr>
<td></td>
<td><strong>DLM/LDM</strong></td>
<td><strong>Day 1</strong></td>
</tr>
<tr>
<td></td>
<td>Fixed Mixed mode on Southern runway L/D change at 15:00. Sequence changes on alternate days.</td>
<td>06:00 Mode Allocation 3, 15:00 Mode Allocation 4</td>
</tr>
<tr>
<td></td>
<td>What it is testing:</td>
<td><strong>Day 2</strong></td>
</tr>
<tr>
<td></td>
<td>• This tests a concept for an alternation pattern that preserves an element of the current runway alternation respite in that for the centre/new northern runways would be in the same</td>
<td>06:00 Mode Allocation 4, 15:00 Mode Allocation 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Why these timings been chosen:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No flights before 06:00 tested at this stage to allow comparison to the mixed mode runway concept. If taken forward early morning flights</td>
</tr>
</tbody>
</table>
### Table 1 - Phase 1 Runway Alternation Test Cases

<table>
<thead>
<tr>
<th>Test Case No.</th>
<th>Description</th>
<th>Example (using modes shown in Figure 5 and 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RA3</td>
<td><strong>What is being tested:</strong></td>
<td>would need to be added to centre and new northern runways.</td>
</tr>
</tbody>
</table>
|               | *One mode allocation fixed for 24 hrs;*  
**Daily sequence over 4-day cycle through all modes;**  
*Change at 00:00 daily* | | |
|               | **What it is testing:** | | |
|               | This focuses on a ‘MDL runway alternation pattern’ changing through four mode allocations over a four-day cycle. Each change will occur at midnight to provide evidence of the effect on capacity compared to a change during the day – i.e. traffic is minimal at night. | | |
| RA3a          | **What is being tested:** | | |
|               | *2 mode allocations operate;*  
*1 mode allocation change in day;*  
*change at 14:00 (divides day more evenly 9h/9h);*  
*sequence changes through a 4-day cycle.* | | |
|               | **What timings are being used:** | | |
|               | *Day 1 Mode Allocation 1*  
*Day 2 Mode Allocation 2*  
*Day 3 Mode Allocation 3*  
*Day 4 Mode Allocation 4* | | |
|               | **Why these timings been chosen:** | | |
|               | Examining the effect on the airspace and airport with a mode allocation change occurring when there is no/minimal air traffic. This will give us a baseline for safety and capacity. | | |
### Table 1 - Phase 1 Runway Alternation Test Cases

<table>
<thead>
<tr>
<th>Test Case No.</th>
<th>Description</th>
<th>Example (using modes shown in Figure 5 and 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>What it is testing:</strong></td>
<td><strong>Why these timings been chosen:</strong></td>
</tr>
<tr>
<td></td>
<td>This focuses on a ‘MDL runway alternation pattern’ changing through four mode allocations over a four-day cycle. Each change will occur at 14:00 to examine the effect of a single change during the operational day with maximum operational complexity. It also tests a more complex mode allocation sequence for the first time. Operational and community input in evaluation is key.</td>
<td>Examining the effect on the airspace and airport with a single mode allocation change occurring when there is maximum air traffic. We have chosen 06:00 as a start to remove any inconsistency with pre-06:00 assessment at this stage. 14:00 was chosen to test a non-standard (15:00) time and it equally divides the day.</td>
</tr>
<tr>
<td>RA3b</td>
<td><strong>What is being tested:</strong> Day 1 06:00 Mode Allocation 1, 15:00 Mode Allocation 2  Day 2 06:00 Mode Allocation 3, 15:00 Mode Allocation 4  Day 3 06:00 Mode Allocation 2, 15:00 Mode Allocation 1  Day 4 06:00 Mode Allocation 4, 15:00 Mode Allocation 3</td>
<td><strong>What timings are being used:</strong>  <strong>Why these timings been chosen:</strong> Examining the effect on the airspace and airport with a single mode allocation change occurring when there is maximum air traffic. We have chosen 06:00 as a start to remove any inconsistency with pre-06:00 assessment at this stage. 15:00 was chosen to test a standard (15:00) time which nearly divides the day equally.</td>
</tr>
</tbody>
</table>

2 mode allocations operate; 1 mode allocation change in day; change at 15:00 (switch time as today 10h/8h); sequence changes through a 4-day cycle.
### Table 1 - Phase 1 Runway Alternation Test Cases

<table>
<thead>
<tr>
<th>Test Case No.</th>
<th>Description</th>
<th>Example (using modes shown in Figure 5 and 6)</th>
<th>What timings are being used</th>
<th>Why these timings been chosen</th>
</tr>
</thead>
</table>
| RA4           | What is being tested:  
3 mode allocations operate;  
2 mode allocation changes in day (6h/6h/6h);  
with odd number of modes allocation changes each day.  
What it is testing:  
Focusing on the community understanding of an alternation pattern that does not guarantee respite every day for all communities but does every other day but is increasing the respite period to 6 hours. The latter is important – we are examining how close we are getting to the balance between daily respite vs increasing length. Also testing whether capacity lost in cumulative and increasing linearly or exponentially. | Day 1  
06:00 Mode Allocation 1, 12:00 Mode Allocation 2, 18:00 Mode Allocation 3  
Day 2  
06:00 Mode Allocation 4, 12:00 Mode Allocation 1, 18:00 Mode Allocation 2 | We have chosen 06:00 as a start to remove any inconsistency with pre-06:00 assessment at this stage. Equally spaced timings with 6 hours of respite. Cycling through an MDL pattern. At the stage we are not testing a second allocation pattern after the 2 days. MDL repeated therefore. |
| RA5           | What is being tested:  
4 mode allocations operate;  
3 mode allocation changes in day (5h/4h/5h/4h);  
same sequence each day.  
What it is testing:  
Daily respite achieved. Complexity for ATM and airport in terms of loss of capacity and safety  
Community driven. | 06:00 Mode Allocation 1, 10:00 Mode Allocation 2, 15:00 Mode Allocation 3, 19:00 Mode Allocation 4 | We have chosen 06:00 as a start to remove any inconsistency with pre-06:00 assessment at this stage. Equally divided spacings giving 4 and 5 hours respite. |
### Table 1 - Phase 1 Runway Alternation Test Cases

<table>
<thead>
<tr>
<th>Test Case No.</th>
<th>Description</th>
<th>Example (using modes shown in Figure 5 and 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RA5b</td>
<td>The mode allocation sequence does not change – stays the same each day – this enables us to look at the cumulative effect on communities whilst maintaining a simpler pattern. Focuses on the shortest equally divided respite period. Also allows examination of ‘fairness’ with the centre runway community receiving twice the amount of respite compared to the outer.</td>
<td>As respite is provided each day it gives an insight into the night period/day period overlap which can increase the period of respite considerably. Whilst all patterns do this, the effect on a short period might reveal differences in community evaluation.</td>
</tr>
</tbody>
</table>

#### What is being tested:

- **4 mode allocations operate;**
- **3 mode allocation changes in day (5h/4h/5h/4h);**
- **different sequence over a 4 day cycle.**

#### What it is testing:

- Daily respite achieved.
- Complexity for ATM and airport in terms of loss of capacity and safety
- Community driven.
- The mode allocation sequence does change – it cycles through a four day alternation pattern that changes each day thus allowing each community to experience respite at key times of day
- Focuses on the shortest period believed to have value in a community: equally divided respite period.
- Also allows examination of ‘fairness’ with the centre runway community receiving twice the amount of respite compared to the outer.

#### What timings are being used:

- **Day 1** 06:00 Mode Allocation 1, 10:00 Mode Allocation 2, 15:00 Mode Allocation 3, 19:00 Mode Allocation 4
- **Day 2** 06:00 Mode Allocation 2, 10:00 Mode Allocation 3, 15:00 Mode Allocation 4, 19:00 Mode Allocation 1
- **Day 3** 06:00 Mode Allocation 3, 10:00 Mode Allocation 4, 15:00 Mode Allocation 1, 19:00 Mode Allocation 2
- **Day 4** 06:00 Mode Allocation 4, 10:00 Mode Allocation 1, 15:00 Mode Allocation 2, 19:00 Mode Allocation 3

#### Why these timings been chosen:

- We have chosen 06:00 as a start to remove any inconsistency with pre-06:00 assessment at this stage.
- Equally divided spacings giving 4 and 5 hours respite.
- As respite is provided each day it gives an insight into the night period/day period overlap which can increase the period of respite considerably. Whilst all patterns do this, the effect on a short period might reveal differences in community evaluation.
### Table 1 - Phase 1 Runway Alternation Test Cases

<table>
<thead>
<tr>
<th>Test Case No.</th>
<th>Description</th>
<th>Example (using modes shown in Figure 5 and 6)</th>
</tr>
</thead>
</table>
| RA6           | What is being tested:  
5 mode allocations operate;  
4 mode allocation changes in day (4h/3h/3h/4h/4h);  
with odd number of modes sequence changes each day.  
What it is testing:  
Focuses on the shortest period believed to have little or no value to a community: equally divided respite period.  
We believe that operationally this is unsustainable so requested feedback from Operational teams.  
We believe the capacity loss is unsustainable combined especially with effect on delay and pressure on schedule after 23:00. | At this stage, no timings were offered to the evaluation teams. |
1.3 **Evaluation of test cases**

1.3.1 The test cases in Table 1 were then passed to 6 evaluation disciplines comprising various subject matter experts:

- Operations & Service;
- Delivery;
- Business Case;
- Sustainability;
- Community; and
- Planning & Property for an initial evaluation.

1.3.2 At this stage, evaluators were asked for qualitative (and where possible quantitative) assessments. This initial evaluation of the test cases is ongoing.

1.3.3 Stakeholders are also vital contributors to this evaluation work, and, in this consultation, we explain runway alternation patterns in some detail and ask questions about how we might use some of the components we are evaluating within those patterns. This is because we want consultees (especially the communities that might be affected by expansion) to give us their feedback and help us reduce the number of options to a shorter list which we can progress with.

1.3.4 Once this stage has completed, we will review the findings of our initial evaluation alongside the feedback from this consultation to:

- revisit the test cases and confirm there are no components that we have not yet evaluated through the test cases that we should have;
- determine whether we should reconsider some components in a different combination to create alternative test cases; and
- determine whether any of the components or test cases should be discontinued.

1.3.5 Once we have a revised, shorter list of options, these options will be taken through to a second stage of evaluation. At this stage we will look to obtain more quantitative data from our evaluators to help us identify our preferred option for inclusion within the development consent order (DCO) application.

1.3.6 We will conduct targeted engagement as described in the document *Developing our approach to noise management.*
1.3.7 Our preferred option will be subject to consultation at our Airport Expansion Consultation in 2019.
APPENDIX 4 – CENTRE RUNWAYS CANNOT BE CONSIDERED FOR MIXED MODE OPERATIONS

1.1 Summary and context

1.1.1 The centre runway cannot be used as a mixed mode runway as part of a simultaneous operation three runway system at an expanded Heathrow.

1.1.2 This paper was written November 2018 for a technical audience to record the reasons for discontinuing runway alternation options in which the centre runway is operating in mixed mode.

1.1.3 This paper will examine:

- Safety Issues resulting from using the centre as a mixed mode runway; and
- Issues with airfield design as a result of using the centre runway in mixed mode for routine operations.

1.2 Position

1.2.1 The Airports Commission submission discounted the use of the Centre runway (09C/27C) as a mixed mode runway when in a three-runway alternation pattern.

1.2.2 The position is driven primarily by safety design complications for missed approach (including baulked landings) procedure design in the context of limited space for safely separating these aircraft from departing aircraft (‘piggy back’ departures) on the same runway (09C/27C) whilst being bounded by departing and missed approach aircraft on the outside runways.

1.2.3 If 09C/27C is used in isolation, then there is a further consideration: mixed mode runways with a heavy/medium aircraft fleet mix need to have restricted displaced threshold length for departures due to wake turbulence issues. Current calculations would rule out 09C from being used as a mixed mode runway.
1.3 Rationale

Primary Issue - Safety by Design

1.3.1 From an ATC perspective, all 6 modes (alternation patterns – MLD, MDL, LDM, DLM, DML and LMD) of operation are possible but any option with mixed mode on the centre runway, with the other 2 runways in operation at the same time, would limit capacity.

1.3.2 There needs to be an ability to cater for a ‘piggy-back’ go-around on the mixed mode runway. A piggy-back go-around is when a departure is committed to take-off and an inbound aircraft on short final for the same runway is either denied a landing clearance or carries out a go-around. This requires the arriving aircraft to perform a go-around with a departure airborne immediately ahead. The resolution is for ATC to provide vectors by turning the aircraft away from each other; in this case one to the North and one to the South. On either of the adjacent runways, there could be an arrival or a departure. Should one of those arrivals also go-around there is no way to turn all the aircraft to provide a safe, tactical resolution. This is illustrated in Figure 19 below.
1.3.3 The way to mitigate this is to make a dependency between the runways with the result that an extra gap needs to be created for the arrival onto the centre runway so that the adjacent arrival has the airspace ‘reserved’ for the event of their go-around. This requires routine larger gaps between arriving pairs. The result, a drop in runway throughput on the mixed mode runway. The reduction in capacity of such a runway configuration is potentially from 48 movements per hour to 24-28 movements per hour.

1.3.4 Based on Heathrow’s discontinuation rule ‘An expanded Heathrow must at least be able to operate a minimum of 740K ATM’s to enable 130MPPA within curfew limits’, mixed mode on the centre runway during three runway operations is not being taken forward as a viable option. Two out of the possible six modes have mixed mode on the
Another of Heathrow’s discontinuation rules is that “An expanded Heathrow will offer predictable and reliable respite, maintaining the principle of runway alternation providing periods without overflight for every community overflown”. These rule out the possibility of mixed mode on two runways at the same time.

Secondary issue: Routine use of centre runway used in mixed mode

If the mitigation referenced above at paragraph 3.4 was considered acceptable by Heathrow, a further secondary issue would then require investigation to determine whether the **routine** use of the centre runway for mixed mode operations would be possible.

The landing threshold on a runway is defined as the point beyond which an aircraft can touchdown / land. In most instances the landing threshold is aligned to the pavement end (typically the start of TORA) to maximise the utilisation of the full runway length. Whilst this is beneficial from an infrastructure utilisation perspective, it is not always possible due to the surrounding terrain, obstacles and environmental considerations beyond the perimeter of the aerodrome. In such cases the landing threshold is often required to be “displaced” from the start of TORA / runway end.

The scheme presented to the Airports Commission (the AC scheme) included threshold displacements of 1161m on the centre runway. The resulting environmental benefits that this brings were an important part of the AC scheme submission. These have been carried forward into Heathrow’s current proposals.

If the centre runway was operated in mixed mode, creating the potential for landing and departing aircraft paths to overlap and, given the relatively short period between the aircraft movements, there is the potential for a departing aircraft to be affected by wake vortices present from the previous arriving aircraft and vice versa. Even with the mitigation of reduced capacity to “increase gaps” (as suggested in 3.4 above), these gaps may not be sufficient to remove safety implications as discussion below from 1.1.16 onwards, with such significant threshold displacements. The “gaps” are therefore likely to increase and the capacity would consequently reduce even further.
1.3.10 The overlap of the approach and climb paths is shown in Figure 21.

Figure 21 – Overlap of paths

1.3.11 The analysis and simulation of wake vortex behaviour is complex and as such NATS produced a report (Wake Vortex Report - NATS) which explored the issue further based on desk study and outputs from previous examples and investigations on the subject. The report concluded that, based on the data available and previous work completed, a displacement of 550m would be a reasonable figure to assume in the absence of more detailed field data for a mixed mode runway.

1.3.12 The conclusion is that should the centre runway be operated in mixed mode in routine operations then significant changes would have to be made to threshold displacements with consequential ramifications for noise mitigation.

ATETS and 09C

It is proposed that the landing threshold on runway 09C is displaced a total of 1100m from the runway end today. The 1100m displacement was determined by the current length being 3900m and the minimum LDA requirement of 2800m. Given the current displacement of 308m this results in a net movement of around 790m from today. The proposed displacement is summarised in Figure 22.

Figure 22 – Threshold displacements
1.3.13 A displacement of 610m or above is needed to safeguard the operation of the ATETs in their current proposed position. A displacement of less than 610m would result in the ATET positions being moved westwards in an area which is already highly constrained by the diverted river channels and M25 to the west. This requirement compromises the 550m estimate from NATS for safe operation of a mixed mode runway. It should be noted that with the current proposal of 1161m of displacement, it is the Take-Off Climb Surface (TOCS), rather than the threshold position, that dictates the positioning of the ATETs.

Non-Routine Use of the Centre Runway in Mixed Mode

1.3.14 For resilience purposes, it may be necessary for the centre runway to be considered for operations in mixed mode on the rare occasions of a runway outage (for example with one of the other runways out of service for maintenance or an incident). In this scenario, could Heathrow consider using the runway in mixed mode? The answer is yes, provided only two runways were in operation. If that were the case, the centre runway could be used in mixed mode as the issues highlighted in 3.1 would no longer apply.

1.3.15 In order to enable the centre runway to be used in mixed mode for non-routine operation, further measures may be requiring including additional RAT infrastructure or the deployment of temporary threshold locations to facilitate a safe high intensity mixed mode operation on an infrequent basis. These points and potential solutions are not covered in detail in this technical note – they will be considered in future design development for resilience purposes.

1.4 Conclusion

1.4.1 Mixed mode is not available on the 27C/09C runway when being operated in a three-runway mode where all three runways are in operation at the same time for airspace procedural design safety.

1.4.2 The only mitigation that could allow mixed mode on the 27C/09C runway when being operated in a three-runway mode (where all three runways are in operation at the same time) requires such a significant decrease in capacity that the Airports NPS minimum of 740,000 ATMS would not be reached.

1.4.3 Even if this mitigation was applied and a lower landing rate was accepted, displacement of thresholds would still be required which would have an environmental impact.

1.4.4 Therefore, mixed mode on the centre runway during three runway
operations is not recommended being taken forward as a viable option and therefore is recommended for discontinuation.
APPENDIX 5 – OPTIONS WITH 4 OR MORE MODE ALLOCATIONS CHANGES WILL NOT BE CONSIDERED

1.1 Summary and context

1.1.1 Following initial work to develop options for evaluation, it became apparent that there are an infinite number of options if there was an unrestricted number of mode changes.

1.1.2 As such, analysis was undertaken to determine how many changes would be possible and appropriate in three runway system, whilst maintaining safety and capacity.

1.1.3 This paper was written November 2018 for a technical audience to record the reasons for discontinuing runway alternation options where the runway mode allocation is changed 4 or more times in a core operational day.

1.2 Position

1.2.1 The following contributes towards ruling out 4 or more alternation changes per operational day:

- the complexity for Air Traffic Control, especially the wider network,
- the ability for Air Traffic Controllers to maintain situational awareness
- the ability for pilots to maintain situational awareness and ensure equipment is programmed correctly preferably at top of descent when on arrival pattern and before start on stand; and
- the effect of a community to understand a published alternation pattern.
- the effect on capacity. Our initial evaluation of options indicated that changing 4 or more times in the day would have a significant effect on capacity because when changes are made, capacity is lost.
1.3 **Rationale**

**Primary Issue - Safety by Design**

1.3.1 An alternation change for the Ground ATC operation varies in complexity depending on the sequence of the change (for example DLM to MDL is difficult to complete smoothly, whereas MDL to MLD on westerlies is relatively simple). Major issues may arise with multiple changes in an operational day with situational awareness especially for taxiway routings for pilots and controllers. Issues could arise with FMS, pilot awareness and understanding of route to runway, controller planning techniques, late changes of routing etc.

1.3.2 The planning for changes from one mode allocation to another in alternation system, even with advanced tool support, is complex and time consuming for supervisors and involves coordination with multiple agencies.

1.3.3 The LTMA is already one of the most complex ATC environments in the world: even with airspace modernisation, mode allocation changes in support of Heathrow are likely to add significantly to the complexity. Each mode change will be assessed for potential hazards as part of the Safety Management System used by NATS. Frequency of risk occurrence will be cumulative for each part of the hazard identification and multiple mode changes (4 or more) are, in the opinion of SMEs, are likely to be increase the risk of some of the hazards above an acceptable frequency creating a risk that cannot be mitigated to a tolerable level.

1.3.4 Pre-planning back into the wider network, especially into European airspace, will be considerable and be exacerbated by multiple changes where inbound streams need to be re-routed for a north to south (or vice versa) entry point into the LTMA infrastructure. Until we have further evidence and understanding of how aircraft will be sequenced into the LTMA, the advice from subject matter experts is that more than four changes per day being feasible is unlikely given current understanding.

1.3.5 Pilot situational awareness approaching an alternation change is something to be considered (there is an effect today even with one change that has been embedded for over 40 years). More changes are likely to increase the likelihood of human error. Tool support will be needed to indicate runway for arrival and departure well in advance. For example, in today’s environment some pilots will confirm with ATC the runway designated to the flight as a final check at alternation change. This is a known human factor ‘hotspot’ – hotspot is an aviation industry
technical term for ‘potential area for incident in time or space’.

**Other issues**

**Airspace Design**

1.3.6 Within the LTMA, traffic flows would likely need some element of holding to allow ‘metering’ changes through the arrival points for Heathrow. How this metering will be achieved is unknown at this time. The more changes there are the more likely each mode allocation change could necessitate some element of holding which could, in turn, affect airspace design. For example, where holding might be considered only in unusual circumstances, 4 changes per day might lead to the conclusion that holding might be more routine. This might also begin to affect airspace design for integration of other airports on London.

**Effect on capacity**

1.3.7 Our initial evaluation of options indicated that changing 4 or more times in the day would have a significant effect on capacity because when changes are made, capacity is lost.

**1.4 Conclusion**

1.4.1 The recommendation is that the consideration of more than four mode changes in an operational day is discontinued primarily for ATC/pilot/network issues.

1.4.2 Other considerations include airspace design and effect on capacity.
1.1 **Summary & context**

1.1.1 Options preparation presented some variations on a conventional alternation pattern such as MDL. These are sufficiently different in how respite would be presented to communities that further exploration was warranted to ascertain whether they could be supported. Following that further exploration, we have concluded that these options are not viable.

1.1.2 This paper was prepared in November 2018 for a technical audience to record the reasons for discontinuing runway alternation options that contain mode alternation patterns such as DDD, LLL, DDD where the airport operates in waves of arriving and departing aircraft with respite being afforded for each community wholesale but for short periods (1-2 hours) should be discontinued.

1.2 **Position**

1.2.1 The ANPS makes no provision as to forms of alternation, only that there be alternation and that it be predictable. However, schedule composition, airfield design and impact on the wider ATM network are likely to make this unsustainable as a proposal.

1.2.2 Proposal is illustrated below in Figure 23:

*Figure 23 – Departure wave followed by arrival wave*

Only Departures for period X
1.2.3 The effect on terminal and stand capacity is likely to be unsustainable at the turnaround period. The number of stands available is currently planned to allow a throughput of aircraft and a rotation in and out of such aircraft.

1.2.4 ATC capacity, especially the network for a wave departure and wave arrival system, has not been tested in the UK or into Europe. Simultaneous arrivals and departures have not been simulated for a three-runway environment. Heathrow’s submission to NATS for FASI-S (LAMP 2) has not included any requirements for any mode of operation other than a conventional schedule. It is likely to have a detrimental effect on the timetable for FASI-S design and implementation if Heathrow were to alter the requirements at this stage, so fundamentally putting airspace implementation for 3R at significant risk.

1.2.5 We will consider whether, in the first instance, the schedule and calculated demand could accommodate such an alternation pattern. If this proves acceptable then further ramifications will be considered.

1.3 Rationale

Primary Issue One – Schedule and Economic demand

1.3.1 Heathrow attracts all different types of traffic; home and away based short haul, mid haul and long haul traffic; high connecting routes and low-cost carrier operations (if looking further in to the future). Each of these traffic types has a different demand profile across the day, resulting in the need for fully flexible operations (there are currently 81 airlines travelling to 204 destinations).
1.3.2 Below is an example of the home based narrow body vs. wide body ground demand, illustrating very different profiles, in fact complimentary in terms of capacity. Narrow body traffic (short haul) leaves early in the morning and rotates throughout the day with all home based flights returning in the evening, whereas the majority of the wide body traffic (long haul) arrives throughout the morning and day, stays on the ground longer and gradually departs throughout the afternoon and evening.

![Graph showing 2035 Aircraft on Ground Demand](image)

1.3.3 Away based short haul carriers tend to arrive a bit later than the first wave of long haul and again will want to rotate throughout the day, whereas some long haul will dwell at Heathrow for several hours before departing.

1.3.4 High connecting routes tend to have a wave pattern to ensure that passengers are able to connect to their onward flights either at Heathrow or at the destination airport. Middle Eastern carriers schedule their departing flight from Heathrow so that they arrive at their destination to meet the onward flight from that airport. Low cost short haul carriers similarly have a wave pattern due to wanting to fit as many rotations in to a day as possible. The three wave patterns are mutually exclusive.

1.3.5 The curfew at Heathrow also dictates traffic flow, thus generating a high arrivals peak in the morning coinciding with the first wave of departures. The graph below shows the difference between Heathrow’s arrivals schedule and Hong Kong’s, where Hong Kong is open 24 hours.
1.3.6 The schedules agreed with the Airlines and Economic team reflect this pattern.

1.4 Conclusion

1.4.1 The recommendation is that an alternation pattern as described in 2.1.1 is discontinued for the following reason:

   a. Schedule composition as agreed by the Airlines and Economic Modelling team would not support this pattern.

1.4.2 Further reasons for discontinuation are:

   b. Further exploration of ATC Network Impact and Design is likely to be prohibitive in terms of timeline.

   c. Airfield Design is unlikely to support this alternation.
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