



# **Respite From Aircraft Noise Summary of research journey**

July 2023

Nicole Porter and Andy Knowles

# Aim of Presentation

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**1**

To provide some context for Heathrow's respite research

**2**

To provide a a high-level recap of the work to date

**3**

To set out our current understanding of some key aspects of delivering respite



# The context of respite – remains the same today

**airspace modernisation**

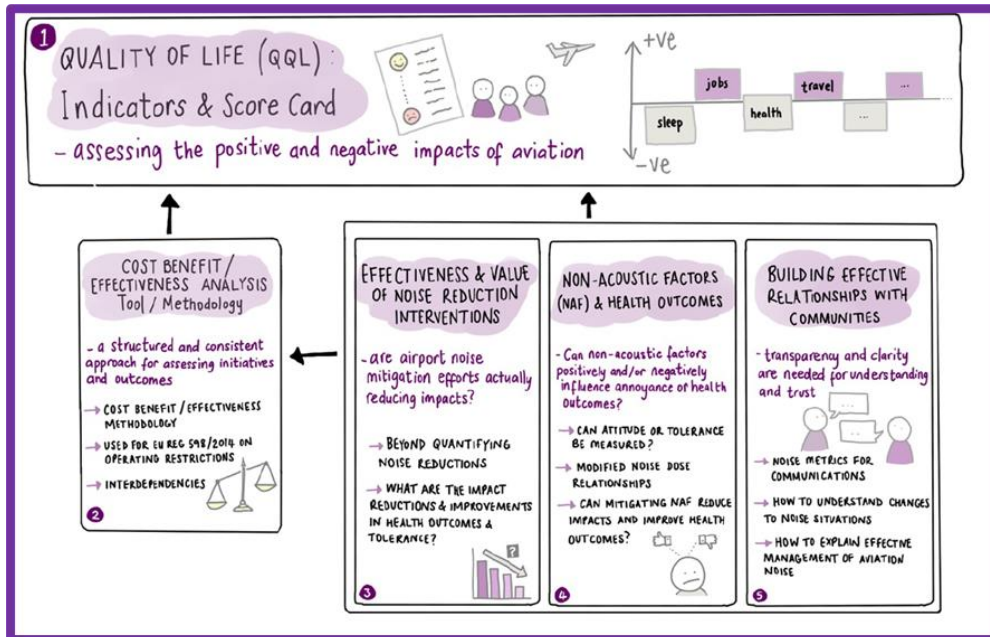
- ★ Performance Based Navigation
- ★ more concentrated flight tracks

**Community demand for respite**

- ★ need a break from aircraft noise
- ★ R3 feedback- it's important

**UK policy context**

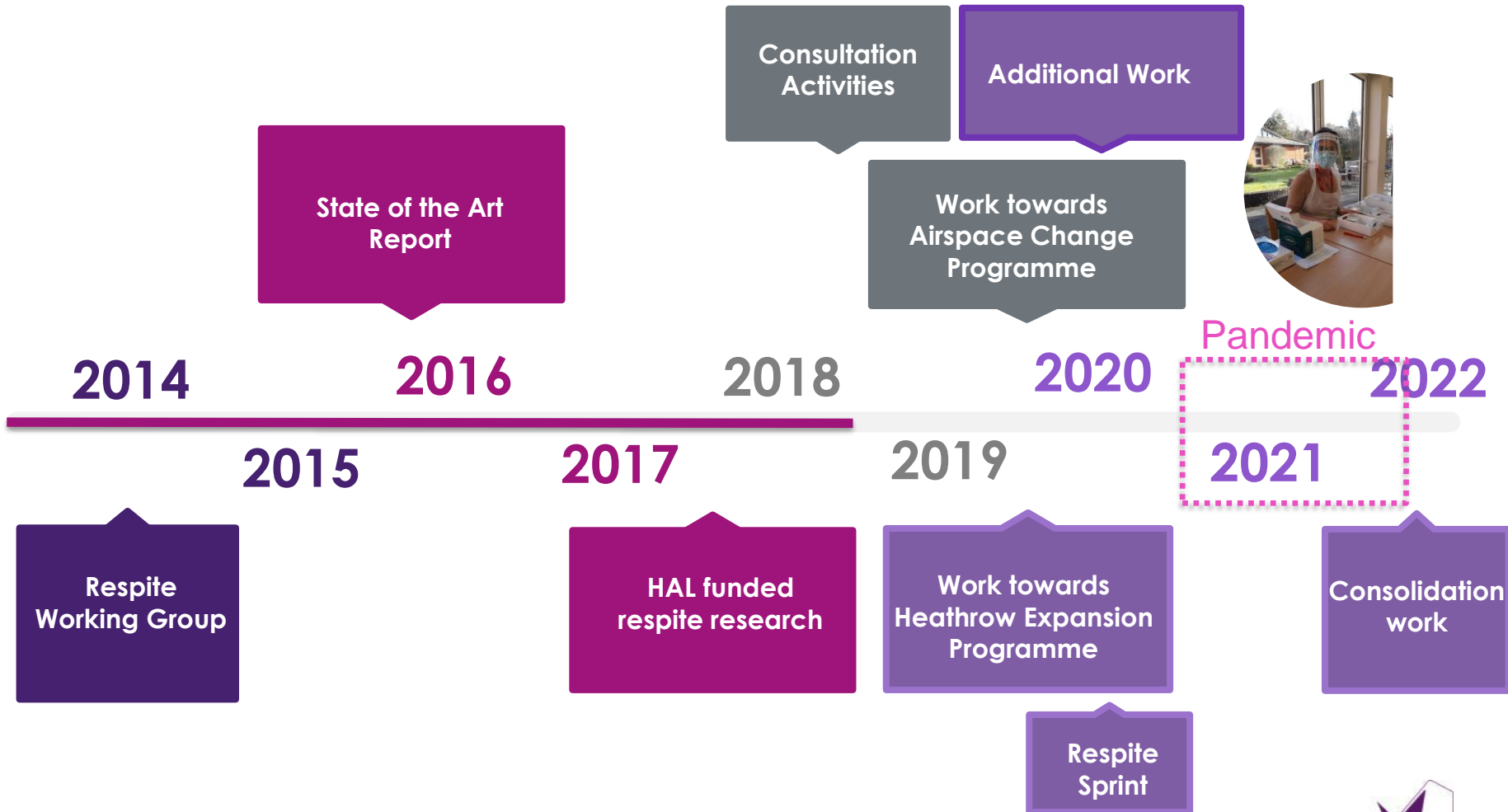
- ★ lack of definition, implementation or delivery guidance



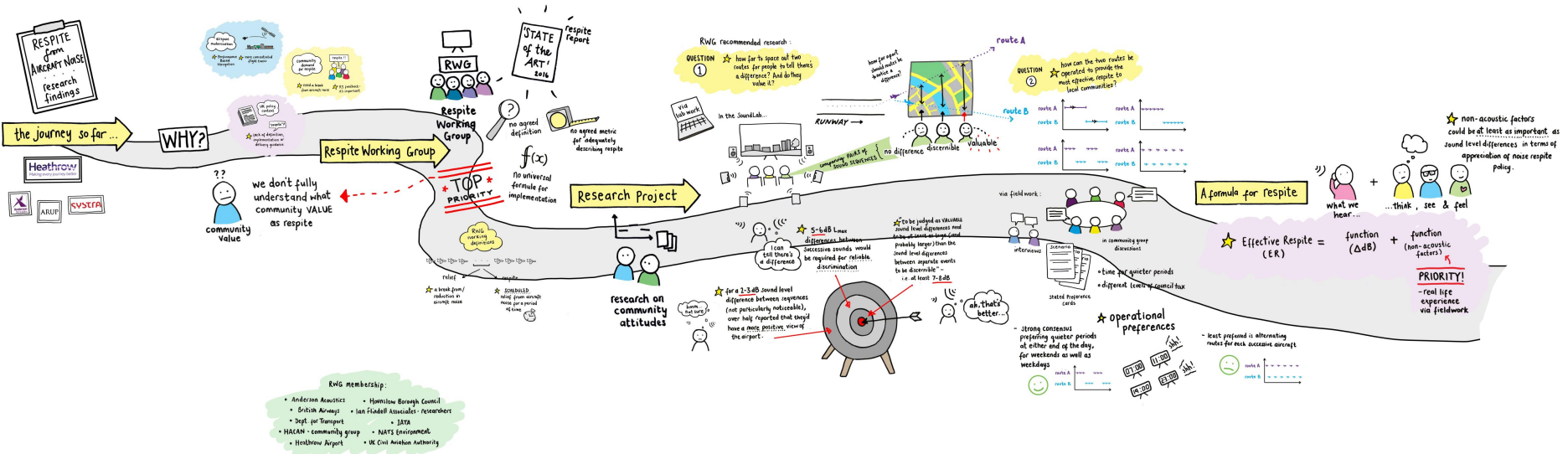
*These drivers require definitions and measures against which designs can be tested and assessed.*



# The Journey



# Phase 1 of respite research



RESPIRE from AIRCRAFT NOISE research findings



the journey so far ...

WHY?

Respite Working Group

Heathrow Making every journey better

Anderson Associates

ARUP

SYSTRA



we don't fully understand what community VALUE as respite



Respite Working Group

'STATE of the ART' 2016

respite report



no agreed definition



no agreed metric for adequately describing respite

f(x)

No universal formula for implementation

TOP PRIORITY

Research Pro



relief

respite

★ a break from/reduction in aircraft noise

★ SCHEDULED relief from aircraft noise for a period of time



research community attitude

**Airspace Modernisation**

- ★ Performance Based Navigation
- ★ more concentrated flight tracks

**Community demand for respite**

- ★ respite !!
- ★ need a break from aircraft noise
- ★ R3 feedback - it's important

**UK policy context**

- ★ "respite"?
- ★ lack of definition, implementation or delivery guidance

# Respite Working Group



no agreed definition

no agreed metric for adequately describing respite

$f(x)$

no universal formula for implementation

**\* TOP PRIORITY \***

??

**community**

we don't fully understand what community VALUE as respite

- RWG membership:**
- Anderson Acoustics
  - British Airways
  - Dept. for Transport
  - HACAN - community group
  - Heathrow Airport
  - Hounslow Borough Council
  - Ian Flindell Associates - researchers
  - JATA
  - NATS Environment
  - UK Civil Aviation Authority



relief

★ a break from/reduction in aircraft noise

respite

★ SCHEDULED relief from aircraft noise for a period of time

RWG working definitions

# Research Project



research on community attitudes

**RWG recommended research:**

**QUESTION 1** ★ how far to space out two routes for people to tell there's a difference? And do they value it?



5-6dB L<sub>max</sub> differences between successive sounds may be required for rel discrimination

I can tell there's a difference

hmm... not sure

★ for a 2-3 dB sound level difference between sequences (not particularly noticeable), over half reported that they had a more positive view of the airport.



Respite report

RWG recommended research:

QUESTION 1 ★ how far to space out two routes for people to tell there's a difference? And do they value it?

QUESTION 2 ★ how can the two routes be operated to provide the most effective respite to local communities?

no agreed metric for adequately describing respite



In the SoundLab...

RUNWAY →

how far apart should routes be to notice a difference?



route A

route B

comparing PAIRS of SOUND SEQUENCES

no difference discernible valuable



Research Project

research on community attitudes

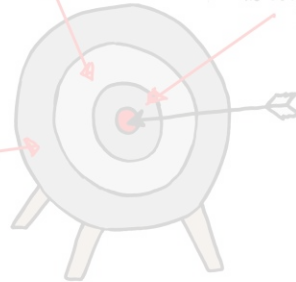
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★ 5-6 dB Lmax differences between successive sounds would be required for reliable discrimination

★ "to be judged as VALUABLE sound level differences need to be at least as large (and probably larger) than the sound level differences between separate events to be discernible" - i.e. at least 7-8 dB



ah, that's better...

via field work



Strong consensus preferring quieter periods at either end of the day, for weekends as well as weekdays

★ operational preferences



least preferred routes



Respite report

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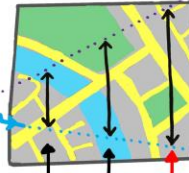
QUESTION 2 ★ how can the two routes be operated to provide the most effective respite to local communities?

no agreed metric for adequately describing respite



In the SoundLab...

RUNWAY →

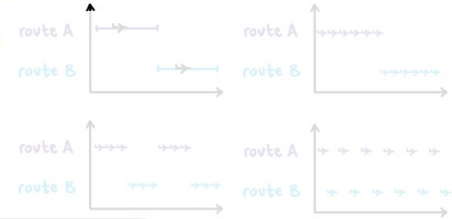


route A

route B



comparing PAIRS of SOUND SEQUENCES



Research Project

via field work:

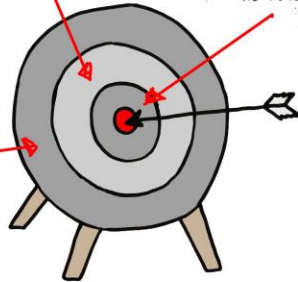
research on community attitudes

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- least preferred routes for

Despite report

RWG recommended research:

QUESTION 1

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In the SoundLab...

RUNWAY →

how far apart should routes be to notice a difference?



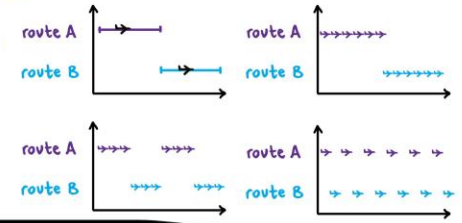
route A

route B

comparing PAIRS of SOUND SEQUENCES { no difference discernible valuable }

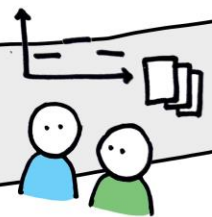
QUESTION 2

☆ how can the two routes be operated to provide the most effective respite to local communities?



No agreed metric for adequately describing respite

# Research Project

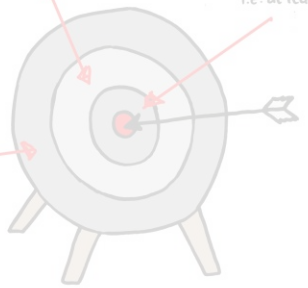


research on community attitudes

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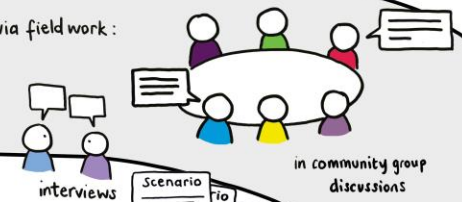
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via field work:



interviews

in community group discussions



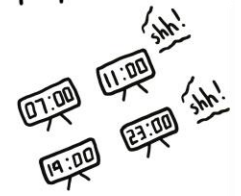
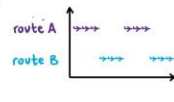
Stated Preference cards

- time for quieter periods
- different levels of council tax

A formula

☆ operational preferences

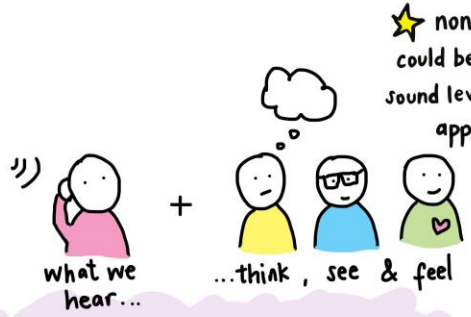
- Strong consensus preferring quieter periods at either end of the day, for weekends as well as weekdays



- least preferred is alternating routes for each successive aircraft



A formula for respite



★ non-acoustic factors could be at least as important as sound level differences in terms of appreciation of noise respite policy.

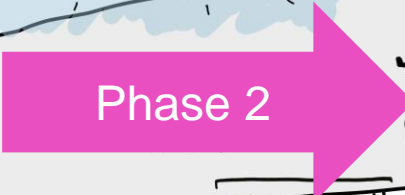


- Dirk Schreckenberg - Zeus GmbH
- Dr Uwe Mueller - German Aerospace Centre (DLR)
- Prof Callum Thomas - Manchester Metropolitan University
- Stephen Turner - Acoustics Limited
- Prof. Stephen Stansfield - Queen Mary, University of London

★ Effective Respite (ER) = function ( $\Delta$ dB) + function (non-acoustic factors)

**PRIORITY!**  
- real life experience via fieldwork

"Overall, the PRG felt that this was a SCIENTIFICALLY ROBUST study providing a number of interesting and useful results."



★ we now know more, but MORE research is needed


RESEARCH Limitations

Sound level differences were considered. More work required to establish spatial differences that could deliver effective respite

whilst to derive results, a val

# Acoustic Outcomes – Phase 1

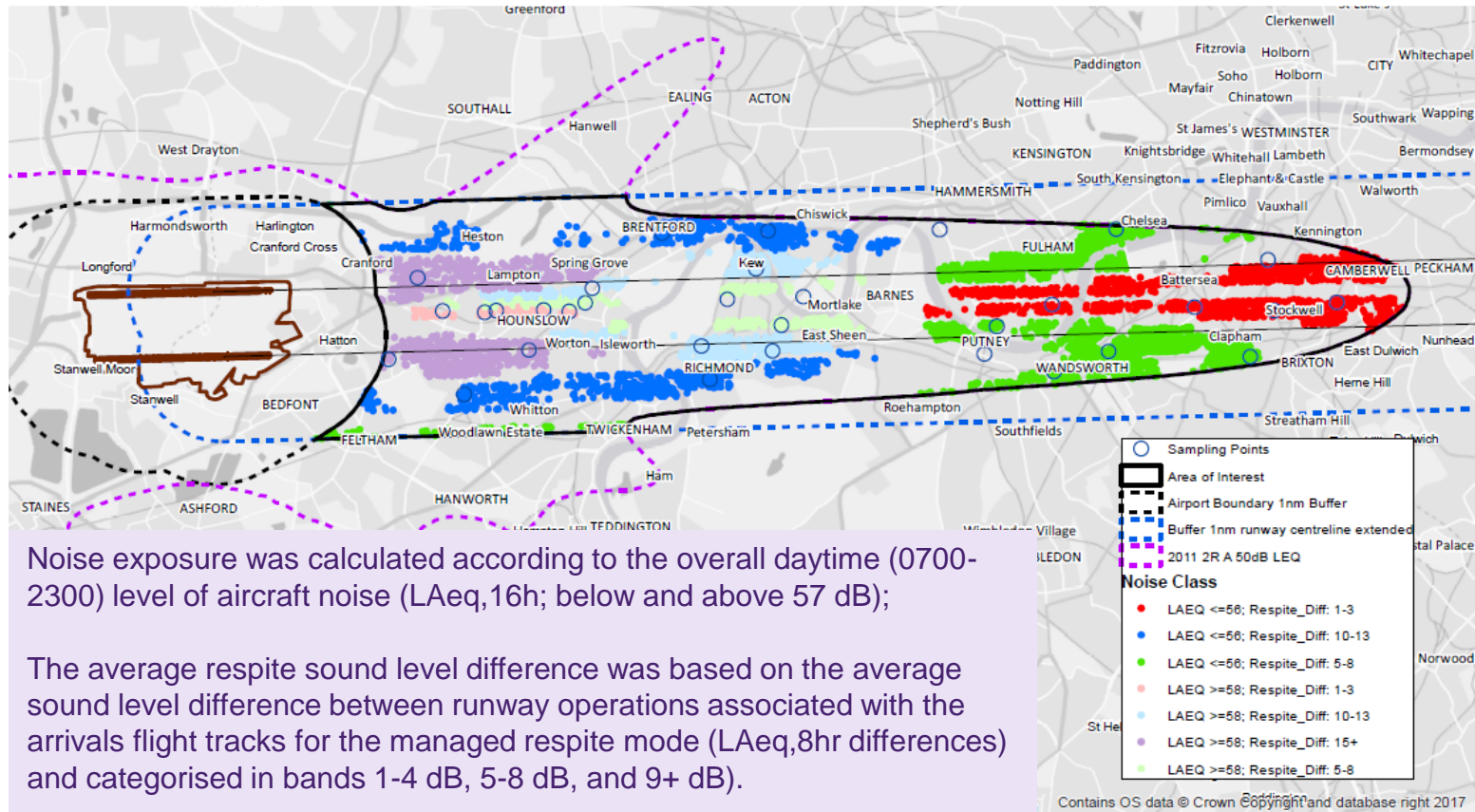


Difference Scenario	Description
<p>Between aircraft events in lab (Phase 1)</p> <p>- Based on <math>L_{Amax}</math> difference measures</p> 	<p>Sound level differences between successive flyover events of at least 3 dB <math>L_{Amax}</math> were necessary for the difference to be 'discriminable'.</p> <p>In practical terms, the results suggest that 5 to 6 dB differences between <math>L_{Amax}</math> of successive aircraft events might be required for more reliable discrimination between the first and second sounds of a pair of sounds differing only in sound level, under active listening conditions.</p> <p>For a series of events, average differences in <math>L_{Amax}</math> of around 7-8 dB were necessary for these differences to be considered of 'value'.</p>



## Phase 2 Field Study

To provide understanding of differences in sensitivity to aircraft sound levels in an area under real-life in-situ conditions (passive listening) than when actively comparing successive aircraft flyover events under laboratory conditions (active listening – Phase 1)



# Uncertainties in Outcomes from Phase 2

The influence of relief caused by changing wind direction on the value of managed respite;

The extent to which differences in perceived benefit are affected by individual differences in non-acoustic factors

The relative value of respite at night compared with respite during the day.

## Qualitative

## Additional Research

## Quantitative

Are there modifications to the current approach to managed respite that would increase its value to residents?

To further understand the potential confounding influence of relief caused by changing wind direction on the value of managed respite.

To explore the relative value of respite at night compared with respite during the operational day.

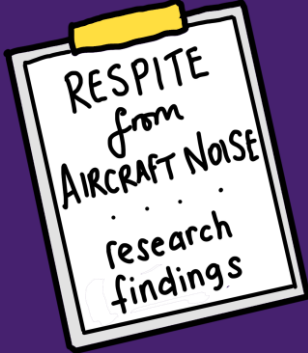
Which non-acoustic factors have the largest impact on the value residents place on managed respite?

Additional noise modelling down to postcode level to inform new higher resolution statistical analysis of existing data.

Further statistical analysis of existing quantitative data.



## Acoustic Outcomes – Phase 2

Difference Scenario	Description
<p>Between 2 periods of time (manage respite modes)  (Phase 2)</p> <p>- Based on <math>L_{Aeq}</math> difference measures</p> 	<p>After having been told about ‘managed respite’, and for areas with average aircraft noise levels above 57dB <math>L_{Aeq,16h}</math> where respondents expressed benefit of respite,</p> <p>It was ‘valued’ where <math>L_{Aeq,8hr}</math> difference was at least 9 dB between managed respite modes; and ‘noticed’ where differences were between 4 and 9 dB <math>L_{Aeq,8hr}</math></p> <p>Differences of 2-3 dB <math>L_{Aeq,8hr}</math> whilst not being particularly noticeable were considered worth having by many.</p>

It is considered that this result is likely to be generalisable to areas already overflown by arrivals or departures but is unlikely to be applicable to areas of new overflight.



# Phase 2 and follow on work highlights

## Effective?

Respite is an effective intervention. It could be concluded that predictable respite is effective as an intervention – it is (genuinely) valued by residents, when they are informed of it, and they certainly don't want it removed.

## Managed Respite v Relief

In general, residents do not differentiate between relief and 'managed respite'. 'Managed respite', and 'E/W relief' provided quite different patterns of noise and noise difference with considerable variation in different areas around the airport. Few residents differentiate between the two.

## Newly overflown

Providing effective respite to some communities who currently receive none, may mean spreading noise over areas not currently overflown, or not overflown as much. In this instance what one side consider a positive outcome that has provided some respite, the other would consider a new noise issue and may then have a greater impact.

## Night-time

Night-time respite considered more beneficial than day-time- Aircraft noise at night was considered by many to be more annoying and disruptive than daytime noise, particularly for those who experience higher noise levels overall (as defined by LAeq). So, instinctively, most people thought that respite at night would be more beneficial than day-time respite.

## Non-Acoustic Factors

The effect of 'managed respite' sound level differences on annoyance was not clear-cut\*, and indeed, in combination, non-acoustic factors were more highly correlated with reported annoyance than acoustic factors. Factors included membership of an amenity group, have lived near Heathrow for a long time, reported annoyance, gender.

\*note that investigating this was not the aim of this work





# OTHER RESPITE WORK AFTER RESEARCH

## Consultation activities

The provision of respite as an important mitigation for expansion.

Alternating runways could provide respite closer to the airport, alternating airspace could provide respite for those living further away.

There was a general preference for provision of respite during the evenings, night-time, and early mornings.

Providing community centred geographic information helps to open up conversations with the public.

### ONLINE POSTCODE CHECKER

Below is a list of design envelope(s) that the postcode or area of interest you have searched for is situated within.

Please click on the individual coloured segments for an indication of aircraft heights in each location.

Select a design envelope below for more information on the number, height and noise of potential flights.

A = Expansion arrivals, D = Expansion departures, I = Two runway arrivals with IPA

A7 A8 D5

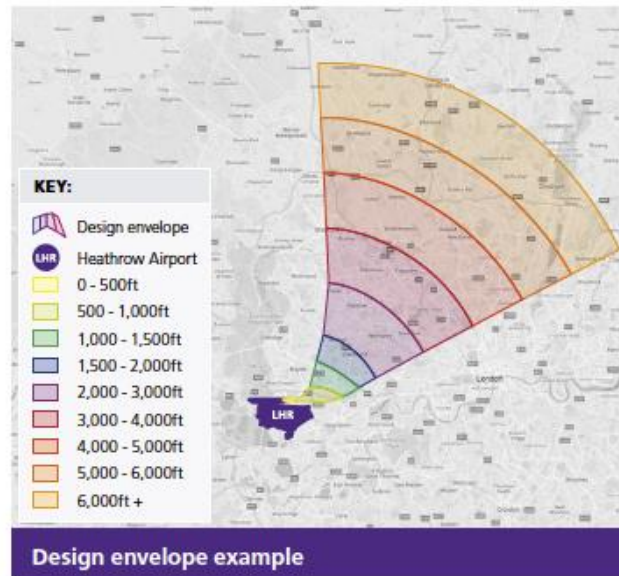
**Expanded Heathrow (3 runways)**

Design envelope: D5  
Envelope Type: Departure  
Height band: 3000ft to 12000ft  
Number of flights: 0-17 Flights per hour  
Number of these flights above 65 decibels: 0-17 Flights per hour

There would be three separate departure flight paths in this area. They would be spaced far enough apart so that you would only ever experience overflight from one of these flight paths.

\*The figures for "Number of these flights above 65 decibels" were revised on 10 January 2019 following corrections to the underlying data. Please use the link below to see our Change Log for more information.

If you are within (or close to) any design envelope, it is possible that you may also see or hear aircraft from nearby design envelopes that you are not directly beneath. This is particularly the case nearest to the airport.



# OTHER RESPITE WORK AFTER RESEARCH

## Respite Sprint

To consider how best to use ,  
information on respite for  
preparing Heathrow  
Expansion and for associated  
Airspace Design.

Representatives in  
attendance were from  
different 'perspective areas':  
airport operations, research,  
airspace, planning and  
impact assessment and  
community reps.

Important to bring everything  
together into a summary  
report.

Important to be clear about  
what is possible now, and in  
the future, and what is not.

# DEFINITIONS

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<b>RESPITE</b>  A break from or a reduction in noise from aircraft overhead.	<b>PREDICTABLE RESPITE</b>  Scheduled respite from aircraft noise for a period of time.	<b>RESPITE NOISE CHANGE</b>  The difference in noise level between different operational modes, most commonly measured as LAeq,T for each mode of operation.	<b>TYPES</b>  Changes can be classified into 3 bands; dB LAeq,T changes of greater than 9 dB being “ <b>valued</b> ”, 4-9 dB being “ <b>noticeable</b> ”, and less than 4 dB being considered “ <b>worth having</b> ”.	<b>UNPREDICTABLE RESPITE</b>  (Previously termed Relief) Unscheduled respite from aircraft noise .
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At present, these definitions only refer to aircraft in flight and not to ground operations. Although the respite language has been evolving, we still do not know how well this language meets the needs. It therefore requires further testing to make sure it is fit for purpose, and further developed where required.



# How is respite subjectively perceived?

Predictable respite is generally viewed as of benefit and considered helpful as a mitigation measure to reduce the impacts of noise.

'Managed respite' is perceived to be beneficial to local people – it is (genuinely) valued by residents, when they are informed of it – and they certainly don't want it removed.

Respite has both quantity and quality elements to it, and the overall appreciation of respite is dependent on both, and subjective perception of respite varies between individuals.

However, many residents are not aware of the current respite provision,

non-acoustic factors such as effectiveness of public engagement, trust and understanding could be at least as important as the respite noise level differences in terms of their appreciation of a noise respite intervention.

$$\star \text{ Effective Respite (ER)} = \text{function } (\Delta\text{dB}) + \text{function (non-acoustic factors)}$$



# How is respite objectively measured?

It is important to describe the degree to which respite can potentially be delivered, along with where and when it can be delivered.

At its simplest level, respite can be described using average noise level (LAeq,T) difference between two operating periods at a particular location and/or for a given population.

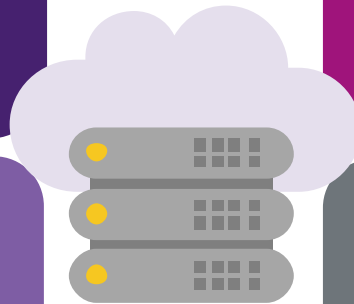
Other event-based measures (e.g., N65) have shown promise, but have yet to be formally tested.

Important to provide population counts and communities that experience the respective noise level difference between operating patterns and present using GIS.

The priority for providing respite is the population for which there are quantifiable adverse effects from noise. Consideration to be given to constraining analysis to defined levels of exposure such as the LOAEL or SOAEL used in Policy and planning.

Supplementary information can be added such 'newly overflown' populations. Currently it is not clear how best to consider time in objectively describing respite.

There appears to be merit in future consideration of an index (or set of indices) to objectively describe the amount of respite provided and then used to compare respite options.



# How is respite best reported and communicated?

The initial review work highlighted at the outset that a strong and effective communication strategy and good community engagement is essential for the successful implementation of respite.

People largely value respite if they know it is being provided so benefit of any future respite scheme is dependent on community engagement as well as the quantity and quality of respite provided.

Multi-stakeholder engagement is fundamental and more efforts in communication are needed.

Research demonstrates that increasing residents' awareness of 'managed respite' could have a positive impact on community relations.

Information should be fit for purpose; community information should be community centric, providing geographic information potentially by postcode.

Adopting meaningful and relevant metric and indices are vital to meet specific purposes - which may vary between community and industry needs. Language and a common narrative are all important.

Additionally, care should be taken with promoting respite as a positive mitigation strategy for those 'newly overflown'.



**Community Engagement**

**Awareness**

**Information**

**Honest**



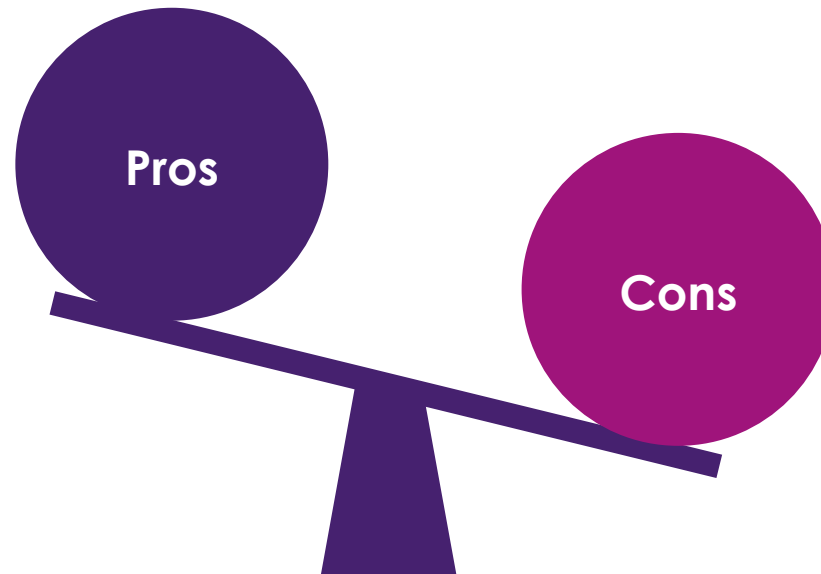
# How does the provision of respite relate to health and Quality of Life impacts?

Aircraft noise can impact health **negatively** in a number of ways including through sleep disturbance and annoyance.

The effect of respite on annoyance is not clear-cut, and indeed, in combination, non-acoustic factors can be more highly correlated with reported annoyance than acoustic factors.

It could be that if respite is not provided when it was expected then annoyance has the potential to increase.

## Assessing the positive and negative impacts of aviation



There is currently no clear indication that providing respite reduces annoyance although there is other evidence suggesting that people who are 'newly overflowed' are more annoyed for the same noise level than those who have been overflowed for some time.

There is currently insufficient information on the benefits of respite to health, quality of life, and on the **economic value** of the effects of respite, and more work is needed.



# What might be the general considerations for designing for respite?

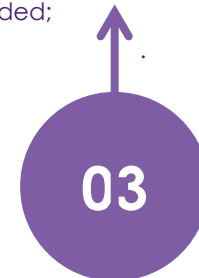
Starting point should be to maximise the separation of adjacent routes - the further apart the routes the better for providing respite - and that priority should be for aircraft up to 4,000ft.



Use CAA guidance for minimum lateral separation and cone angles for aircraft to be considered "overhead" and minimum separations with associated dB reductions.



For practical reasons it is suggested that initial analysis for assessing differences between routes for the purposes of providing respite should be based on event L<sub>max</sub> differences. Route combinations that do not fit the "noticeable difference" principles should be discarded;



*For aircraft up to 4,000ft, noticeable noise level differences could be achieved between aircraft on adjacent routes by ensuring that the cone formed by an elevation angle of a maximum 48.5 degrees under the centreline of each route should not overlap up to 4,000ft; and centrelines should be separated by at least 1,500m.*





# What might be the general considerations for designing for respite?

Separations between routes to be maximised as far as possible (within the safety, physical and operational constraints, considering broader noise policy and other environmental, emissions and sustainability factors) to achieve the highest L<sub>Amax</sub> differences possible between individual aircraft noise events on different routes (differences of average L<sub>Amax</sub> of say >9 dB to be considered 'of-value') .



Difference Scenario	Description
Between aircraft events in lab (Phase 1)  - Based on L <sub>Amax</sub> difference measures	Sound level differences between successive flyover events of at least 3 dB L <sub>Amax</sub> were necessary for the difference to be 'discriminable'.  In practical terms, the results suggest that 5 to 6 dB differences between L <sub>Amax</sub> of successive aircraft events might be required for more reliable discrimination between the first and second sounds of a pair of sounds differing only in sound level, under active listening conditions.  For a series of events, average differences in L <sub>Amax</sub> of around 7-8 dB were necessary for these differences to be considered of 'value'.

The real-life in-situ exposure differences in terms of the longer term average LAeq,T will depend on the fleet mix, number of events, aircraft operational procedures, heights etc. So once combinations of routes for "managed respite modes" have been determined, LAeq,T differences between 2 operational modes should be generated with anticipated use.



The differences should be analysed and results at this stage used to refine the airspace design to maximise average (LAeq,T) sound level differences between modes where possible .



Difference Scenario	Description
Between 2 periods of time (manage respite modes) (Phase 2)  - Based on L <sub>Aeq</sub> difference measures	After having been told about 'managed respite', and for areas with average aircraft noise levels above 57dB L <sub>Aeq,16h</sub> where respondents expressed benefit of respite, it was 'valued' where L <sub>Aeq,8hr</sub> difference was at least 9 dB between managed respite modes; and 'noticed' where differences were between 4 and 9 dB L <sub>Aeq,8hr</sub> .  Differences of 2-3 dB L <sub>Aeq,8hr</sub> whilst not being particularly noticeable were considered worth having by many.

# What next?

## A Roadmap for Respite Research

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### Develop with RWG

A clear research objective, strategy and outcomes

### Evolve

Through wider feedback via targeted presentation and discussion with other key stakeholders and researchers.

### Fund

The roadmap should also serve to seek funding and encourage others, both national and international, to join in the research programme

### Execute

Through a co-ordinated research programme

