EXPLORING THE CONCEPT OF FAIR AND EQUITABLE DISTRIBUTION TO MINIMISE SOCIAL UNACCEPTABILITY OF AIRSPACE DESIGN OPTIONS – FINAL REPORT

PREPARED FOR GATWICK AIRPORT LTD

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EXECUTIVE SUMMARY

Background

The UK is currently undertaking a process of airspace modernisation, which has revealed potentially competing objectives for the management of aircraft noise impacts. Communities at some airports are concerned about the fairness of potential outcomes in terms of changes to the pattern of aircraft noise exposure.

From a noise perspective, the UK Civil Aviation Authority (CAA) and airports[1] responsible for coming forward with airspace change proposals were charged with balancing economic and social benefits from a growing air transport system and any associated emissions outcomes with the potential adverse noise impacts on communities near airports. The UK CAA established a 7-stage procedure that airspace change sponsors must complete including specific requirements for stakeholder engagement and UK CAA approval at pre-determined gateway points in the decision-making process. Stage 1 efforts to engage with local communities in defining 'Design Principles' have been critically reviewed. Despite apparent clarity on these design principles (DPs) two key omissions looked set to reduce the value of this consultation stage on subsequent stages in the UK CAA process of airspace change development and implementation:

1. There was a general lack of ranking/prioritising design principles which, it was concluded, would likely make the process of trading-off between principles very challenging, particularly where DPs appear to be conflicting such as the preference for dispersing tracks, whilst attempting to minimise the number of people overflown.
2. There appeared to be very little discussion, let alone agreement, on how to capture performance against specific noise-related DPs using metrics that describe operations and their noise consequences (to allow the relative merits of different airspace change options to be illustrated and informed decisions made).

The research reported here seeks to address these two omissions by engaging directly with noise affected communities around one UK airport to better understand perceptions of the (un)fairness of different patterns of the lateral distribution of aircraft resulting from airspace change concepts.

The pre-cursor to this work was the FED1 study which undertook an extensive review of literature and policy documentation to highlight the importance of fair and equitable distribution to the ultimate community perception of the acceptability of future airspace changes. That work has provided a basis for this second part of the work reported here with the specific aim:

"To understand how airspace design options influence those features that impact perception of fairness and equity to inform more socially acceptable airspace modernisation".

1 Throughout this report it is assumed that sponsors of airspace are usually airports although it is understood that on occasion they may not be.

Specifically, this work sought to develop metrics to capture critical features of changes to the noise environment which appear to influence perceptions of (un)fairness and thus the risk of socially unacceptable outcomes from the airspace modernisation process.

Social Justice

In recent work linking concepts of social justice to aircraft noise exposure, it was found that perceptions of distributional fairness are influenced by the balance between the costs and the benefits of a change. However, the perception of the relative merits of costs and benefits will vary between individuals and thus it is essential to engage with groups of residents as to their interpretation of the fairness (or otherwise) of changes in the distribution of aircraft noise in order to inform the assessment of airspace change options and the ultimate decisions as to the outcomes. Our work set out to do just that by presenting groups of residents in a focus group setting with a virtual airport with which it was possible to explore perceptions of different airspace change concepts compared to a 'baseline' position representative of the current conventional distribution of aircraft around a route centreline. The social justice research also presented the important concepts of procedural, informational and interpersonal fairness which play a key role in overall perceptions of fairness.

Methodology

Following a series of stakeholder and community focus groups (FGs), test material was developed to use in a total of 13 community focus groups, drawn from areas with differing experiences of aircraft noise around a UK airport. Residents were presented with airspace change concepts related to a single westerly departure route turning to the north and splitting to the east. This 'baseline' situation was taken as representative of aircraft operations pre airspace change modernisation. Once the baseline had been described, 4 different aircraft distribution concepts were presented to the FGs where the fairness and equity was discussed. These 4 fictitious departure routes were: (1) Replication of the conventional route, (2) Limited dispersal of movements within the NPR, (3) Wider dispersal within the NPR with noise consequences beyond, and (4) Extensive sharing via a new route.

To assist comprehension of the nature of change associated with each aircraft distribution concept, focus group participants were presented with graphical representation of the spatial distribution of aircraft movements along with an image of their geographical distribution (traffic for one day on an existing route of a UK airport was used for this purpose and manipulated to reflect the different patterns of spatial distribution). This was supplemented by images of the N65 contours for each concept and subsequent change in N65 events compared to the baseline.

Outcomes

The illustrations using the virtual airport concepts stimulated open and considered discussion among focus group participants, whereby removing reference to specific locations reduced NIMBY bias and enabled discussions to reflect on the overall fairness of different patterns of increases and decreases in aircraft noise

event outcomes. Participants were willing and able to express preferences and it became possible to relate these changes in the spatial distribution of increases and decreases in N65 events to perceptions of fairness. Although each focus group was composed of participants drawn from areas experiencing different levels of exposure to aircraft noise around a UK airport (including some with no overflights and relatively little/no aircraft noise exposure), there was general consensus as to the opinions expressed regarding the range of concepts presented for aircraft movement distribution.

Concentration of aircraft movements along existing route centrelines was considered unreasonable as those already most exposed to aircraft noise would experience an increase in their noise burden.

- Some limited sharing of the burden of aircraft noise events could help overcome adverse perceptions of concentration.
- Focusing the spreading among populations currently experiencing some noise exposure could allay concerns over the extent of change against expectation.
- The greater the extent of change (in the number and proportion of louder events), the more concerns were raised about impact/unacceptability. Thus, where dispersal options extend over wider areas (concepts 3 and 4) increasing concerns were raised about (for example):
    - Change against the expectations of residents.
    - Conflict with existing land uses/designations (e.g. contrast with features of AONBs (areas of outstanding natural beauty).
    - Likelihood of overflying populations with no or only limited experience of aircraft noise.

The influence of perceptions of distributional fairness and how other non-acoustic factors may increase or decrease the risk of socially unacceptable outcomes is summarised in 'a risk of unacceptability spectrum'.

Significantly, whilst the original intention of the focus groups was to use the virtual airport and associated airspace change concepts to explore perceptions of fairness and equity, responses to the airspace concepts focused on the issue of the fairness/unfairness of outcomes compared to the baseline almost exclusively. This appeared to be motivated by concerns over the extent of change compared to an existing unequal distribution of noise events represented by the baseline, rather than by a desire to establish more equitable distribution of movements across surrounding populations which, given the unequal distribution in the baseline, would have entailed significant change for most communities. Thus, perceptions of distributional fairness in the case of change to a pre-existing distribution of noise events was dominated by the extent of change and not the establishment of more even (equal) distribution of noise events.

In summary, the discussions revealed a preference for minimal change compared to the existing patterns of noise exposure, where the use of a number above metric (N65) was particularly helpful in allowing participants to understand the implications of different airspace change options on the spatial distribution of noise on the ground. Such transparency around the consequences of airspace change proposals enhances informational

fairness and can help build trust in the procedural fairness of airspace decision-making leading to more socially acceptable outcomes (or the least socially unacceptable outcomes).

Framework Development

The focus group outcomes demonstrated that, at least in the context of airspace change, where there is an existing distribution of aircraft, change in the spatial distribution of aircraft noise (events) lies at the heart of perceptions of fairness. The work then sought to explain how insights into the distributional consequences of airspace change may be accomplished by using N65 and associated Person Event Index (PEI) metrics to describe the spatial patterns of aircraft noise before and after a proposed change. The supporting assessment should enhance perceptions of informational and procedural fairness.

Given the importance attached to the extent of change, a stepwise approach was developed to enhance community understanding of the implications of airspace changes, thereby empowering engagement in decisions that will ultimately affect residents. This approach follows a logical path from:
STEP 1: Spatial and narrative presentation of options
STEP 2: Spatial presentation of N65 and N65 change heat maps.
STEP 3: Categorising the spectrum of N65 exposure into meaningful bands and defining thresholds of change by reference to these bands.
STEP 4: Spatial presentation of N65 change categories.
STEP 5: Relating N65 changes to population distribution.
STEP 6: Quantifying populations exposed to different categories of N65 change.
STEP 7: Determining the noise burden from an airspace change by calculating PEI outcomes and differences.
STEP 8: Aligning Quantitative Features of N65 and PEI with the Hierarchy of Relative Risk
STEP 9: Analyse the aggregate changes for each proposal.
STEP 10: Consider the relative risk of social unacceptability of each proposal by considering the relative performance of options against defined N65 change categories for population and PEI.

This work demonstrates how insights as to the impact on the total noise load, its distribution and the extent of change can be gained from populations in N65 change categories and by introducing the concept of 'Person Events' (STEP 7). The population and PEI features help explain the aggregate, distributional consequences of changes from design proposals for local people. These features of the changes to the noise environment could therefore also be used to highlight the extent and consequence of concentration or sharing regimes – providing the basis for transparent and comprehensive engagement with populations potentially affected by Airspace Change Proposals (ACPs).

Critically, it is not proposed that the relative performance of options be used to categorically include or exclude options, rather that the relative risk (of social unacceptability) is used to support the sponsors shortlisting of

options, consider mechanisms to mitigate risk and crucially as a means of presenting the potential outcomes of options to communities to allow a transparent discussion of the relative merits of each option to inform ultimate decision-making.

Conclusions and Recommendations

It is clearly a sensible intent to reduce the overall health consequences of aircraft operations for local people and so the "concentrate and avoid" approach is understandable. However, this approach lacks consideration of the changes in distribution of noise, the consequences of concentration for the smaller number of people (and possibly new people), the implications for change against expectation of land-use and the perception of the changes by the broader population. These conventional assessments simply result in the best outcome being the one with the least overall impact of the options available. This approach has generally resulted in significant adverse reaction from local communities

The work represented in this report aims to contribute to understanding how the dimensions of fairness can be considered. This includes enhancing community engagement through developing a better understanding of the issues of greatest concern to residents. Which is, in turn, used to propose an assessment and engagement framework using supplementary metrics to increase public understanding of the consequences of airspace options such that the processes leading to decisions on specific airspace change options are transparent and allow community input to the final outcomes.

The approach will allow the incorporation of distributional fairness considerations and thereby provide for more comprehensive assessment and discussion of ACPs with local communities. However, we present one example of the use of this supplementary assessment framework, and it is acknowledged there may be a need to refine/tailor the approach to the local circumstances at individual airports relating to preference for minimal change, use of N65 metric, and N65 bands and change categories.

Given the strong link between the extent of change in the noise environment for communities resulting from an airspace change concept and perceptions of the (un)fairness of the outcome, the work set out to develop a suite of metrics to highlight the extent of change (in N65 events) by way of facilitating more transparent dialogue with communities and thereby empowering them to influence ultimate airspace change decisions.

If the preference for a particular outcome is known, at our case study airport community focus groups consistently favoured minimal change, then the risk of socially unacceptable outcomes can be linked to specific patterns of changes to N65 distribution and PEI consequences. The risk factors linked to changes in the distribution of noise events can then be used to assess the relative risk of socially unacceptable outcomes arising from airspace change proposals which, as in the case in the UK CAP1616 process, have been solely assessed for their aggregate noise consequences. We argue that such an assessment can be used to refine proposals and

also in their transparent presentation to communities, enabling more effective dialogue intended to promote community influence over final airspace change decisions. The novel use of Q methodology in this study helped to reveal the influence of attitudes, including understanding potential groupings of common attitudes and preferences on the perception of fairness. In future, including a Q Study as a precursor to the Focus Groups may help frame the development of appropriate materials for exploring the range of local attitudes and preferences in the focus groups.

Our study has shown that the risk of socially unacceptable outcomes from airspace processes is linked to perceptions of the extent of change to the noise environment and its distribution; however, how risk is linked to the direction of change in objective noise measures is intimately bound up with community preferences for a type of change – it may be in other circumstances, at other airports, that communities see benefit in concentrating noise away from centres of population. Nevertheless, the suite of assessment tools proposed here is still relevant, simply their relationship to the risk of socially unacceptable outcomes changes. Thus, whilst the assessment framework may be universally applicable, the link to perceptions of fairness and thus the (un)acceptability of outcomes needs to be explored with communities at every airport location. Similar comments can be made about the need to tailor the N-above threshold and associated banding of N65 change and changes between categories, to local circumstances.

The work has developed a mechanism for the transparent assessment and communication of changes in the distribution of aircraft noise arising from airspace changes, which can be linked to the relative risk of perceived unfairness of outcomes and their social acceptability. A degree of openness and honesty in communicating the strengths and weaknesses of each option should enhance perceptions of these dimensions of fairness

It is therefore recommended that, where possible, airports:

- Implement this framework to complement the existing approach (it is recognised that the extent to which it is applied will need to consider existing and proposed airport size and impacts).
- Undertake exploratory precursor engagement with communities and stakeholders to explore different forms of noise (re)distribution in order to understand the drivers of risk to social (un)acceptability of airspace change concepts and community objectives from this process. Our experience suggests that this may be best achieved through a limited number of focus groups, using a virtual/concept airport environment so as to be neutral to the local area.
- Apply the assessment described within this report to airspace change proposals to support their relative evaluation, refinement and shortlisting. Use the outputs to mitigate risks of socially unacceptable outcomes and refine options according to distributional fairness principles established in the first consultation, in the context of policy consistency.
- Design and develop transparent communication tools, drawing on the outputs from the assessment of changes in noise distribution, to enhance the quality of community engagement over selected airspace change options.

- In consultation, present communities with a range of viable options (even if one is presented as preferred) and with this transparent information on noise distribution consequences, enabling individuals to make informed decisions about their own preferences.
- Input of community preferences to the selection of the final airspace change, thereby demonstrating meaningful engagement and consideration of community preferences in final decisions/outcomes, helping to build trust in decision-making.

Whilst there is a challenge to be recognised within the context of policy assessment, this study and its findings are not intended as a "challenge to policy" and nor do we consider there to be implications for existing policy. This study has found that minimal change in the distribution of aircraft noise reduces the risk of social unacceptability (at least in the context of populations local to Gatwick). The findings and proposed framework are not intended to be a decision-making tool, more that it supports existing processes by providing greater understanding of the potential consequences on the social acceptability of changes to distribution of aircraft arising from airspace modernisation, and should improve transparency and openness in the engagement processes. All of which ultimately should deliver less socially unacceptable outcomes. It should also not be considered as a framework that will deliver a universally accepted solution.

Next steps

The following is recommended as urgent follow up work:

1. Supporting airports in their CAP 1616 journey as detailed above. This includes:
    - Consider whether it is appropriate to update guidance to sponsors of airspace change for them to consider the social acceptability of their proposals in addition to appraisals of costs, benefits and impacts currently required by CAP1616.
    - Testing the approach for specific Gatwick FASI proposals and refine if appropriate.
    - Encouraging the adoption of this approach at other airports.

2. Dissemination of and feedback from the findings through;

    - Preparation of a layperson summary and slidedeck.
    - Presentation at relevant committees, groups, and conferences – UK and internationally.
    - Academic publications.

3. Further ground-breaking research through:

    - Publishing Q approach and findings separately.
    - Exploring the use of Q analysis to frame community engagement and overarching objectives.
    - Development of GIS led tool for PEI information.

ACKNOWLEDGEMENTS

We thank Gatwick Airport Ltd which sponsored the work described in this report. We gratefully acknowledge the financial support from the UK CAA Airspace Change Support Fund for this work. We would like to acknowledge the contribution of knowledge from the Expert Review Group, attendees of the Stakeholder Review Groups and all the Focus Groups, and all those who have contributed their time and expert opinions. Although this report consolidates all the work and findings, the conclusions and recommendations are the responsibility of the authors.

ERG STATEMENT

The members of the ERG were asked to comment on version 1 of the final report. The key feedback is summarised below.

"The value of this study is that it has identified the preferences residents have when PBN flight paths are introduced, including the sort of respite they regard as fair. The findings have relevance to all airports. It should be of particular value to the CAA and the Department for Transport as they take forward their plans for Performance Based Navigation."

“The report is well structured. The executive summary, the introduction and review of existing topic-related scientific work helps getting into the topic. The key outcomes of the focus groups, workshops and the Q methodology are described in a clear and understandable way. The separation of the detailed description of the empirical work from the main report by moving the description to the annex is very helpful for following the main messaged in the report in particular for those readers less familiar with social and behavioural science. The advantage of the used noise metric N65 used instead of average sound levels for the communication in the focus groups are clearly described (as well as the disadvantages). Using a mainly qualitative approach with a quantitative supplement as part of the Q methodology for the assessments of perceived fairness and social acceptability of aircraft operations is reasonable given that it is a new, understudied topic in aviation. “

“The authors clearly mention the limitations of the study, both regarding the used noise metric (N65) and the empirical methods and the outcomes, among them that the results about perceived fairness of aircraft operations obtained at Gatwick Airport are not necessarily the same as at other airports. Thus, the recommendations given for other airports to implement a similar community engagement project, first, because this is mentioned by participants of the empirical studies as being needed and, second, to overcome the potential limitations in generalizability, is reasonable and supported by the author of this review statement. “

“It should be considered that the generalizability of the results for the region around Gatwick Airport might be is restricted. The focus group results and the viewpoints or discourses identified in the Q method study helps to understand what perspectives and views about fair aircraft operations and changes in aircraft operations exist in the Gatwick Airport region. To what extent which view exists in the region, how many residents follow which view and whether there are differences in views and perspectives in different areas within the airport region is not clear from the empirical work used in this project. If one is interested in that a quantitative survey could be conducted at Gatwick Airport following FED2 in order to verify and quantify the perspectives and views identified in FED2. It is accepted that conducting representative quantitative surveys nowadays is challenging given the permanent decrease in compliance to survey participation to be observed in Europe and in the US for several years. “

CONTENTS

1 INTRODUCTION

Airspace is currently being modernised. The Government published its Airspace Modernisation Strategy (AMS) in 2018 which sets out the national programme to modernise and upgrade the UK's airspace. The initiative, in which Gatwick is playing a significant role and which will change the architecture of the airspace design across the South East of England, is the Future Airspace Strategy Implementation - South or FASI-S. As part of airspace modernisation, the airport is legally required to introduce the latest navigation technology as stated in the European Commission Implementing Regulation (EU) No 2018/1048 on the Performance Based Navigation (PBN).

When considering the concerns raised by noise groups affected by aircraft, a number of campaign groups around Gatwick have highlighted a policy of "fair and equitable dispersal (FED)" of traffic as a priority, rather than a concentration of aircraft over certain areas. While this high-level FED objective has been sought by communities participating in Gatwick's Noise Management Board since 2016, no adequate description of how to design and deliver a FED environment exists in government policy or legislation.

There is at present no policy framework, description or guidance upon which to base design considerations consistent with a FED aim. Instead, Government policy[2] takes a wider view stating that "...the impact of aviation noise must be mitigated as much as is practicable and realistic to do so..." and that tackling localised impacts of aviation is central to a sustainable future for the sector[3]. Given the policy focus on local impacts, the existing airspace design process places significant emphasis on consultation to develop the principles on which designs are based and assessed. The current airspace design process has established a set of design principles within which FED will need to be considered.

Against this background, Gatwick Airport's Noise Management Board (GNMB) identified a need to conduct an independent assessment of fair and equitable dispersal (FED) concepts. Gatwick Airport Ltd (GAL) commenced a work programme to understand how the concept of "Fair and Equitable Distribution" (FED) of aircraft noise could be developed within the current airspace design process.

The work programme started with FED1 which undertook an extensive review of literature and policy documentation to highlight the importance of fair and equitable distribution to the ultimate community perception of the acceptability of future airspace changes. FED1 concluded with a series of recommendations highlighting the vital importance of stakeholder engagement in negotiating the practical application of these

2 DfT (2023). Overarching aviation noise policy: policy paper. Available@ https://www.gov.uk/government/publications/aviation-noise-policy-statement/overarching-aviation-noise-policy
3 DfT(2022). Flightpath to the future: a strategic framework for the aviation sector. Available @ https://www.gov.uk/government/publications/flightpath-to-the-future-a-strategic-framework-for-the-aviation-sector

concepts and understanding how specific airspace change proposals might best address them. This work has provided a basis for this second part of the work reported here.

The aim of this second part of the work is;

> *"To understand how airspace design options influence those features that impact perception of fairness and equity to inform more socially acceptable airspace modernisation",*

by conducting an in-depth qualitative assessment, working directly with aviation and community stakeholders, to define the performance features and their metrics that influence perception of these concepts.

This is the final report, providing details of the work, findings, and recommendations moving forward. The next section, Section 2, sets out the methodology, signposting where to find fuller details within this report. Section 3 puts the research work in the context of the previous work, FED1, and is a high-level review of that earlier work phase. It also reports on some more recent work on this topic. Section 4 describes the key work outcomes, signposting to the Annexes which provide fuller details of each work stage. Section 5 brings together the findings by looking towards a framework, to introduce FED considerations into the assessment, selection and engagement over ACPs. The main conclusions are presented in Section 6 with recommendations for follow on work to further test and operationalise the proposed approach.

2 METHODOLOGY

The first part of this work was to set this project within the context of the previous FED1 work and to consider the relevance of a supplementary EU project on fairness and equity from the social justice perspective. These are summarised in Section 3.

From that grounding, the project was then conducted in a number of component steps as shown in Figure 2.1. There was also an additional component which ran concurrently and was focussed around developing further understanding using a Q-methodology technique. A short overview of each step is given next, with more details provided in the Annexes.

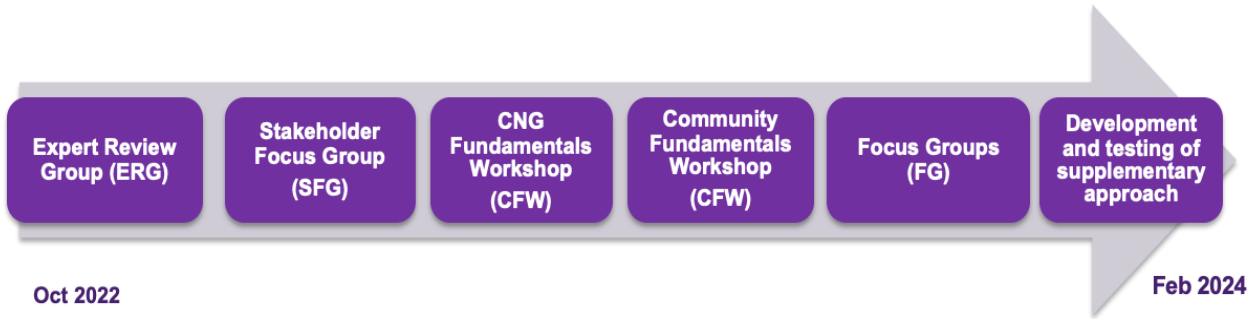


Figure 2.1: Key Work Steps

Expert Review Group (ERG)

From the outset, it was the intention for work to be reviewed by an independent panel of experts, made up of 4 members covering a range of experience and specialisms. The ERG was set up in October 2022 with its role agreed as to review the planned work tasks, periodically review progress and outcomes, whilst recommending additional considerations, and reviewing the project report (see Annex 1). The ERG statement of this work is provided at the beginning of this report.

Stakeholder Focus Group (SFG)

Two SFGs were held to help to frame the research. The purpose of each was to gain feedback from different key stakeholders on the features, concepts and barriers to effectively mitigating social unacceptability of aircraft noise. The key areas of focus were around designing realistic and workable concepts for testing in the subsequent focus groups, understanding potential barriers (and potential options to overcome these) to implementing effective strategies for mitigating social unacceptability of aircraft noise, and to understand how best to gain effective 'buy-in' from key stakeholders for the research journey. Two groups were held in December 2022, (see Annex 2).

Community Noise Group (CNG) and Community Fundamentals Workshops (CFW)

As part of the early work, community fundamentals workshops took place to explore core perceptions and attitudes towards existing and potential concepts for future managed airspace operations, and to inform the development of focus group materials intended to identify attributes of social unacceptability, fairness, and equity. The intention was to better understand the lived experience of residents and how that influences their quality of life, attitude to the airport and perception of the acceptability (or otherwise) of airport operations and explore possible future flight distribution concepts that could result from airspace modernisation to better appreciate those features that make for more, or less, acceptable outcomes from participants' perspectives. The findings were used to refine the design of realistic and workable concepts for testing in the focus groups. Four workshops were held at the Gatwick Hilton Hotel in February and March 2023. The first workshop participants were from local Community Noise Groups. The remaining three workshops were attended by mixed groups of participants drawn from varied locations, using an independent recruiter. (See Annex 3).

Focus Groups (FG)

The central element of the empirical research work was the use of Focus Groups. This part of the work was to build further understanding of key features driving perceptions of social unacceptability, fairness and equity of distribution of aircraft operations through better understanding of the lived experience of residents and how that influences their quality of life, attitude to the airport and perception of the acceptability (or otherwise) of airport operations. Additionally, this element of the work sought to explore possible future flight distribution concepts that could result from airspace modernisation to better appreciate those features that make for more, or less, acceptable outcomes from participants' perspectives. It also explored key metrics to reflect these features. It was used to Inform on steps for mitigating social unacceptability and to set out the context of how outputs might be used in airspace change process. Thirteen workshops were held at local venues from 20th June to 11th July 2023. The independent recruitment company recruited mixed attendees from the specified areas, booked the local venues, and arranged payments. (See Annex 4).

Q Methodology (Q)

Q methodology is the scientific and systematic study of subjectivity (attitudes, feelings, perspectives, thoughts, opinions, values) towards a topic, issue or question. It reveals different viewpoints around a subject and was used to develop supplementary insights into the ways in which participants looked at aircraft noise and fairness, and airspace modernisation and noise. This work was carried out with people who had attended focus groups, after that element of the empirical work was completed. (See Annex 5).

Development of Approach to Assess Relative Risk of Social (un)acceptability

The final stages of the work were split into two parts;

(1) the analysis and considerations of key findings (see Section 4), leading to

(2) the development of an approach to assess the relative risk of social (un)acceptability (see Section 5).

For this work, it was recognised that the use of event-based metrics could contribute positively to the quality and transparency of CAP1616 driven public engagement by enhancing informational, and by extrapolation, procedural, fairness[4]; thereby supporting more socially acceptable outcomes. We introduced metrics to describe consequences of distributional changes of airspace designs. Our general approach using these metrics was brought into a worked example and tested with the ERG, SRG and a few members of the AMS Support Fund group. Refinements were made.

4 Please see section 3 for more details on different types of fairness.

3 REVIEW OF RECENT KEY WORK

3.1 Introduction

This section aims to set this project within the context of the previous FED1 work and provides a high-level summary of that work. Since the FED1 report publication, there has also been additional, ongoing relevant work from the perspective of social justice research, and this is also summarised in this section.

3.2 Previous FED1 project

The FED1 report[5] explains the history and need for work on Fair and Equitable Dispersion (FED). FED was introduced in 2015 as an aspirational objective among others, by communities affected by noise from aircraft using London's Gatwick Airport. The NMB considered how FED could be achieved but was unable to identify a clear definition that would enable airspace managers and aircraft operators to design solutions to meet this aspirational objective of FED. The FED1 study, commissioned by Gatwick Airport Limited, on behalf of the NMB, was tasked with studying this challenge, which had become all the more significant as a result of the UK's Airspace Modernisation Strategy (AMS). The FED1 study was commissioned to help inform the development of Gatwick's FASI-S airspace change proposals.

The FED1 work and report covered the following objectives:

- To describe current regulations, policy and guidance for the mitigation of aircraft noise in relation to airspace design.
- To take into account expected policy and regulation developments and note any gaps observed in the policy, regulatory and process frameworks relevant to airspace design and change.
- To identify available and expected future technical and procedural options for the fair and equitable distribution of arriving and departing aircraft.
- To identify a comprehensive suite of suitable metrics to measure and report distribution of traffic and total noise exposure/impacts in any affected area. This covered acoustic metrics, health effects and Non-Acoustic Factors.
- To develop potential methodologies, suitable for use in the CAP1616 process, for evaluating the effectiveness of each of the identified traffic distribution options to deliver fair and equitable distribution of aircraft.
- To engage through workshop(s) with all NMB stakeholders on the points above.

This work provided a number of definitions (on page 33 of the FED1 report), taken from the Cambridge dictionary, which are reproduced below:

5 Study on fair and equitable distribution of aircraft at Gatwick, Martinez et al, Report from University of Salford, Manchester, March 4th 2022

- **Fair**: Treating someone in a way that is right or reasonable, or treating a group of people equally… Free from favouritism or self-interest or bias or deception; conforming with established standards or rules
- **Fairness:** The quality of treating people equally or in a way that is right or reasonable
- **Equitable**: Treating everyone fairly and in the same way. Fair to all parties as dictated by reason and conscience.
- **Dispersal**: The action of spreading across or moving away over a large area, or of making people or things do this.

The report included the following sections; Policy Regulations, Technology and Procedures, Metrics for Aviation Noise, Evidence Review of Effects of Aircraft Noise on Health, Role of Non-Acoustic Factors and FED Recommendations, and Conclusions and Further Work Proposed. For the full details, please refer to the FED1 report.

The FED1 work made a number of suggestions and assertions which have been largely built on in the FED2 work:

- It called for a dialogue to be opened with the CAA to discuss how WebTAG+ and/or a health dashboard and NAFs analyses could additionally be considered in their decision making.

- The work summarised a number of airspace design concepts with the potential to offer noise mitigation that are drawn from UK CAA Guidance CAP1378[6]. It also summarised the findings of CAP1378 regarding the minimum lateral distance between routes to ensure meaningful changes in aircraft noise exposure on the ground.

- It suggested that, although time averaged metrics, such as $L_{Aeq,T}$ are widely studied, relatively simple to understand and are somewhat correlated to annoyance, other metrics such as NA, LAmax and Intermittency Ratio can provide more accurate information about the number of overflights effectively contributing to the total aircraft noise exposure. It added that other acoustic and psychoacoustic metrics able to better account for short-term noise exposure and impacts with respite, relief or dispersal schemes need further investigation.

- It indicated that there is a reliance on steady-state relationships in noise and health impact assessments and lack of studies of airspace change, change in exposure and respite. There is a lack of studies of event-related metrics, such as N-above or other metrics such as the intermittency ratio and overflights. There are limitations in the ability to quantify the effects of a change in aircraft noise on health;

6 Airspace Design Guidance: Noise mitigation considerations when designing PBN departure and arrival procedures, CAP1378, UK CAA, 2016. https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=7289

- It recommended further work to understand the capabilities of available acoustic and psychoacoustic metrics, and to assess whether they are better able to account for short-term noise exposure and impacts with respite, relief or dispersal schemes, than $L_{Aeq,16h}$. For example, complementary metrics or 'optimal dispersal' of traffic where the harmful impacts of aircraft noise are reduced, while reducing the total number of people exposed to significant aircraft noise.

- By reviewing a comprehensive suite of suitable metrics, a framework based on the most appropriate metrics can be established for the assessment of aviation noise impacts on communities.

- There exists uncertainty in the use of WebTAG (now re-named TAG – Environmental Impact Appraisal [7]) at small geographical scales and in terms of how health impacts influence the CAA's decision making in the airspace change process. It proposed that health outcomes can contribute to the evaluation of FED, in addition to the CAP1616 requirement to use WebTAG for airspace redesign.

- The identification by ICAO of the importance of Non-Acoustic Factors (NAFs), in relation to community aircraft noise annoyance, to be considered in aviation policy and the proposal that assessment of NAFs can contribute to the evaluation of FED.

- Recommendation of the integration of specific NAFs into the CAP1616 process. The Civil Aviation Authority (CAA) reviewed research on NAFs in CAP1588 (CAA, 2018) and recommended that: "questions on trust in authorities and perceived fairness in air traffic related decisions should be included in future surveys [of communities], given the importance of these aspects to the annoyance response".

- Recommendation to carrying out an in-depth investigation of the human response to noise exposure for newly overflown.

- Recommendation for a stakeholder consultation to assess the NAFs and soundscape requirements/ preferences of those affected by Gatwick Airport operations and the airspace change process (ACP).

- Reduce the adverse impacts from noise and increase the beneficial impacts of good quality sound environments (experienced in relation to the airport and ACP process) be agreed with stakeholders.

The FED1 work recommended a conceptual framework, taking account of acoustic, psychoacoustic, non-acoustic and health factors to: (i) aid the development of a FED consultation (or co-creation) process with the wider

7 https://assets.publishing.service.gov.uk/media/66434490ae748c43d3793a87/tag-unit-a3-environmental-impact-appraisal.pdf

communities around Gatwick Airport; and (ii) the development of an agreed definition of FED. This is reproduced in Figure 3.1[8].

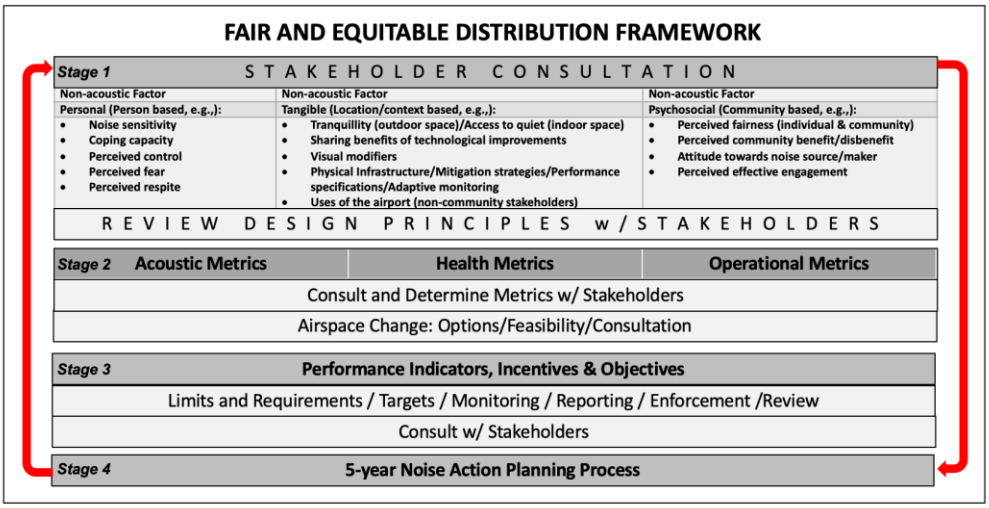


Figure 3.1: FED1 Conceptual Framework Model

The process was described as:

- *"Stage 1 of the framework sets out the three dimensions of NAFs: Personal, Tangible and Psychosocial and proposes a stakeholder consultation to determine the relevant NAFs for agreeing a definition of FED. The guidelines for how to conduct an assessment of the NAFs are set out in the ISO soundscape standard series (ISO, 2014; 2018; 2019 and footnote 49).*
- *During Stage 2, based on the NAFs derived from the Stage 1 data collection and analysis, the selection of acoustic (including psychoacoustic and technology) options, health, and operational metrics are consulted and determined with stakeholders based on the ability of the metrics to fit the design principles reviewed in Stage 1.*
- *Stage 3 consists of agreeing the Performance Indicators, Incentives and Objectives for the agreed suite of parameters and how these will be monitored, reported, enforced and reviewed. Once again, it is crucial that this stage is reviewed in consultation/co-creation with stakeholders.*
- *Stage 4 links the agreed suite of metrics (Stage 2) and parameters (Stage 3) with the airport's Noise Action Planning process agreed in consultation/co-creation with stakeholders. "*

Key to this approach is to consider, in consultation with stakeholders, what the key features are for delivering fair and equitable distributions. This requires working towards defining FED (from developing some 'design principles'). It also requires bringing together objective acoustic metrics, with health and operational metrics, and how these relate to these key features for airspace option analysis and comparisons. It then requires a number of parameters against which to evaluate performance (in consultation with stakeholders) and criteria for success. The final stage is to incorporate the agreed metrics and performance parameters into the noise management plan, again in consultation with stakeholders.

8 taken from FED1 report Figure 7-1. Conceptual framework of the general stages required for operationalising the development of an agreed definition of Fair and Equitable Distribution, adapted from (Fenech et al. 2021; Lavia et al. 2021; Riedel et al., 2021)). ©Lavia, Clark and Torija.)

The FED1 recommendations included the need for a stakeholder consultation to assess the NAFs and soundscape requirements/preferences of those affected by Gatwick Airport operations and the airspace change process (ACP). It recommended that the outcomes of this be used to review the ACP design principles with stakeholders and inform the development of an agreed definition of FED. The FED1 study then recommended that the outcome be used to develop a methodological framework, to operationalise FED. Finally, as a next step, the FED1 work recommended that a detailed method for implementing the conceptual framework be developed. It was proposed that the resulting operational method would be based on real-world aviation scenarios and supported by the technical feasibility of any recommendations.

Conclusions

The FED 1 work provided an excellent foundation for this new work. It included a comprehensive review of policy, metrics, health effects, non-acoustic factors, and operational options. It highlighted gaps in knowledge, provided a conceptual framework to aid the development of a FED consultation (or co-creation) process with the wider communities around Gatwick Airport. It also made recommendations for the way ahead.

Building on the FED1 work and its recommendations, this FED2 work has included a major focus on feedback from all stakeholders, with emphasis on community. This work includes in-depth qualitative assessments to define the
performance features and their metrics that influence perception of the concepts. It looks towards the need to better communicate and understand how airspace design options influence those features. It also explores the options for adopting the most appropriate and understandable metrics for effective consultation, including complementary/supplementary metrics. The work also explores how to show the impacts on newly overflown populations., The work builds on the ideas behind the FED1 conceptual framework to develop a best practice methodological framework for minimising social unacceptability.

3.3 EU Funded Social Justice Research Work - Germany

Concurrent with the FED1 work was an EU funded project ANIMA[9] that sought to develop new methodologies, approaches and tools to manage and mitigate the impact of aviation noise on human health and inform more sophisticated and effective noise management strategies. This work addressed issues relating to the nature of the human response to noise, the role of non-acoustic factors in modifying that response and the importance of decision-making processes in determining the acceptability of noise management outcomes. Specifically, it called for aviation authorities to appreciate that 'community engagement has to be understood as a possibility for residents to not only have a voice, but above all, to take part in the decision-making process. Their voice has

9 https://anima-project.eu/

to count rather than be only consultative'[10]. Such engagement, therefore, has to be meaningful (relevant to issues valued by communities) and impactful (able to have genuine influence over outcomes) and examples of this were investigated, assessed, and delivered as part of the wide-reaching research project.

One example is the work published by Hauptvogel et al in July 2021 which looked at aircraft noise distribution as a fairness dilemma[11]. It offered an additional perspective on the topic of Fairness, Equity and Social Unacceptability of aircraft noise. The paper analysed the fairness dilemma of aircraft noise distribution from the perspective of social justice research, identified ways of dealing with unfair distribution of noise and provided recommendations on how to implement fairness considerations in concrete interventions to reduce annoyance from aircraft noise. The key concepts and recommendations from that paper are summarised below, together with some comments in relation to planning for our FED2 work.

What is Social Injustice and Social Exchange?

The paper explained that evaluation of a sound as noise is highly subjective and depends on a variety of non-acoustic factors, such as attitudes, expectations, and situational and personal factors. Psychological models of noise reactions suggest that the stress reaction, here the degree of annoyance, also depends on the possibility to cope with and control the stressor. Underlying these non-acoustic factors is social (in)justice or (un)fairness (the two terms were used interchangeably throughout the manuscript). This construct has been extensively examined in the organisational and justice context with regard to the acceptance of outcomes of social exchange. In fact, social (in)justice is seen as equivalent to (un)fairness.

Social injustice was described in the paper as when actions are taken that infringe upon a group's rights, marginalise their opportunities, or treat them unfairly. It occurs when an individual or group treats another individual or group within a society unfairly, resulting in disadvantages to that individual or group. Social exchange theory proposes that social behaviour is the result of an exchange process. The purpose of this exchange is to maximize benefits and minimize costs. Most relationships are made up of a certain amount of give-and-take, but this does not mean that they are always equal. Social exchange suggests that it is the valuing of the benefits and costs of each relationship that determine whether or not we choose to continue a social association. Social exchange theory suggests that we essentially take the benefits of a relationship and subtract the costs in order to determine how much it is worth.

How can aircraft noise exposure be related to social (in)justice and social exchange concepts?

10 Heyes, G., Hauptvogel, D., Benz, S. Schreckenberg, D., Hooper, P.D. and Aalmoes, R. (2022) 'Engaging communities in the hard quest for consensus', in Leylekian, L., Covrig, A. and Maximova, A. (Eds) Aviation Noise Impact Management, Springer. https://doi.org/10.1007/978-3-030-91194-2_9

11 Aircraft Noise Distribution as a Fairness Dilemma—A Review of Aircraft Noise through the Lens of Social Justice Research, Dominik Hauptvogel, Susanne Bartels, Dirk Schreckenberg and Tobias Rothmund. Int. J. Environ. Res. Public Health 2021, 18, 7399. https://doi.org/10.3390/ijerph18147399. This research was kindly supported by a grant of the Seventh Framework Programme of the European Commission) within the scope of the project COSMA and by a grant of the programme Horizon 2020 of the European Commission within the scope of the project ANIMA.

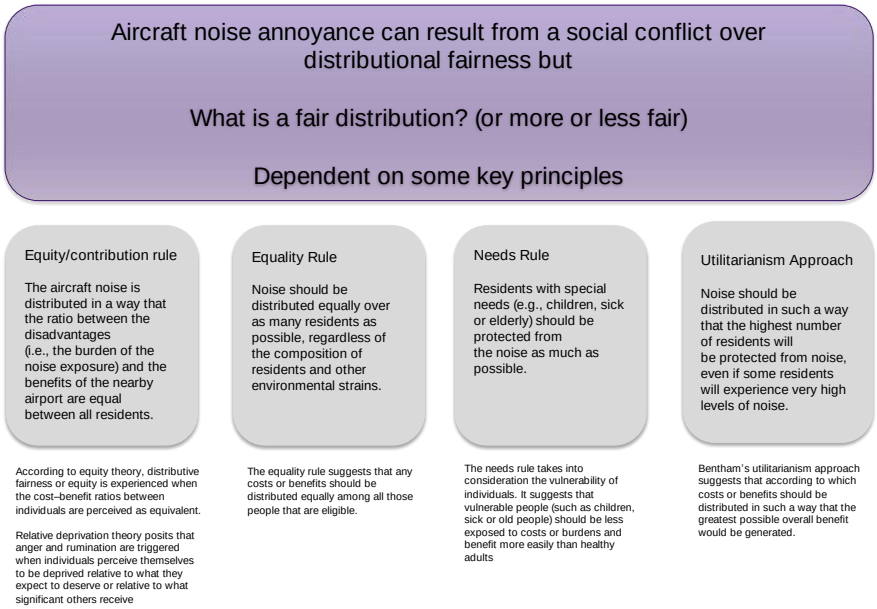
The paper explained that the noise from aircraft can, therefore, be seen as a constant reminder of unfair treatment. The uneven spread of noise in proximity to an airport area can be seen as a fairness dilemma: the noise has to be shouldered by one group, and the potential advantages of the airport are shared by others. Therefore, the ratio between the benefits and drawbacks of the nearby airport varies considerably between residents. Importantly, residents perceive having little control over the decision of how the burden of noise is distributed. The fairness dilemma of aircraft noise exposure can be viewed using the psychological perspective of social justice research.

What are the types of Fairness?

Hauptvogel et al's social justice research distinguished between three different forms of fairness: distributional, procedural, and informational/interactional.

What is distributional fairness?

Using the paper, the concepts are summarised as:



It was stated that individuals differ in their fairness evaluations not only because they rely on different fairness principles but also because they differ in their general sensitivity to perceiving and experiencing unfairness. Unfortunately, no answer can be given at present to the question of which of the principles of distribution of aircraft noise presented should be implemented to achieve the fairest perception of aircraft noise.

The FED2 study builds on this work and posits that the perception of fairness may be a relative term – that is, more or less (un)fair.

In addition, it is recognised that in distributional fairness, there are two sides of the scale:

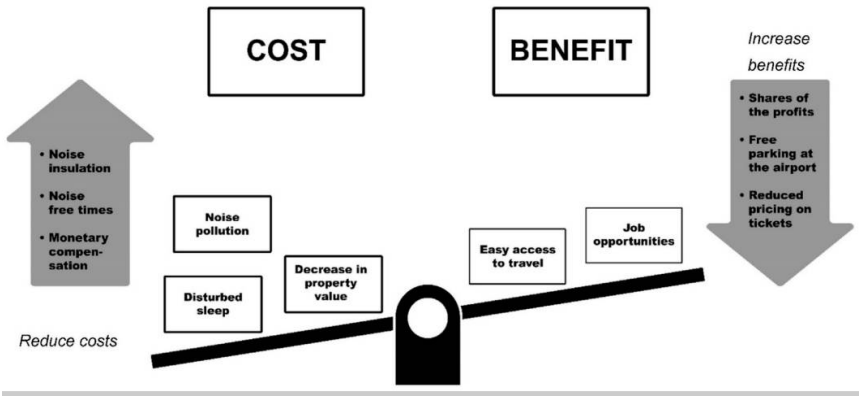


Figure 3.2: Figure 1 from Hauptvogel[12]: Illustration of balancing the individual cost–benefit ratio

The paper stated further that research on distributional fairness consequently suggests two different strategies for interventions to minimise perceived unfairness in the distribution of airport noise:

(1) implement the fairness principle that is most likely to be perceived as fair by a respective group of residents.
(2) compensate individuals who are disadvantaged by a specific noise distribution so that their ratio between costs and benefits improves.

Compensation options that were highlighted by Hauptvogel et al included:

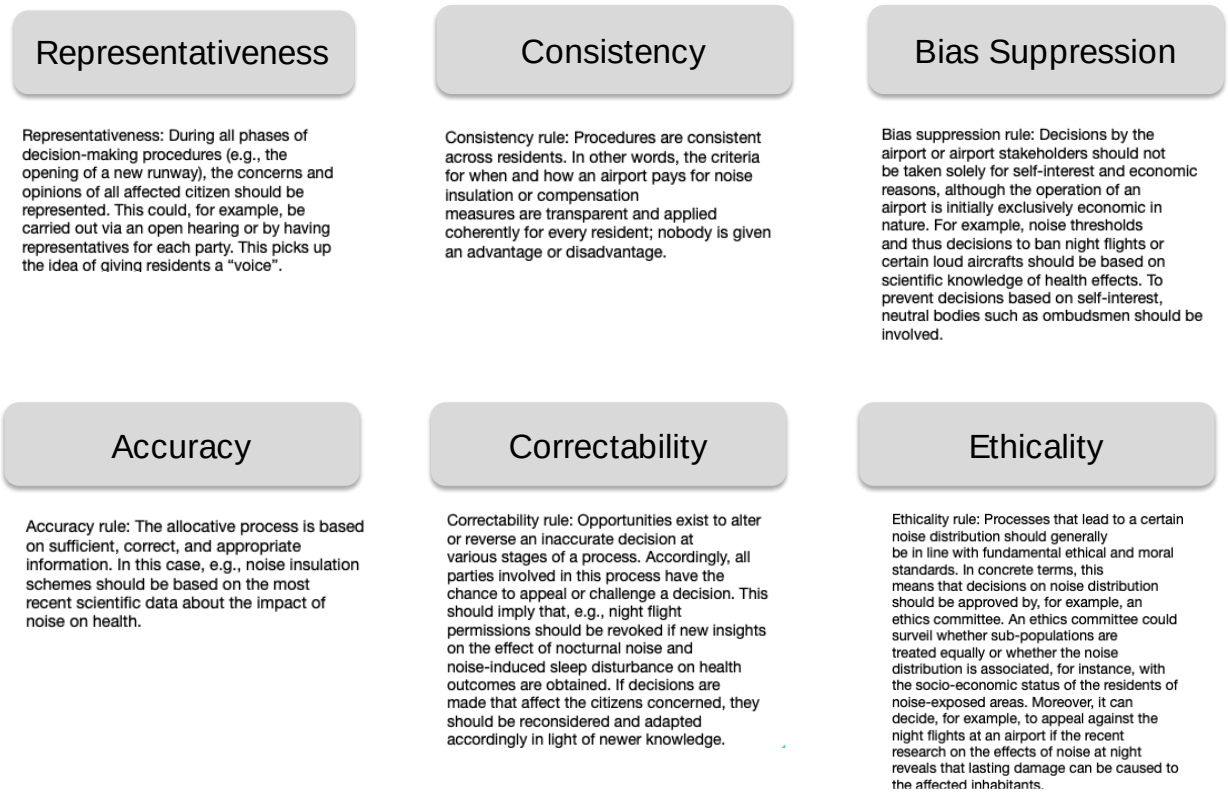
- Noise insulation – However, it was pointed out that noise insulation measures at home lack efficiency to reduce undesirable noise effects such as annoyance and that research on the effectiveness of interventions is needed.
- Noise free times (respite) - Work continues on designing for respite.
- Compensating for the loss of value - Financial compensation for the loss of value of real estate which had been observed e.g. buying up properties, one-time payments. However, the effectiveness of this option and whether it reduces annoyance is not understood.
- Increasing individual benefits - Some findings have been derived from a focus group study performed around Cologne-Bonn airport. These include providing shares of the profits from the airport; free parking at airports; reduced pricing on flight tickets but the effectiveness of such interventions is not known.

What is procedural fairness?

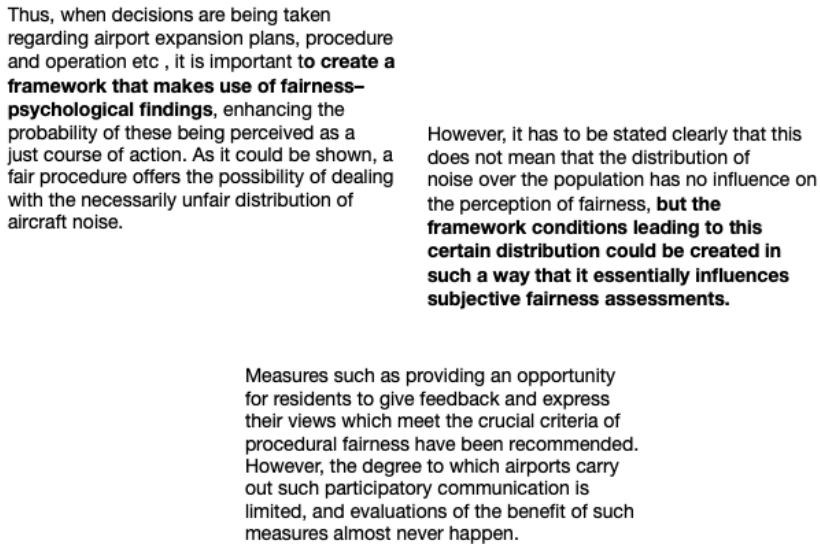
The paper explained that this relates to decision and process control. Process control is associated with an individual having the chance to express his or her perspectives and provide input before a decision is made.

12 Aircraft Noise Distribution as a Fairness Dilemma—A Review of Aircraft Noise through the Lens of Social Justice Research, Dominik Hauptvogel, Susanne Bartels, Dirk Schreckenberg and Tobias Rothmund. Int. J. Environ. Res. Public Health 2021, 18, 7399. https://doi.org/10.3390/ijerph18147399. This research was kindly supported by a grant of the Seventh Framework Programme of the European Commission) within the scope of the project COSMA and by a grant of the programme Horizon 2020 of the European Commission within the scope of the project ANIMA.

Decision control, in contrast, refers to the actual amount of influence the individual has on the decision-making process. The paper goes on to explain that it is becoming increasingly clear that people are not only concerned with the outcomes of a decision, but, more importantly, with the procedures that lead to the decision. It explains that research has suggested that procedure is perceived as fairer when the individual has some amount of control in the decision-making process. Procedural fairness is important for people because it conveys information about one's status in the group. Being granted some amount of control in the process of a decision implies that one is a valued member of a group and thus enhances the feeling of belonging and self-esteem. Furthermore, it suggests that perceived procedural fairness is used as an indicator of trustworthiness when people want to reduce the uncertainty of not knowing if an individual or a party can be trusted. The paper then addresses how procedural fairness can be achieved (summarised below) as the themes presented were considered during the FED2 work.



Hauptvogel et al went on to think through how the approach they described might be incorporated into aircraft noise management. Key comments included were:



In relation to the FED2 work, this highlights the importance of a framework based on principles for a fair process and underlines the need to consider what is to be achieved and how this may be delivered effectively. Once again, it stresses the need for effective community engagement to be included in the framework.

What is Informational and interpersonal fairness?

The work proposed these concepts as:

> *"Interpersonal fairness focuses on the degree to which people are treated with politeness, dignity, and respect by the decision-making party. Informational fairness describes the quality of the explanations given to the affected people that justify the reason for the application of a certain decision-making procedure or the distribution of the outcome in a certain way".*

In other words, Hauptvogel et al suggested that the airport's communication management should not only provide engagement opportunities for residents but also communicate in a way that is perceived as fair.

The paper examined how to create a fair interaction between the airport and its residents. It suggested that the criterion of informational fairness is based around (1) truthfulness with communication from the airport being made in an honest and candid way, and (2) justification with decisions regarding noise exposure being perceived as fairer when an adequate justification or reasoning is provided. In addition, when decisions are made about aircraft noise, the final outcome is seen to be fairer if information about the process is given in advance rather than if it is given after the outcome has been determined. The criteria of interpersonal fairness are based on (1) respect, with residents encouraged to actively participate in the decision-making process and the airport emphasizing the relevance of each resident's contribution and listening to their feelings and perceptions, and (2) propriety, with prejudicial and improper comments avoided.

How is this implemented?

The paper brought the approach to the distribution of aircraft noise from the perspective of fairness research together by recognising that as the accessibility of airports is generally not only necessary but even desirable, noise has to be distributed over a certain airport region which will ultimately put more strain on some residents compared to others. By taking different perspectives on the psychology of fairness into consideration, Hauptvogel et al argue that an overall unfair event, such as the distribution of noise, can still be perceived as more or less unfair. The paper ended with concrete recommendations on how perceived fairness in the distribution of aircraft noise can be increased based on fairness category, fairness aspect, application options and feasibility assessments. It concluded that future research is needed to systematically evaluate the effectiveness of such fairness interventions.

These ideas have been used to inform our thinking and preparation for our FED2 work. A follow up paper presented at ICBEN conference in 2023[13] also contributed to our thinking. This paper introduced a validated instrument to assess a broad range of fairness aspects in surveys. The Aircraft Noise related Fairness Inventory (fAIR-In), a multifaceted psychometric instrument, based on three items, aimed to assess the fairness of aircraft noise and airport management from the perspective of the four facets of distributive, procedural, informational and interpersonal fairness. The goal was to establish a foundation for addressing concerns, improving relationships, and creating a fairer and more trusting relationship between airport operators and residents in the long term. It was also suggested that the fAIR-In could provide essential support for implementing interventions in airport management. By identifying which aspects of fairness are perceived positively or negatively, targeted and efficient interventions can be planned to increase perceived fairness and build neighbourly relationships. The paper also explained that fAIR-In could offer a low-cost and quick-to-implement tool for evaluating implemented interventions, which could help close the current gap in airport activities' evaluation. The authors suggested that early integration of fairness seemed crucial to minimising negative consequences for residents whenever noise scenarios are subject to changes.

The paper reported on the development and validation process through a survey with 1,367 residents living around three airports in Germany. The study examined the correlations between fairness facets and predictive variables. The results indeed confirmed the four-factor structure of fairness and showed high predictive validity regarding annoyance, airport and air travel acceptance, as well as protest behaviour. It concluded that the fAIR-In is a useful instrument to capture existing community perceptions of the airport and for the design, monitoring and evaluation of measures aimed at building a better neighbourly relationship between the airport and local residents.
Although a copy of fAIR-In was not available for review, it might assist in the evolution of the FED2 best practice framework approach, and/or later testing before and after an intervention.

13 Aircraft Noise related Fairness Inventory – Development and Validation of a Psychometric Instrument Dominik Hauptvogel, Tobias Rothmund, Dirk Schreckenberg, Susanne Bartels, ICBEN 2023, Belgrade

4 KEY WORK OUTCOMES

4.1 Introduction

The original FED1 study highlighted the vital importance of engaging directly with noise affected communities to better understand those aspects of an airport operational environment and noise exposure consequences that influence perceptions of fairness and equity in the distribution of aircraft noise exposure and impact. In this respect the initial FED1 work corroborated the conclusions of the EU funded ANIMA study[14] which advocated for more transparent and comprehensive engagement over noise management interventions, recognising that this can 'encourage feelings of control, trust and understanding' in communities 'by listening to residents, developing empathy for them, and building management strategies that are sensitive to their wants and needs'[15]

To build systematically on these previous studies and those described in Section 3, the research team sought and received guidance from the ERG and SFG as to the most appropriate approaches and methods for engaging with communities, through which the idea to use a virtual airport setting to facilitate discussion over different lateral distribution patterns emerged and was developed. This approach was then tested in a series of CFWs, which were particularly helpful in understanding issues of most concern (e.g. degree of change and conflict with the expectations of residents in areas overflown) and also helped in refining a 'limited' sharing/dispersal concept involving distribution of aircraft within existing areas of concentration/NPRs. Through these development stages, a sophisticated approach to the use of focus groups was developed, intended to explore potential changes as a result of airspace modernisation and how they were perceived by residents living near an airport but experiencing a wide range of noise exposure due to their relative proximity to routes and the airport itself. The virtual airport helped to remove as much self-interest as possible from the discussions, encouraging responses to the consequences of different aircraft movement distributions for surrounding communities as a whole.

At each focus group, community representatives were introduced to the virtual airport, covering arrival and departure routes and operational modes, before focusing on one westerly departure route turning to the north and splitting to the east (see Figure 4.1). The latter was used to illustrate a 'baseline' situation in which the vast majority of operations (98%) fall within a normal distribution around the route centreline extending 1.5km either side to the edge of the noise preferential route (NPR), this was taken as analogous to other operational situations (e.g. arrivals) where navigational norms result in the concentration of aircraft movements in similar sized areas. Thus, it is hoped that the comments and opinions relate more generally to the distribution of aircraft movements, whether departing or arriving.

Once the baseline had been described 4 different aircraft distribution concepts were presented to the FGs:

14 See the ANIMA Methodology HYPERLINK "https://anima-project.eu/noise-platform/anima-methodology"https://anima-project.eu/noise-platform/anima-methodology

15 Heyes, G.A., Hooper, P.D., Rajé, F. and Sheppard, J. (2021) The case for a design-led, enduser focused airport noise management process, *Transport Research Part D*, 95, p. 14. (102847). https://doi.org/10.1016/j.trd.2021.102847

1 Replication of the conventional route – this was used as a starting point, harnessing the potential of performance-based navigation through airspace modernisation to ensure that aircraft fly the prescribed centreline more accurately and consistently, resulting in a much narrower band of distribution for the vast majority of movements within 0.5km each side of the route centreline.

2 Limited dispersal of movements within the NPR – here two sub-routes were created 750m to each side of the original route centreline and movements shared equally between them (assuming a normal distribution of flights across an area extending 0.5km each side of all routes). This spreading of aircraft numbers resulted in an increase in overflights around the new sub-routes and a corresponding reduction in flights on the original route centreline compared to both the baseline and Concept 1 scenarios.

3 Wider dispersal within the NPR with noise consequences beyond – this Concept extends dispersal to two further sub-routes 750m beyond those described in Option 2. Thus, movements are distributed evenly across 5 routes in total each accounting for one fifth of the original traffic normally distributed across 1km (0.5km each side of each route). This has the effect of pushing the concentration of the movements further away from the original route centreline with some overflights now beyond the NPR but within 0.5km of it. Consequently, there are noise exposure benefits for locations near the original route centreline as movements are spread outwards, with commensurate increases in noise events towards the outside edges of the NPR and beyond.

4 Extensive sharing via a new route – here a new route is located away from the original centreline and NPR to take a third of the traffic from the original route and create significant noise benefits for those under the original route, whilst newly exposing an area previously not overflown.

Modelling of the original suite of aircraft movements in these different lateral distributions resulted in the production of L_{eq} and N65 outputs to highlight the noise consequences for different locations relative to the baseline case. The primary intention of the focus groups was to reveal opinion on one of the fairness characteristics described in social justice research[16], namely distributional fairness. However, given the use of supplementary noise metrics to illustrate the changing patterns of noise on the ground and that conversations extended to issues relating to how decisions are made as well as the data on which they are made; the focus groups findings relate also to other dimensions of social justice, those of procedural and informational fairness, introduced in Section 3.3.

Conversations with participants in the 13 focus groups revealed the following opinions about the fairness (or otherwise) of the baseline associated with each of the concept scenarios described above.

16 See Section 3 for further details.

4.2 Concept comparisons

4.2.1 Baseline vs Concept 1

More precise and consistent navigation of the original conventional route was described to participants using the illustration in Figure 4.1

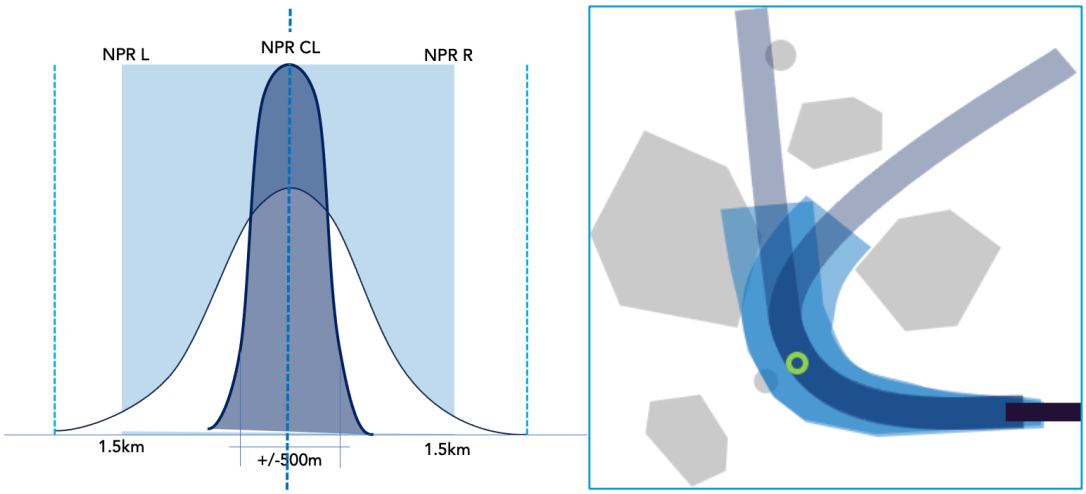


Figure 4.1 – Depicting a narrowing of the 'corridor' of aircraft movements from 3 to 1km

Before going on to describe the potential consequences for noise on the ground, opinion was expressed in FGs regarding the fairness of this change. This nearly universally was met with concern for those residents located near the route centreline where it was recognised that the currently most noise exposed would be even further burdened, with comments (all in italics) such as:

- *not good for people in the middle*
- *looks problematic for those under the centreline*
- *it's not fair to burden those people more*
- *not fair if economic benefit is elsewhere*
- *even if fewer people [affected], it's still grim for them*
- *if you're under the 1km line you're buggered*
- *those currently with a bigger burden get more*
- *totally cruel*
- *sounds like purgatory*

Further concerns were expressed that such an increase in noise exposure for the already most affected might tip people over the edge from just tolerable to intolerable, with particular points made regarding:

- *health effects and social impacts*
- *might tip people over the edge*
- *concentration could tip the balance*
- *how safe is this?*

When shown the noise on the ground implications illustrated by changes in the number of events over 65dB Lmax (see Figure 4.2; note changes in L_{eq} so marginal as not to be discernible in a change graphic), practically all participants felt that this confirmed their original impressions as to the impacts arising from the change in aircraft movement distribution.

- *N65 is useful in understanding the consequences of this choice*

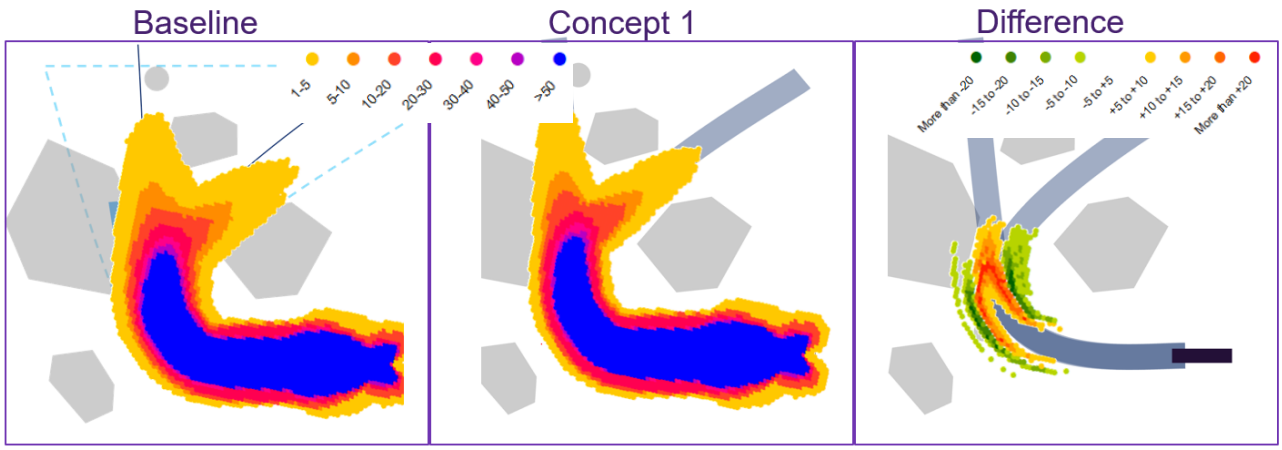


Figure 4.2: N65 data for Concept 1

In response to the change in N65 events, only a few participants across all FGs acknowledged the potential benefits from concentration to residents located at the edges of the NPR, more comments were made about the benefits to be derived from some sharing of the noise burden:

- *on strictly utilitarian terms it makes sense to spread [aircraft] across a wider area*
- *us at the side are happy to take noise for those at the middle*
- *the load should be spread across as many people as possible*
- *surely spreading makes it more bearable for everyone?*
- *Please spread the load – not focus the load*
- *Fairer to share*

In contrast, some pointed to the potential benefit of concentration especially where this could be located over areas of low population density:

- *spread the load around villages*
- *if over less people less will be affected*
- *if you are already burdened why not carry on*

Wherever the benefits and disbenefits fell, participants pointed to a role for compensation to help mitigate any loss in amenity:

- *what could you do for compensation?*
- *we need information about compensation options*
- *give me an option for compensation*
- *you can't make these changes without talking about compensation more seriously*

Although some commented that compensation could not mitigate for increased noise …..some don't care about compensation, just want less noise…. and that insulation does not solve the problem of outside noise intrusion.

Overall, whilst acknowledging that any decision relating to changes in aircraft distributions … *is not simple*…, the weight of expressed opinion was that **exposing those already most affected to more noise events was unreasonable/unfair, exacerbating existing inequalities** – even where the concentration results in less people being exposed. Thus, **some form of spreading of the burden of aircraft movements was seen to be an improvement** over replicating existing route centrelines if that leads to increasing concentration. In particular, concerns were raised that increasing exposure to noise for those near the route centreline might mean that critical health thresholds are exceeded and that the burden would become unbearable for those populations, despite any tolerance to relatively high levels of noise that may be present. Further, the perception among those residents living near existing areas of movement concentration around Gatwick Airport was that whilst they may have been aware and accepting of some aircraft noise, this has become worse over time with increasing air traffic and, as such, concentration would make things even worse.

4.2.2 Baseline vs Concept 2

In this Concept, two sub-routes were introduced each side of the original route centreline to provide for some sharing of aircraft movements, as illustrated in Figure 4.3.

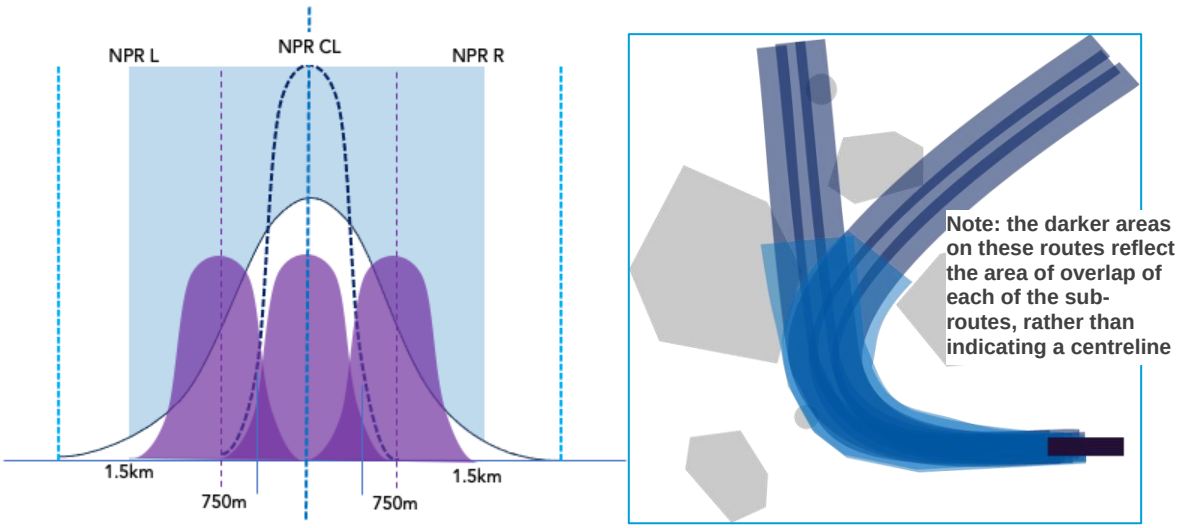


Figure 4.3 – Limited lateral distribution using two sub-routes

The **majority of responses to this concept were positive** indicating that this degree of sharing removed some of the burden on the most noise affected and avoided the negative consequences of the concentration associated with Concept 1. This is reflected in the comments reproduced below:

- *sharing out more evenly would be fairer*
- *looks fairer*
- *it looks good on paper*
- *who doesn't go on planes? – should share the burden*
- *yes – generally considered fairer*

- *this option is probably a bit fairer*
- *heat out of the middle bit*
- *if you affect more [people] at a lower rate this is preferable than letting the centre reach piss-off point*

However, when reflecting on the disruption that may be caused by the changes in noise exposure as illustrated by the N65 data presented (see Figure 4.4), some **participants raised concerns about the impact of sharing.**

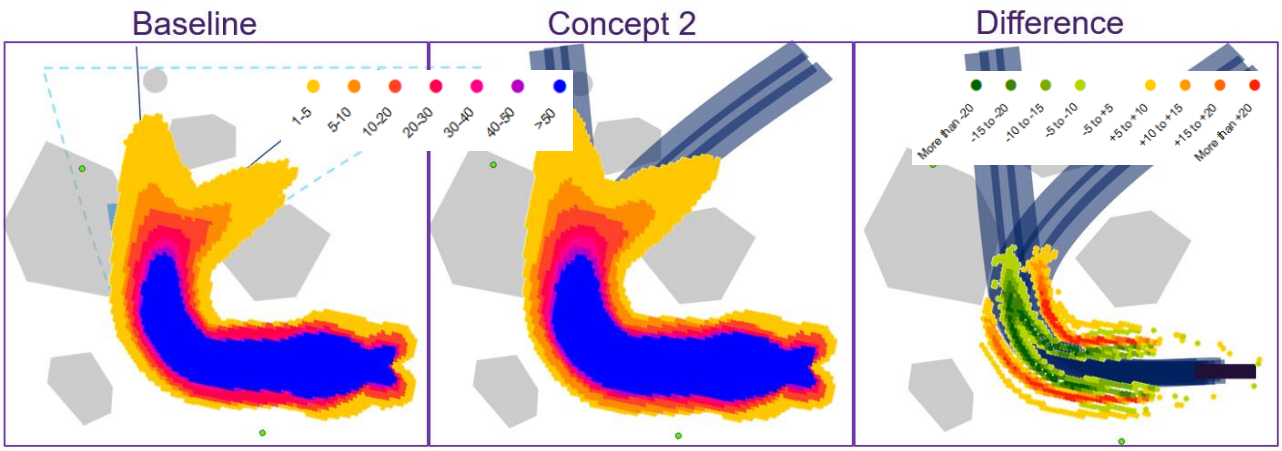


Figure 4.4: N65 data for Concept 2

- *there may be a lot more people in the red*
- *not fairer for those in the overlap [of route distributions]*
- *why burden new people*
- *people in the centre are used to noise (this comment engendered quite a bit of disagreement)*
- *I'd be quite annoyed about having a bit more noise like this*
- *harder for more people*

Given these concerns, it was hardly surprising that many participants recognised that there is **no simple answer** to the distributional question:

- *depends where you live whether its fairer*
- *you can't please everyone*
- *it comes down to where you live*
- *it's all about managing expectation…. those on the edge might not be expecting an increase*
- *I'd say it's more complicated*

In the light of this range of views a number of participants commented on the **need for more information** to inform decision-making:

- *need a percentage difference compared to now, to decide*
- *I'd be quite annoyed at having a bit more noise like this … if residents aren't made fully aware*
- *background noise levels*
- *other solutions such as decrease noise emissions at source*
- *[impact] depends on activity in area*
- *Rural areas don't have background noise*
- *Depends on the purpose/use of land underneath – environment/wildlife*

- *Carbon impact and pollution risk*
- *Need to treat schools and vulnerable people differently*
- *Historic areas with Grade I and II listed building can't be insulated so should be avoided*

And with respect to the **operation of the routes:**

- *How long would each be operational*
- *How do you operate these three routes… number hours, time of day….*
- *We need to know in advance when we will be overflown*
- *Put time periods on these routes would be better*

Some of these comments touched on the value, or otherwise, of respite:

- *If there's respite, that's good*
- *The idea of a schedule/plan is generally more attractive*
- *Put time periods on these routes would be better*
- *Respite is better than nothing*
- *How does respite affect how much traffic we get at other times?*
- *How long would each [respite period] be operation?*

The crux of the challenge in balancing the distribution of adverse and beneficial consequences of concentration versus sharing was summarised by one participant:

- *Is it fairer to fly over more people but with less noise overall or less people with more noise?*

And put more succinctly by another:

- *It's about spreading or taking the pain*

Whatever the position on the merits of sharing the burden of noise exposure, there was consensus on the **need to include the question of future traffic growth** in the consideration of the consequences of changes in movement distribution:

- *what's happening about absolute numbers over time?*
- *fairer as long as overall numbers stay constant*
- *this option seems better but depends on future [growth]*
- *if having discussions about distribution, can't have them without discussion of numbers/growth/repercussions of night flights*
- *for the whole picture you need numbers and distribution*
- *more routes, more planes*
- *if there's distribution, you can't have that consideration without discussion of the numbers into the future*

These observations appeared to be in part driven by a **concern over change more generally and the absence of effective consultation and participation** over what was seen to be unfettered growth:

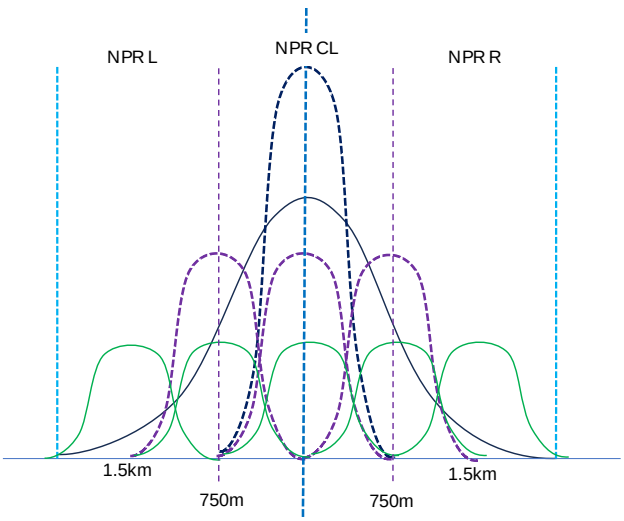
- *people are used to what they know – don't change things*
- *I've felt the impact of growth*
- *need to discuss future growth and airport priorities*
- *we want less noise. Let's be realistic about this 'consultation', is it really going to change anything about making decisions at Whitehall? No.*
- *are our views being listened to? The person making decisions is not impacted*

Addressing these concerns would appear to demand a more transparent and comprehensive approach to public engagement over airspace change in which the distribution of increases and decreases in noise events is identified, and communities are consulted on the impact of potential future changes to air traffic. Responses to the value of N65 data in capturing the spatial extent and direction of change suggests **event-base metrics may contribute positively to honest and open dialogue.**

Overall, Concept 2 involving **some limited sharing over areas already overflown is generally perceived to be fairer** than Concept 1 (concentration) and is recognised as alleviating the noise burden of the most affected currently. Nevertheless, there appear to be some modifiers to this position including consideration of the number of people (as well as areas) affected and the nature of the areas being overflown (e.g. rural vs urban distinction). Furthermore, when considering any distributional changes resulting from specific ACPs, there needs to be transparency over the consequences of future growth on the geographical extent and severity of noise impacts.

4.2.3 Baseline vs Concept 3

In this Concept, two further sub-routes were introduced each side of the sub-routes described in Concept 2. Thus, the air traffic is shared over 5 routes in total covering an area of distribution that extends 0.5km each side of the NPR (or existing overflight corridor), as illustrated in Figure 4.5.



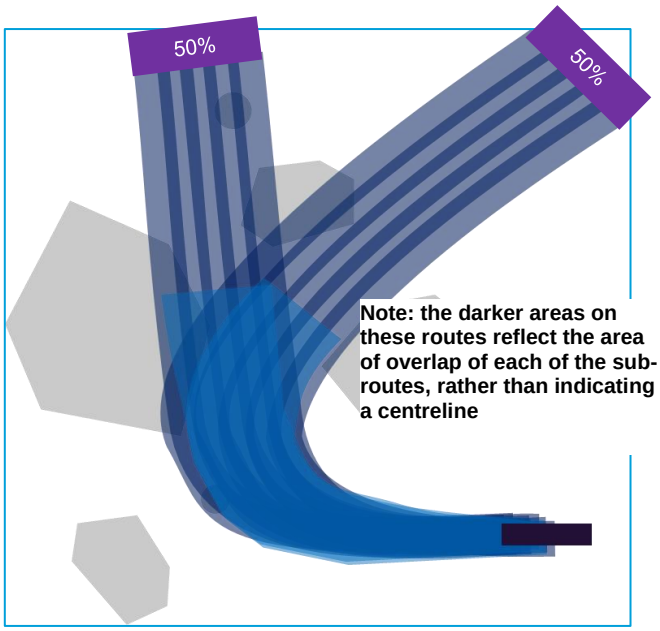


Figure 4.5 – Extended lateral distribution using a total of 5 sub-routes

Concept 3 represents more extensive sharing than Concept 2. However, again, **many participants regarded this scenario positively** acknowledging that more sharing would further relieve noise exposure on those originally most exposed whilst sharing the burden over a wider area and potentially more people:

- *This feels better*
- *This is a better compromise [than Concept 2]*
- *This spreads the load better*
- *Kind of fair*
- *Fairer – more sharing*
- *Any dilution is better*
- *This is the best option for me*
- *This irritates more, but less intensely – fairer*

The last comment hints at **concerns over the increasing scale of both positive and negative impacts** being felt over a wider area as illustrated the change in N65 distribution (see Figure 4.6).

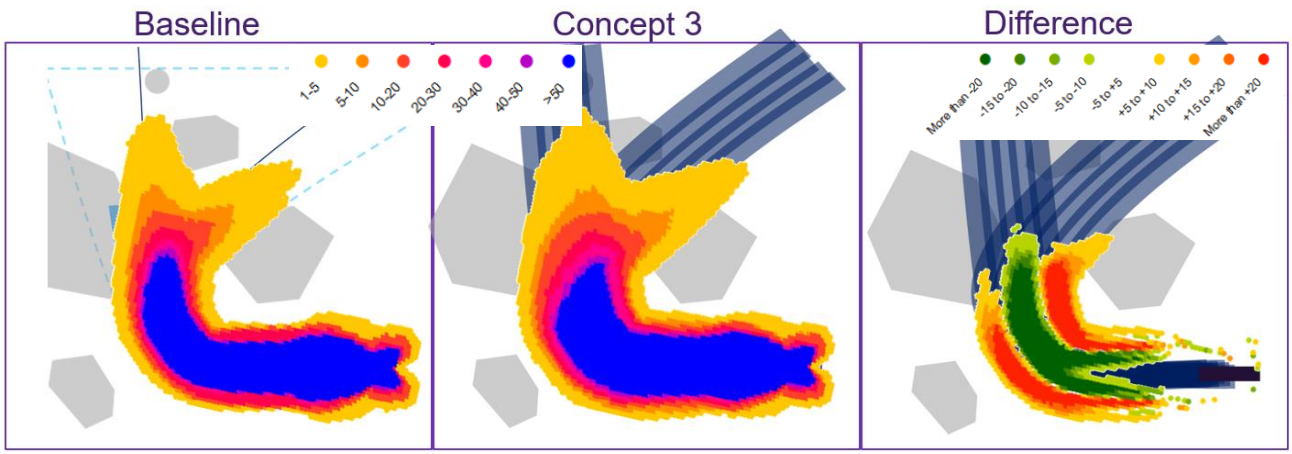


Figure 4.6: N65 data for Concept 3

These concerns were evidenced in a number of comments that either disliked this option or foresaw problems arising were it to be implemented:

- *Worse – it's a bigger change so more people will notice and feel it*
- *It would be hard to sell this idea to people on the outskirts*
- *Doesn't look better and the environmental impact may be worse – just pushing the problem further*
- *For some people this is a big change and they would notice*
- *Some kicking off would happen as a result of this option*
- *Noise over new area – not fair*
- *Result in more protest*
- *Could be more noise on rural areas not used to it*

It is clear from these comments that **participants were wrestling with the implications of a more significant change in the disruption of adverse and beneficial impacts** and whether this represented a fairer or more acceptable outcome:

- *Depends on goal…. aim to be less affected or less dramatically affected (balancing act)*
- *Benefit in the middle, disbenefit on edge*
- *Better or worse? Can see both sides*
- *Relief to most exposed at expense of those less exposed*
- *Looks more equal but not sure about fairer….. it's new on edges, so lots of resistance to this*
- *Moving gaol posts for people's expectation…… the further you go out, the more change from expectation*

These comments imply that there **may be a point at which the perceived benefits of sharing (fairer options) are outweighed by concerns over the degree of change**/conflict with expectations, with a preference of minimising change:

- *There's a tipping point*
- *Why bother to change it? Surely minimal change is better*
- *The bigger degree of change, the more challenging the acceptance of that change will be*
- *Minimal changes with alternation seems to be the general opinion here*

The point where the **socially acceptability of sharing is eroded by concerns over the degree of change** is something that could/should be explored further and may well be influenced by a range of factors, some of which were highlighted by participants:

- *It depends where the noise is…. The countryside would be quieter but there are less people that would be affected*
- *Number of houses double-glazed or the concentration of people*
- *Some land is of greater value than others*
- *Numbers [of aircraft] are important*
- *It's important to think about the number of people living there*
- *We need more information to decide if it's fairer*
- *What about the distribution of people?*

And with respect to the practical delivery of sharing traffic:

- *It depends on the schedule*
- *Any respite would be good*
- *Depends on how much and when it's rotated*
- *Respite attract, management of it comes [down] to negotiation with individual communities*

Thus, it would appear that **comprehensive dialogue over the relative merits of ACPs will need to be transparent about the location of decreases and increases in noise events, numbers of people this may affect, how 'fair' distribution will be achieved operationally, nature of the land types (e.g. urban/rural) exposed to noise, and how traffic may change in the future**. These elements of informational and procedural fairness were highlighted in the following comments:

- *Need to talk with real scenarios…. Compared to what other airports are doing*
- *We need trust*
- *Change needs to be implemented quick and easy*
- *Timeframes for introducing this?*

But some remain cynical about the potential of transparent engagement with communities to result in genuine influence over airspace change:

- *This is a trick, can't divorce distribution for absolute numbers*
- *What's the airport's goal? Is community involvement actually being listened to?*

Overall, Concept 3, introducing a greater degree of sharing than Concept 2, met with a more mixed reaction (than that to Concept 2), with **the benefits of wider spreading of the noise burden acknowledged by some, and others highlighting that the degree of change will be more noticeable and felt across wider areas, some of which may not have previously experienced much aircraft noise**. Thus, the risk of social unacceptability appears to increase with the degree of change, number of people potentially affected and with the nature of the areas affected (affecting quieter areas with previously little noise exposure increases the risk). Consequently, effective public engagement over specific ACPs will need to provide information on these features if communities are to fully understand the outcomes of each proposal and make informed decisions at to their relative merits (degree of (un)acceptability).

4.2.4 Baseline vs Concept 4

In Concept 3, a new relief route is introduced to take one third of all the original traffic (see Figure 4.7). It is assumed that aircraft will be shared across the breadth of the NPRs for all three routes along the lines of that described in Concept 3 (i.e. 5 sub-routes).

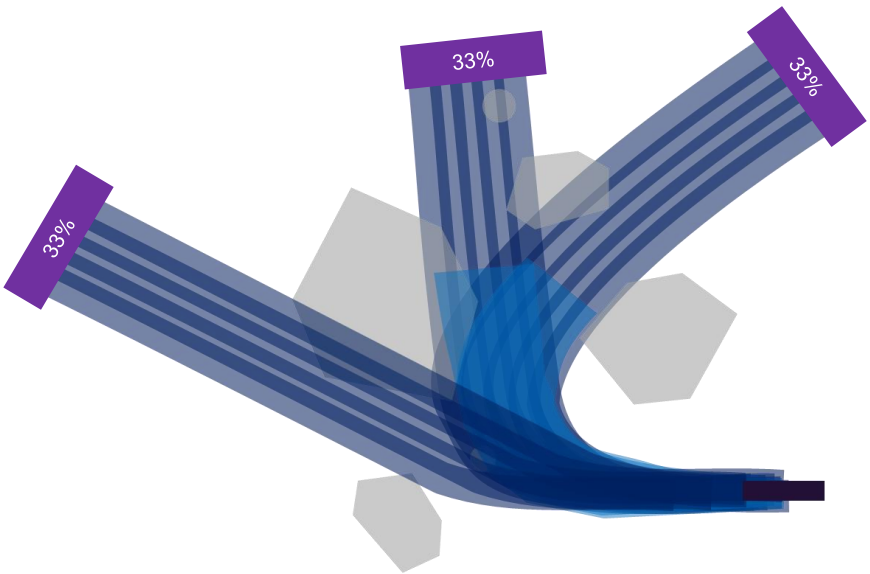


Figure 4.7 – New relief route to take one third of all traffic over an area previously not overflown

This concept divided opinion more so than that of either Concept 2 or Concept 3. Whilst some participants felt that this more extensive sharing of air traffic was fairer, most highlighted the likely opposition to this scenario:

- *We all benefit from planes so it's fairer to share the load*
- *Fairer to spread further*
- *This is preferable*
- *This would increase quality of life in the noisy zones*
- *You need to share noise on busy and rural areas*
- *It's fair and inevitable if everyone gets a plane occasionally*
- *No one should have too much of a burden*
- *This would affect a load more people*
- *Just going to upset a load of people who never had aircraft before*
- *Not fair as people would have bought their house without knowing there was a danger of being overflown*
- *You're going to affect a lot of people who've never been overflown…. That's not acceptable*
- *That's really unfair*
- *This will cause more aggravation than benefit*
- *It's unfair to those who have never been overflown*

It would appear that the **degree of change feature again influenced the perception of participants** with some even acknowledging that whilst theoretically fairer, it would be less socially acceptable:

- *Concept 3 is more equitable but would displease many more people*
- *What about the expectations of the newly overflown?*
- *It depends on how extensive the change is*

The scale of change was evident in the N65 illustration, and in this concept only, also resulted in observable changes in L_{eq}.

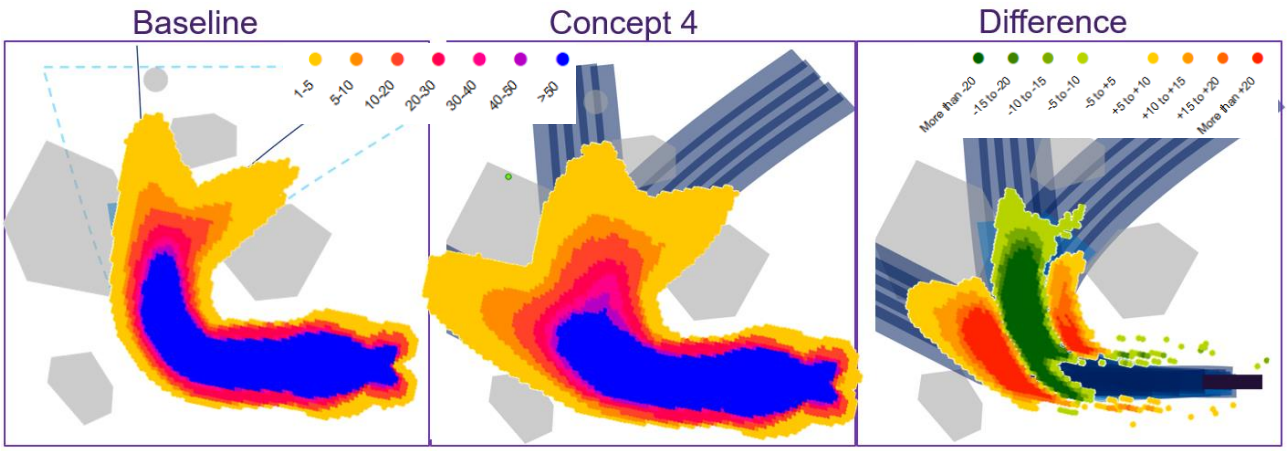


Figure 4.8: N65 data for Concept 4

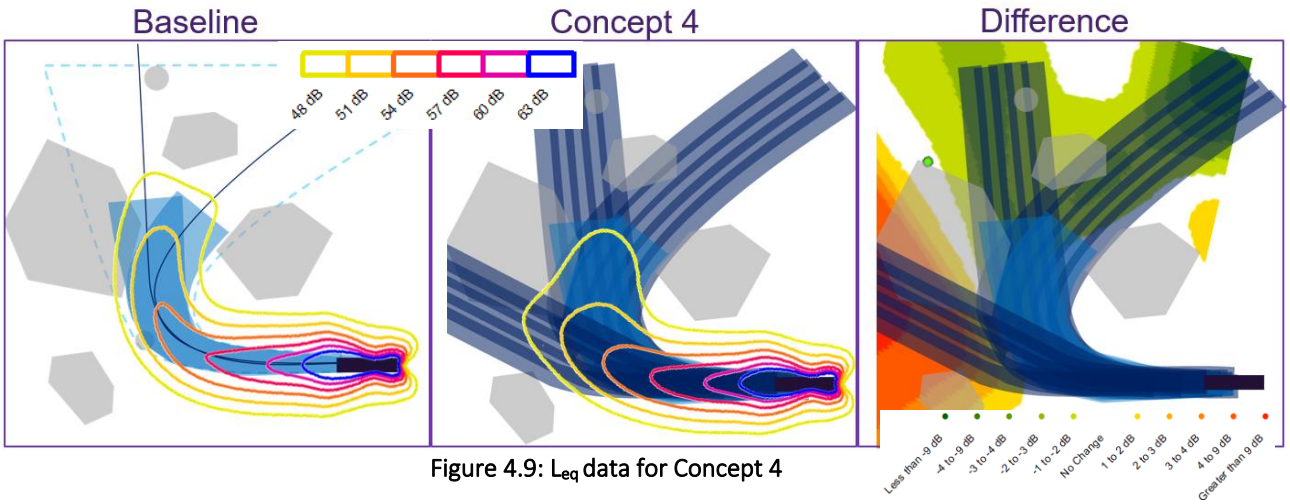


Figure 4.9: L_{eq} data for Concept 4

Any **concerns over the degree of change**, as captured in the noise metrics above, appeared to be **exacerbated by other factors** such the total number of people affected, newly overflown areas, contrast with expectations (often bound up with land types/uses):

- *Populations are important*
- *Would be a bigger change on quieter areas*
- *You don't choose [to live under newly overflown areas] it's out of order*
- *Areas overflown are not used to noise…. leave it as it is*
- *What about ANOBs*

The **relevance of these opinions to other potential scenarios** (e.g. the movement of a single route to a new area to reduce the number of people overflown/affected by noise) is also evident in the following comments:

- *New route…. Depends on what is underneath. People, ANOBs, wildlife, hospital….*
- *What about new people? Big change*
- *Rural area – quieter so notice more, but fewer people so less impacted*
- *Urban…. Aircraft less noticeable, so doesn't make sense to focus aircraft on rural areas*
- *If it's a big change, that's our concern*
- *Impact the least amount of people and compensate them*

The role of compensation in any discussion about changes to the location and distribution of aircraft movements was frequently highlighted, along with the need for thorough engagement over ACPs

- *Financial compensation needed when noise get to a certain point*
- *Compensation needed*
- *Can you redesign the area around the airport and relocate people?*
- *You need to be transparent in order to negotiate*
- *Need to have a community debate*
- *If I'm getting more [noise], what's the deal for the community? Need to have that conversation*
- *Need real scenarios for consultation events*
- *Scenarios….. need to take account of local conditions and experience*

Overall, the responses to Concept 4 reinforced those from Concept 3, namely that t**he larger the perceived scale of change, and contrast with expectations, the greater the risk of socially unacceptable outcomes**. However, the point at which the benefits acknowledged to be associated with some limited spreading of the burden are outweighed by these concerns is unclear from these focus groups.

4.3 Implications for AM design and decision-making from FG learning and Q studies

The overall conclusions from the opinions expressed in the FGs regarding the range of concepts presented for aircraft movement distribution is that:

- **Some limited sharing of the burden of aircraft noise events** could help overcome adverse perceptions of concentration
- **Focusing the spreading among populations currently experiencing some noise** exposure could allay concerns over the extent of change against expectation
- **The greater the extent of change** (in the number and proportion of louder events), **the more concerns are raised about impact/unacceptability.** Thus, where dispersal options extend over wider areas increasing concerns are raised about (for example):
    - Change against the expectations of residents
    - Conflict with existing land uses/designations (e.g. contrast with AONB features)
    - Likelihood of overflying populations with no or only limited experience of aircraft noise

These influences over perceptions of fairness are resonant with the personal and tangible NAFs highlighted in FED1 and could inform a risk of social unacceptability framework to supplement assessments of individual Airspace Change Proposals (ACPs), thereby assisting in shortlisting options and, critically, informing subsequent public engagement over the shortlisted ACPs at individual airports.

Comments about the need for transparent and comprehensive public engagement over ACPs and a genuine opportunity for communities to influence final decisions suggest that, when discussing specific ACPs, airports should identify areas and populations likely to experience decreases or increases in noise events as a result of any change. This will enable communities to determine what they regard as the most acceptable (or least unacceptable) option and inform dialogue on compensation/mitigation regimes and reasonable levels of growth within the distributional parameters agreed upon. Thereby, positively contributing to procedural and informational fairness as described in Section 3.3.

Q studies

The importance of the quality of public engagement and a call for a genuine opportunity to influence decisions was further reinforced by the outcomes of the Q studies that were undertaken with participants after their involvement in the FGs.

These Q methodology studies were used to gain greater understanding of the diversity of perspectives around airspace modernisation, noise and fairness. Their intended role was to reveal nuanced views amongst research participants to inform and enhance key insights obtained through the focus groups. Two Q studies were undertaken: the first, main study, sought to explore views around fairness and, the second, considerations of noise with respect to airspace change.

The **findings indicated that there is a need for engagement to be meaningful and characterised by openness, genuineness, honesty and transparency.** There is also a requirement that communities have an influence over outcomes. There is a call for airport growth to be subject to environmental constraints too. It was also considered to be **important that changes in noise, number of flights and their heights are communicated to help judge fairness of any potential airspace change**. In addition, **there should be a realistic cap on flight numbers**.

Other key findings were that it is not considered fairer to overfly urban rather than rural areas and that it is not fair that communities have to accept the noise burden. A focus on a propensity towards common good was also revealed in the assertion of concern about impacts across all communities and not just one's own.

The main study uncovered three discourses: Discourse A was characterised as anti-noise and pro-environment, Discourse B as pro-noise sharing and Discourse C as pro-compensation/pro-respite/concerned about housing and communities.

There was no strong association between the location of respondents with respect to the airport and their propensity to favour a particular discourse, although Discourse B was generally associated with people living further out and Discourse C with people nearer in. This apparent openness to consider the wider consequences of changes to aircraft distributions was also evident in the FGs where participants often commented along the lines of whilst it may not be better for them, they could see the advantages for overall fairness. Whether residents will be so willing to embrace this more utilitarian viewpoint when discussing actual ACPs remains to be seen. But these results do point to the success of the virtual airport concepts in allowing discussions over fairness and acceptability that were not dominated by NIMBYism.

The other study revealed four discourses: Discourse A called for a limit on traffic growth, Discourse B for a limit to change in noise exposure (noise envelope approach), Discourse C for compensation where there is largest change (cost benefit analysis approach) and Discourse D for greater equity (noise burden vs overflights – near in/further out).

Further details on the Q methodology work can be found in Annex 5.

4.4 A role for event-based metrics

Given the need for transparency and comprehension to underpin effective public engagement and contributions to decision-making, it is significant that FG participants found the N65 illustrations for each of the concept scenarios to be valuable in aiding their understanding of the implications for residents arising from changes to the pattern of aircraft movements. Thus, the use of event-based metrics like N65s could contribute positively to the quality and transparency of CAP1616 driven public engagement by enhancing informational, and by extrapolation, procedural, fairness; thereby supporting more socially acceptable outcomes.

The value of event-based metrics such as the N65 lies in their:

- **Sensitivity to relatively small changes** in the lateral distribution of aircraft movements within a route, not picked up by L_{eq} measures. Such sensitivity could also be harnessed to illustrate the benefits (in terms of reductions in N65 events) of operational improvements intended to reduce noise on the ground
- Capacity to **illustrate the spatial change in events**, highlighting those areas experiencing increases or decreases in noise events resulting from a change in the lateral distribution of aircraft movements
- Change **patterns strongly reflecting the perceptions** of distributional changes and impacts, thereby aiding understanding of the consequences of specific changes to aircraft movement patterns
- Power to illustrate the **geographical extent and consequence of concentration and sharing regimes**, providing the basis for transparent and comprehensive engagement with populations potentially affected by ACPs at different airports.

Overall N65 illustrations resonated strongly with participants' perceptions of changes and could therefore be used highlight relevant features noise impact distribution. If overlaid with population data, they could even be extended to **quantifying benefits/disbenefits** by calculating changes in the number of person events thereby contributing to decision-making around **compensation/mitigation** based on a full understanding of the locations and populations adversely affected by changes in the distribution of aircraft movements.

Given these attributes of event-based metrics such as the N65, changes in these metrics associated with different lateral movement distributions can be linked to increases in the likelihood of socially unacceptable outcomes. For example, assuming the preference is for minimal change (i.e. more reflective of the extent to which noise is shared at the moment), then **the risk of unacceptable outcomes increases with**:

- Increasing area of N65 event change (both positive and negative)
- Increasing N65 person events, especially if the proportional change in events is high
- Increasing overall person event index (PEI)

Thus, the N65 metric can shed light on the costs and benefits of alternative options for the distribution of aircraft and thereby contribute to distributional fairness as described by Hauptvogel et al and summarised in Section 3.3.

The focus groups also highlighted a **range of secondary factors that appear to influence the risk of unacceptability,** these include:

- Absolute (health) effects on those most adversely affected by the change
- Characteristics and expectations of locations experiencing more events above 65dB
- Perception of land value:
    - Environmental qualities such as tranquillity
    - Land-uses (e.g. urban vs rural, parkland, etc)
    - Designations (e.g. AONBs)

The influence of perceptions of distributional fairness and how other NAFs may increase or decrease the risk of socially unacceptable outcomes is summarised in Figure 4.10.

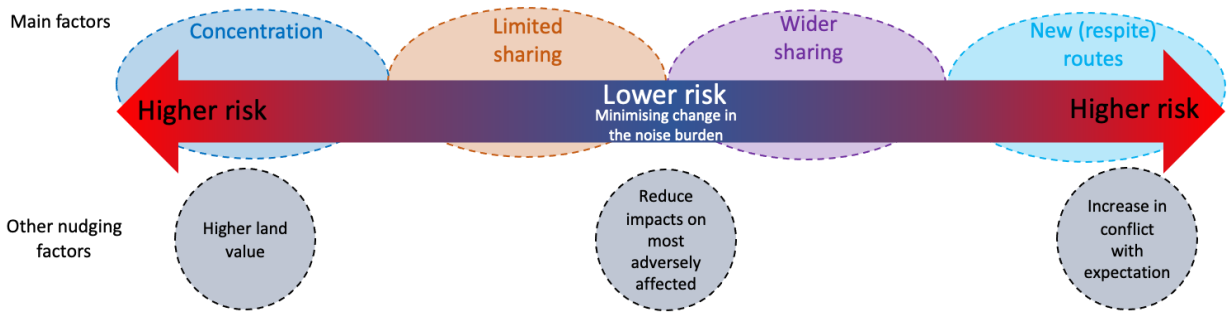


Figure 4.10: Risk of unacceptability Spectrum: Distributional factors contributing to the risk of unacceptability

4.5 Implications for airspace design assessment, engagement and decision-making.

Core to airspace redesign involves making decisions about the implications for the noise burden arising from the redistribution of aircraft. The perception of the relative fairness of a redistribution has been defined in previous studies as "Distributional Fairness" – people make a judgment on the distribution and the balance of costs and benefits (Hauptvogel et al. 2021). The FG & Q Study outcomes clearly indicated that judgment of fairness is not binary, but more of spectrum of (un)fairness. There is therefore a spectrum of risk associated with a particular redistribution being considered unfair.

The FG findings presented here, and illustrated in the **Risk of Unacceptability Spectrum**, suggest that airspace designs that result in minimal change in the redistribution of the burden of aircraft noise (presented as changes in event-based metrics), and minimise increases for those that are already most affected are likely to be considered more distributionally fair, and more socially acceptable. In airspace design terms this implies that some form of limited spreading of aircraft movements around areas already overflown is likely to be considered a more socially

acceptable outcome than allowing aircraft to concentrate around a route centreline as a result of more precise and consistent navigation.

As this sharing becomes more geographically extensive (whether this be to distribute aircraft across existing NPRs or to share the noise burden over a wider geographical area with the addition of new routes) the point(s) at which perceived benefits from sharing become outweighed by concerns over sharing is unclear and might only be revealed when specific ACPs are discussed with communities.

Further, the interaction between the perception of fairness from sharing over wider geographic areas and measures that could be introduced to provide noise relief/respite and compensation is also unclear at this time, and again may only be revealed when specific ACPs are discussed with communities. It is evident from respite studies (Porter et al, 2023)[17] that there should be caution applied to the presentation of respite as a benefit to people who are currently not burdened by aircraft noise.

Whilst the geography of the redistribution was considered to be of primary importance, the present study also revealed a consensus that it would be considered unfair for the burden on those currently most significantly at risk of adverse health outcomes to increase further, even if this means larger numbers of people exposed to lower noise levels. The latter was regarded as a fairer outcome if the burden on the most exposed is reduced along with the associated risk of adverse health outcomes.

Whilst the extent of changes in the geographic distribution of the noise burden and increased risk of adverse health outcomes for those already significantly at risk were found to be primary factors affecting perception of fairness, the present study has also revealed the importance of other, secondary, features that influence acceptability (e.g. land-uses, changes against expectations, etc.). The extent of the relative importance of these should be revealed when specific ACPs are discussed with communities. This would allow decisions to be more sensitive to underlying social values, which in turn could better inform appropriate compensation/mitigation packages for those negatively affected by change.

The present study highlighted not only the importance of the change to the redistribution of the noise burden on perception of fairness, but also highlighted the role of informational and procedural fairness, as described by Hauptvogel and colleagues (2021), during the overall engagement processes in reaching a socially acceptable airspace redesign.

A number of comments were received in the FGs indicating a mistrust or cynicism over consultation associated with historic changes arising from airport developments and aviation growth more generally. This demonstrates

17 Respite from aircraft noise: Summary of research journey, Porter N et al, Anderson Acoustics Ltd, Report 5522_002R_4.0, 2023 - see https://www.heathrow.com/company/local-community/noise/making-heathrow-quieter/respite-research

that the CAP1616 process will take place in an environment of resistance to change and thus must adopt as transparent a position as possible if trust is to be built up with communities over the process and outcomes of decision-making.

The importance of changes in the distribution of increases and decreases in noise events in determining social acceptability is in contrast to the CAP 1616 ACP assessment process that focuses almost exclusively on the aggregate consequences of change (for example, as quantified using Tag) linked to the use of average noise level metrics. Acknowledging, illustrating, and negotiating over these distributional changes would appear to be essential for airspace sponsors if the risk of socially unacceptable outcomes from AM are to be managed down. Materials used in the focus groups revealed the greater utility of noise event metrics (compared with average noise level metrics that are primary metrics in the CAP1616 process) to transparently communicate noise distribution changes in a meaningful, understandable, and relatable manner (characteristics of information fairness) that is reflective of residents' lived experience.

Similarly, **the insights provided by event-based metrics could also add greater depth to negotiation over the appropriateness or otherwise of 'concentrate and avoid' options for route changes being considered by some airports under AM**. Such engagement with potentially affected communities could further explore the influence on (un)acceptability of variations in the number of people affected by increases in noise events and the severity of change (e.g. changes in N65 person events) compared to those benefiting from different route locations designed to avoid centres of population.

For these beneficial outcomes to arise from **future public engagement by airspace change sponsors over ACPs, the latter must allow for the presentation of a range of genuine options (i.e. ones that are operationally viable), where the consequences of each are presented transparently including explicit illustration of the spatial pattern of increases and decreases in noise events**. This will enable full scrutiny of all options, including any preferred by the airspace change sponsor, and empower communities to express their preferences. Providing opportunity for these preferences to influence the final decision over the selection of specific ACPs should enhance procedural and informational fairness, contributing to more socially acceptable outcomes and, over time, helping to rebuild trust in aviation authorities through demonstrably supporting social justice.

It is worth emphasising at this point that any discussions of the benefits, or otherwise, of noise sharing cannot ignore the influence of future traffic growth on the noise outcomes achieved from changes in aircraft distribution. Repeatedly in our FGs participants highlighted their concerns that growth in absolute numbers of aircraft could erode the noise exposure reductions that sharing might achieve, thus it would appear essential to transparency and open negotiation that plans for traffic growth are incorporated into discussions and ultimate decision-making.

How should airspace change sponsors introduce noise distribution features into the selection and consultation over ACPs?

CAP1616 provides a comprehensive and thorough approach to airspace design consistent with meeting UK Aviation Policy objectives with significant consideration of environmental noise impacts, effects on health and quality of life through a prescribed consultation process. Whilst comprehensive, the assessment procedure uses aggregate changes in adverse impacts with average noise level metrics as the primary metrics and Tag. The focus groups revealed cynicism and mis-trust in such assessment and consultation processes associated with airport and airspace development. Communities are left with a feeling they have been misled on changes to impacts arising from developments as, post change, the perception of the change does not match the expectation nor the expressed changes in consultation. The FG materials suggest that the use of average noise level metrics to describe noise exposure and changes does not relate to individual or community level experience.

Thus, whilst It is generally recognised that there is a need for an assessment of impacts of airspace options consistent with policy, the present study has revealed that if fairer and less socially unacceptable airspace designs are going to be implemented, **there is a need for airspace change sponsors to, where possible, to introduce consideration of (re)distribution of aircraft noise into the assessment and shortlisting of ACPs as well as into the associated consultation and engagement with communities over the ultimate decisions over preferred airspace changes.**

A Framework for the Assessment of Risk of Social Unacceptability

The outcomes of this Focus Group and Q Study ("this study") suggest that "social unacceptability" is grounded, at least in part, in a perceived imbalance of concepts of distributional (costs and benefits), procedural, and informational fairness suggested by Hauptvogel et al (2021) throughout the current process. An overall framework therefore needs to consider these concepts:

- *Assessment of Distributional Fairness*

  Change in distribution of the noise burden is a significant risk factor of social unacceptability:

  - An assessment of compliance with policy must be considered to sit alongside and at the start of any framework. Clearly any options that do not comply with policy should be rejected. Further, and consistent with FG discussion, options that increase the risk of adverse health outcomes for those who are already at significant risk of adverse health effects should be rejected (note that this is subtly different to the statement of UK Aviation Noise Policy).
  - The greater the perceived scale of the change compared with expectation, the greater the risk because the balance of distribution of cost and benefit is deemed unfair.
  - The "spectrum of risk of social unacceptability" presented in the previous section illustrates that the greater the deviation from the existing situation, the greater the risk, whether this is because of greater burden on those already burdened through increased concentration, or through wider sharing with new routes.

- The introduction of new routes to increase sharing, reduces noise for those already burdened, but increases noise for new people (by spreading the existing traffic over more routes) and thus the risk of socially unacceptable outcomes.
- The benefits of sharing should not be eroded by increases in movements.

- *Engagement with Procedural and Information Fairness leading to negotiated outcomes.*
  - Procedural Fairness - Engagement, rather than a "consultation" that has a possibility of changing aspects of the outcome. In other words, meaningful, open and honest engagement through which there is a "negotiated" outcome may reduce the risk of unacceptability.
  - Informational Fairness - Consultation is often focussed on positive aspects, and downplays the negative aspects, of change in noise distribution – this is seen as dishonest and has led to a general lack of trust in the aviation industry. The use of average noise metrics to provide information in "consultation" does not reflect the perception of community experience and generally does not reflect change of experience since the standard average noise metrics are insensitive to nuanced changes (that become regarded as insignificant in noise impact assessment and appraisal). Honesty in the negative as well as the positive outcomes, explained in ways that are understandable to all, transparent and reflect experience, together with the opportunity to affect decision outcomes (procedural fairness) can reduce the risk of unacceptability. This should include the implications for future growth to enable discussion and negotiation of mutually acceptable limits on growth.
  - Public engagement over ACPs, must allow for the presentation of a range of genuine options (i.e. ones that are operationally viable), where the consequences of each are presented transparently including explicit illustration of the pattern of increases and decreases in noise events. This will enable full scrutiny of all options, including any preferred by the airspace change sponsor, and empower communities to express their preferences. Providing opportunity for these preferences to influence the final decision over the selection of specific ACPs should enhance procedural and informational fairness, contributing to more socially acceptable outcomes and, over time, helping to rebuild trust in aviation authorities through demonstrably supporting social justice.
  - A Final Design Choice should emerge from the engagement process so that local people have had a genuine opportunity to influence the final outcome. It could be that the final design choice is different to the initial preferred option. This possibility is a critical factor in successful engagement.
  - Certainty over future impacts with growth should be negotiated as part of the engagement process that may allow for reasonable growth with guarantees around future impacts (expressed in understandable and relatable metrics) – for example a socially acceptable Noise Envelope.

Supplementary Framework Metrics

Focus Groups revealed that event-based metrics better reflect public perception and are more sensitive to nuanced changes than average noise level metrics and could be used to assess the risk factors described above. The primary metric for assessment of daytime implications, consistent with CAP1616 and used in the FGs, is the

N65 (the number of events with a maximum noise level greater than 65 dBA – see earlier for further description of this metric). Discussion revealed the importance of connecting N65 with population referred to as "Person Events" for which a metric already exists known as the "Person events Index" (PEI) which combines the NA (Number of events Above) with the population that experience that NA to produce an overall noise event load according to the formula PEI = NA x population. This can be calculated at any population centre by assigning a NA value to that point and multiplying it by the population at that point, to get an overall total, the PEI is summed across all the population points. For reasons outlined previously, the study used N65 for daytime as this seems to reflect the level at which there may be some interference with conversation outdoors and is also the stated NA metric in CAP1616.

The PEI concept was developed following public reaction to the opening of a new runway at Sydney Airport in the mid-1990s. Local communities claimed that the standard assessment approaches hid the fact that noise benefits were only achieved through concentrating aircraft noise on a small number of suburbs[18]. PEI was developed to more transparently describe and improve understanding of changes in distribution of noise burden arising from changes in flight paths that better reflected the lived experience. The metric was adopted for assessment of aviation noise in Australia and is described as "a tool to build public confidence in decision making processes through improving the transparency of conventional assessment approaches". Further information on PEI can be found in the "Going Beyond Contours"[19] and "Expanding Ways to Describe Aircraft noise"[20] discussion papers published by the Australian Government' Department of Transport & Regional Services.

The Focus Groups in the present study clearly indicated the utility of N65 in describing lived experience and frequently referenced population as an important factor – PEI, as an existing descriptor which combines these two key factors, has therefore been suggested as an objective measure to aid understanding the implications of design options on distributional fairness.

In the next chapter a framework to assess for the relative risk of social unacceptability of proposed airspace changes is developed using the N65 and associated PEI metrics identified here.

18 https://trid.trb.org/view/721025
19 https://www.infrastructure.gov.au/sites/default/files/migrated/aviation/environmental/transparent_noise/files/going_beyond_noise_contours.pdf
20 https://www.infrastructure.gov.au/sites/default/files/migrated/aviation/environmental/transparent_noise/files/sepb_discussion_paper.pdf

5 DEVELOPMENT OF A FRAMEWORK TO INTRODUCE FED CONSIDERATIONS INTO THE ASSESSMENT, SELECTION AND ENGAGEMENT OVER ACPS.

5.1 Introducing the approach

The present study has found, at least in the context of airspace change where there is an existing distribution of aircraft, that change in the spatial distribution of aircraft noise (events) lies at the heart of perceptions of fairness.

The *perception of fairness* is therefore bound up with the existing context, the change from what is happening at the moment (i.e. an existing distribution) and how that affects a perception and expectation of an area. In contrast, the idea of *equitable distribution* (in perhaps the traditional context of fair distribution) is seen as delivering a significant change and therefore not commensurate with fairness. This relates to the fairness of noise exposure itself - i.e. it is only fair if it is perceived that every effort is continually made to reduce that burden through technological advances and flight procedure improvements.

For informational and procedural fairness, potentially affected communities must be provided with information that is meaningful and relatable if they are to understand the implications of specific proposals from their own perspective, and so be able to determine which option(s) are most preferred (or at least those that are least unacceptable). Indeed, the findings from our Q study emphasise the importance attached to open, genuine and honest engagement with communities over airspace change (See Text Box 5.1). It is therefore essential that assessment of options considers not just aggregate consequences, but also spatial change in noise (ΔN65) and that potential consequences for people (ΔPEI for N65) are illustrated for each airspace change proposal.

What Q methodology findings tell us about informational and procedural fairness

The Q findings contribute to our understanding of a less risky (in terms of social unacceptability) future in which nuanced airspace change takes place. This would minimise the risks of certain perceptions amongst stakeholders of informational, procedural and distributional unfairness. By addressing the concerns that the Q findings highlight around each of these facets of fairness, the process and outcomes of airspace change may become more socially acceptable.

Each of the dimensions of fairness are listed below along with the perspectives expressed through the Q study:[1]

Informational

- There is a need for meaningful engagement, characterised by openness, genuineness, honesty and transparency.
- Communication of changes in the number of flights and their heights seen to help judge fairness of a potential change.

Procedural

- There must be a real opportunity for communities to have an influence over outcomes.

Distributional

- There is a need to understand the noise differences across various communities to appreciate whether an airspace change is more or less fair.
- There is a concern about impacts of airspace change in other communities, not just one's own.
- Airspace change should not result in new people being regularly overflown. However, there is a caveat that concedes that change may result in overflight of new people. In this case, regularity of overflight seems to be the issue of concern, pointing to the potential need for some element of respite in such a scenario.

Thus, Q appears to tell us that a better picture of airspace change would be one in which transparent and open communication about change, and the nature of such change, would be the norm. Processes and procedures for engagement would support and encompass true stakeholder influence over any change. Given that potential spatial noise impacts are of concern at the household and community levels and beyond, the better scenario would place distributional fairness at the centre of all considerations around airspace change.

1. Note: There were 3 discourses or perspectives revealed by the Q study. The reporting here pertains to common perspectives across all 3 of these groups.

Text Box 5.1 - Q Study findings on fairness

This chapter seeks to explain how insights into the distributional consequences of airspace change may be accomplished by using N65 and associated PEI metrics to describe the spatial patterns of aircraft noise before and after a proposed change. How airspace sponsors might incorporate this into the wider CAP 1616 policy-based aggregate assessment procedures (1) is illustrated in Figure 5.1. A supporting assessment such as that proposed herein should enhance perceptions of informational and procedural fairness by shedding light on the distributional consequences (2) of airspace change options when engaging (3) with potentially affected communities in decision-making in Stage 3 of the CAP 1616 process.

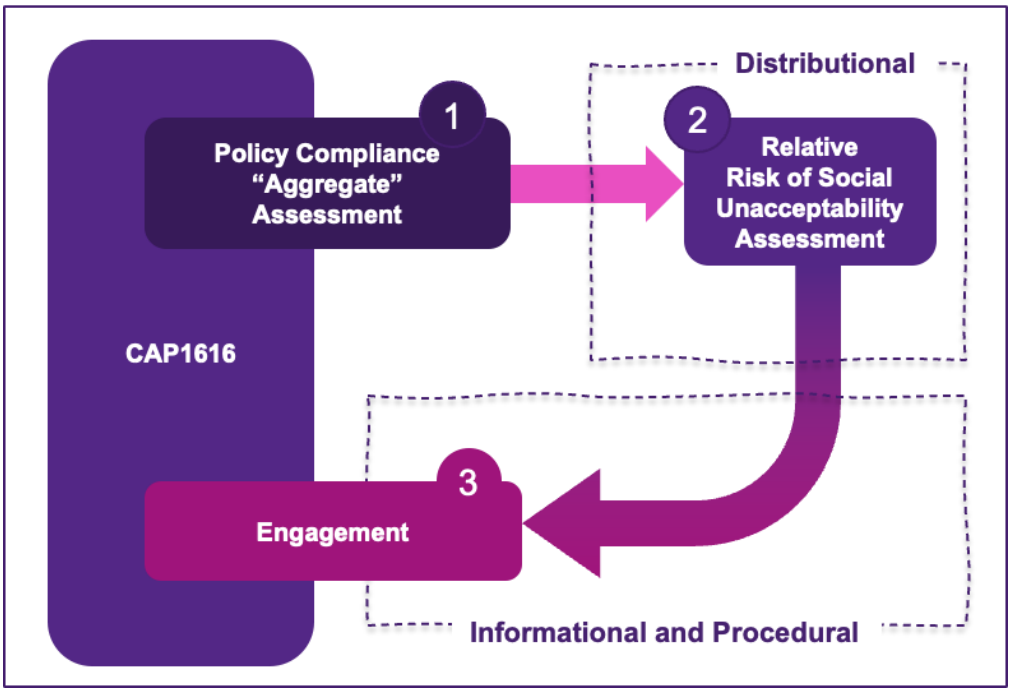


Figure 5.1 . How airspace sponsors might incorporate this into the wider CAP 1616 policy-based aggregate assessment procedures

To contextualise how N65 and associated PEI data could be used in a distributive fairness evaluation, the chapter takes a stepwise journey through CAP1616 procedures and FED2 findings, before proposing a suite of assessment tools to harness N65/PEI data to reveal information relevant to community concerns about the potential (un)fairness of airspace changes.

5.2 CAP 1616 context

CAP1616 provides the framework procedure for the redesign of an airspace. It provides a staged, structured and detailed approach through which design options are developed, appraised, assessed and consulted with stakeholders. The requirements for consideration in design are significant and wide-ranging (including safety, operational and efficiency through to addressing climate change and environmental concerns). Whilst not the only environmental issue considered, it is generally recognised that the implications of aircraft noise are often the most significant of the environmental concerns for local people.

Early in the process, airport sponsors are required to consult on the principles on which redesign are to be based, so that priorities can be established. From here a range of options are developed for individual routes that are appraised, these are whittled down from a long list to a short list through a series of assessment imperatives (which include operational, safety, efficiency, environmental). Those that emerge in a shorter list are combined to create airspace systems that are considered locally and with respect to their interaction with the airspaces of other airports and the wider network. Stakeholder and community consultation is embedded in the process at all stages. The Fair and Equitable Distribution (FED) research has considered the noise consequences

on the perception of fairness in the context of airspace redesign, rather than an entirely new airspace at a new airport.

From a noise perspective, the appraisal and assessment of noise implications are undertaken using aggregate, average type noise level metrics (such as the $L_{Aeq,T}$) consistent with the guidance of UK Aviation Noise Policy. CAP1616 states:

"The Government's noise policy is "to limit, and, where, possible, reduce the number of people in the UK significantly affected by adverse impacts from aircraft noise. For the purpose of assessing airspace changes, the Government wishes the CAA to interpret this objective to mean that the total adverse effects on people as a result of aviation noise should be limited and, where possible, reduced, rather than the absolute number of people in any particular noise contour."

To be consistent with this, priority should be given to reducing the total significant adverse impacts rather than the number of people who will experience aircraft noise. Therefore, from a noise perspective, it may on occasions be better to have multiple concentrated routes that share noise among more people, than a single concentrated route which affects fewer people but to a greater extent."

The implementation of an airspace system that fully harnesses the capability of PBN will mean that routes are flown more accurately and consistently, ultimately resulting in noise being concentrated in areas below route centrelines. 'Reducing the total significant adverse effects" could be achieved by pursuing an approach that concentrates aircraft over least densely populated areas, and so avoiding more densely populated areas (an approach that herein is referred to as 'concentrate and avoid').

Focusing on the aggregate impacts lacks consideration of the changes in distribution of noise, the consequences of concentration for the smaller number of people (and possibly new people), the implications for change of expectation of land-use and the perception of the changes by the broader population. Whilst Government policy does not specifically seek to minimise the impacts of noise, but to limit and where possible reduce,assessments will often find the "best" outcome being the one with the least overall impact of the options available. This would likely arise from following a 'concentrate and avoid' type approach. However, this approach has generally resulted in significant adverse reaction from local communities.

It is noted that the policy allows for the scope to disperse this concentration over wider areas through the use of multiple concentrated routes if this results in reduction in the total adverse effects on people. It is also worth noting that CAP1616 suggests that an approach that prioritises the most policy optimal outcome may not be the best in all situations:

"Rather than a 'one size fits all' approach to whether single or multiple routes are better, sponsors must_ consider the impacts of different options and decide what will work better in a given situation. These decisions should be informed by considering the anticipated noise impacts, and through engagement with communities."

CAP1616 requires all airspace change proposals to be subject to a sustainability appraisal using TAG. This approach favours options with the highest net benefit when considered in an overall aggregated manner. The distribution of that change has no influence on the outcome of that assessment. Consequently, a preference for the outcome that has the minimum overall effects, again likely with a 'concentrate and avoid' approach, will generally be favoured regardless of where the changes occur.

5.3 FED2 Study Context

The FED2 Study found that the concept of "Fair Distribution" in the context of airspace change does not appear to be related to equitable distribution, or sharing, of aircraft over an area or population so that "noise" is "evenly shared". Rather, the perception of fairness among communities around Gatwick Airport appears to stem from minimising the change in the spatial distribution of the existing noise load whilst delivering noise reduction through technology and flight procedures to reduce noise on those who are overflown.

The Focus Group research revealed a hierarchy of risk factors that affected how changes to the spatial distribution of aircraft and associated noise burden arising from airspace change proposals might be viewed as more or less (un)fair and linked this to the risk of socially unacceptable outcomes in Figure 4.10. This hierarchy of risk factors is illustrated in Figure 5.2.

As identified previously, minimal change to the pattern of sharing of the noise has been found to represent the lowest risk to social (un)acceptability. The principal approach taken in airspace modernisation is to harness the accuracy of PBN to deliver concentrated flight paths that can be flown predictably and consistently. The present study has shown that this increases the risk of socially unacceptable outcomes. Relative risk was generally found to increase when new people are exposed to noise that contrasts with their expectation and existing experience of aircraft noise.

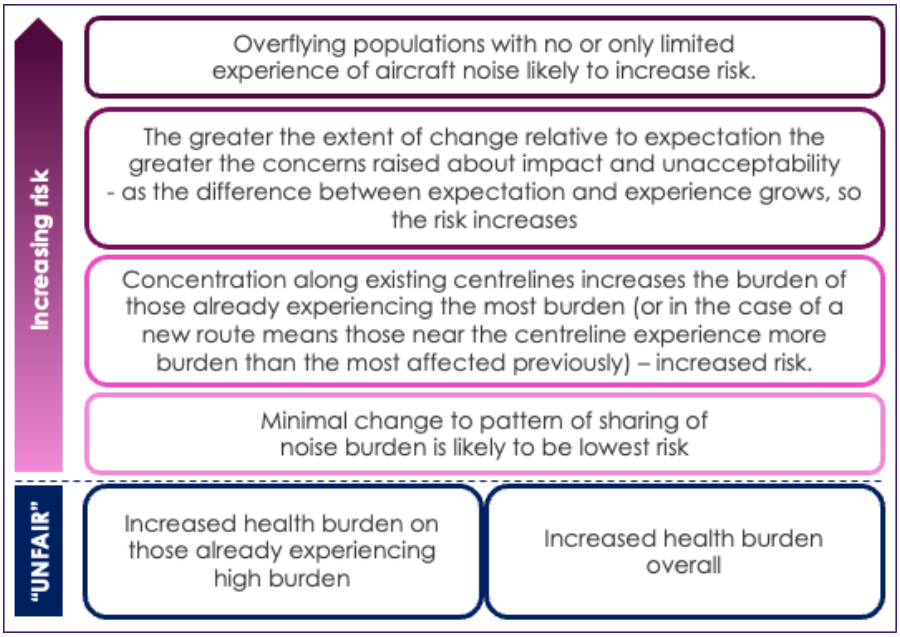


Figure 5.2 Hierarchy of relative risk of unfairness

This hierarchy underpins the development of the framework presented in the next section.

5.4 A Framework for assessing and communicating the distributional consequences of airspace change proposals

In this section, a means of illustrating and assessing the distributional consequences of airspace change proposals is described. This framework and the steps involved are explained by reference to three airspace design concepts:

- Minimal change – the option that represents the minimum change to routes within the constraints of the PBN technology from the existing structure.
- Minimise population exposed – adopting an approach that seeks to actively concentrate flight paths and avoid population by introducing a new route.
- Sharing – an option that seeks to share aircraft across two areas.

It should be noted that all the concepts considered are based on high-accuracy PBN principles that will concentrate aircraft on the flightpaths which, as per the hierarchy, would likely increase relative risk. But, as this is considered the starting point for airspace design, it is most relevant.

The framework follows 10 fundamental steps that contribute to understanding distributional fairness (2) and enhancing informational and procedural fairness (3) to support sponsors during the CAP1616 process as presented in Figure 5.1 previously. These Steps are summarised in Figure 5.3 below and described in more detail in the following sub-sections.

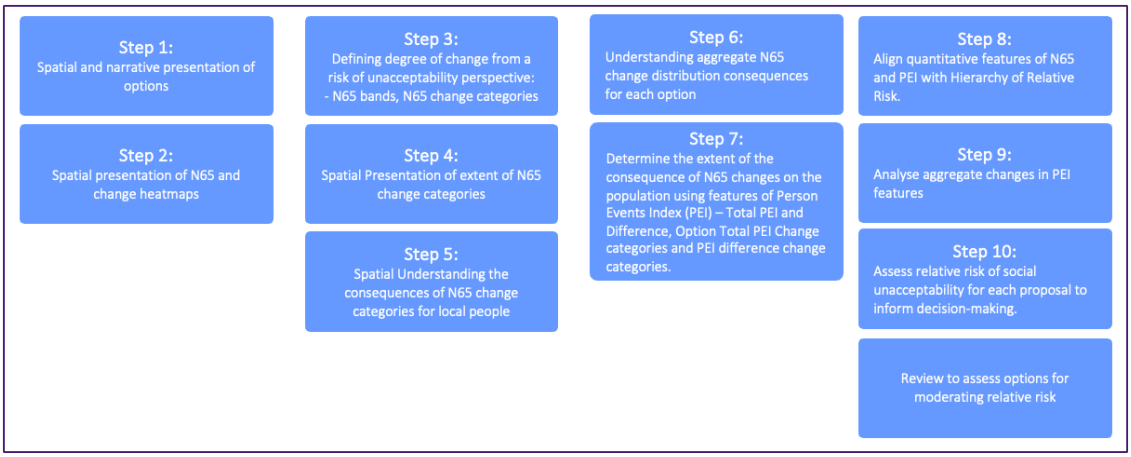


Figure 5.3: Framework for improving understanding of noise distribution consequences arising from airspace change proposals and relating this to relative risk of social unacceptability.

The aim of the framework is to support sponsors during the CAP 1616 process by providing insights into the noise distribution consequences of ACPs and thereby assist in their shortlisting and presentation to communities, facilitating negotiated outcomes that could potentially *reduce* the risk of socially unacceptability.

STEP 1: Spatial and Narrative Presentation of Options.

The first step is to illustrate the options and provide an explanation of the basis for these options. An example illustration is shown in figure 5.4 for the three concepts outlined above.

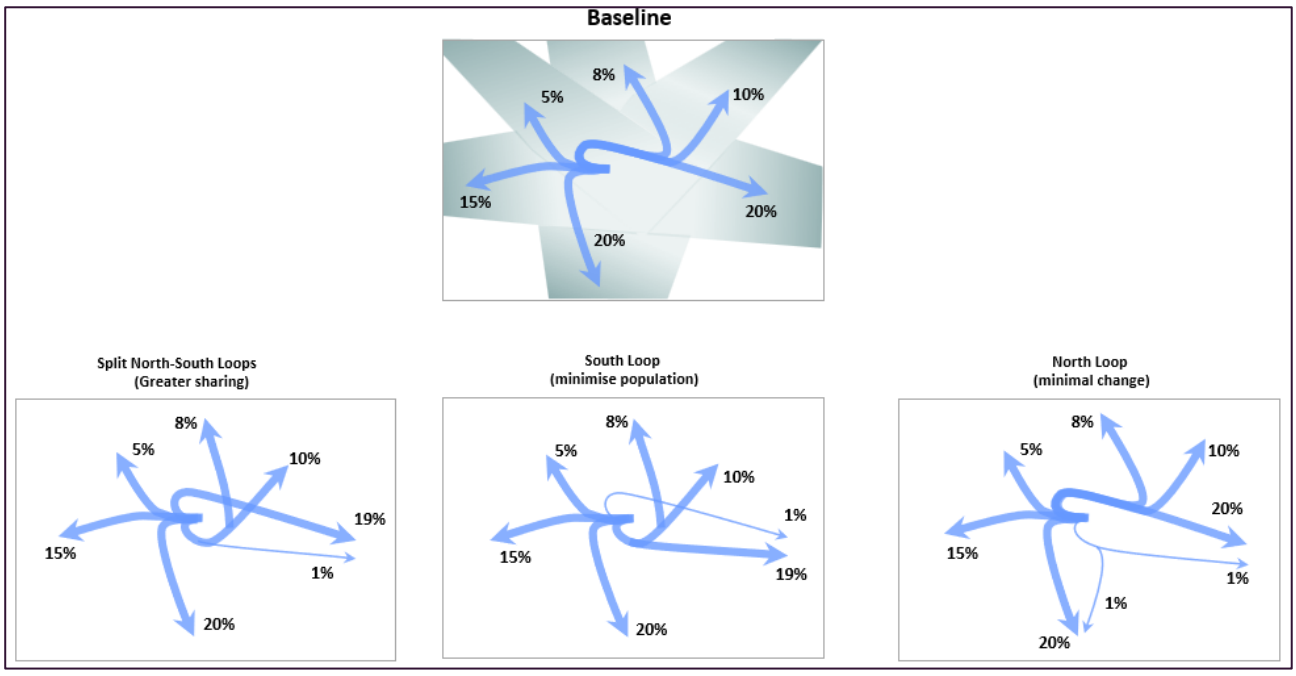


Figure 5.4: Airspace proposal illustrations with key goal intent (baseline at the top)

STEP 2: Spatial Presentation of N65 and N65 Change Heat Maps

The second step is to illustrate the N65 spatial distribution for each of the options (and the baseline) and N65 change heatmap (relative to the baseline case). This is to simply illustrate the spatial pattern of noise events and change. Examples of 16h daytime N65 noise exposure are shown in Figure 5.5. The banding for colours in Figure 5.5 N65 illustrations could use the banding structure adopted as part of Step 3 (Figure 5.6).

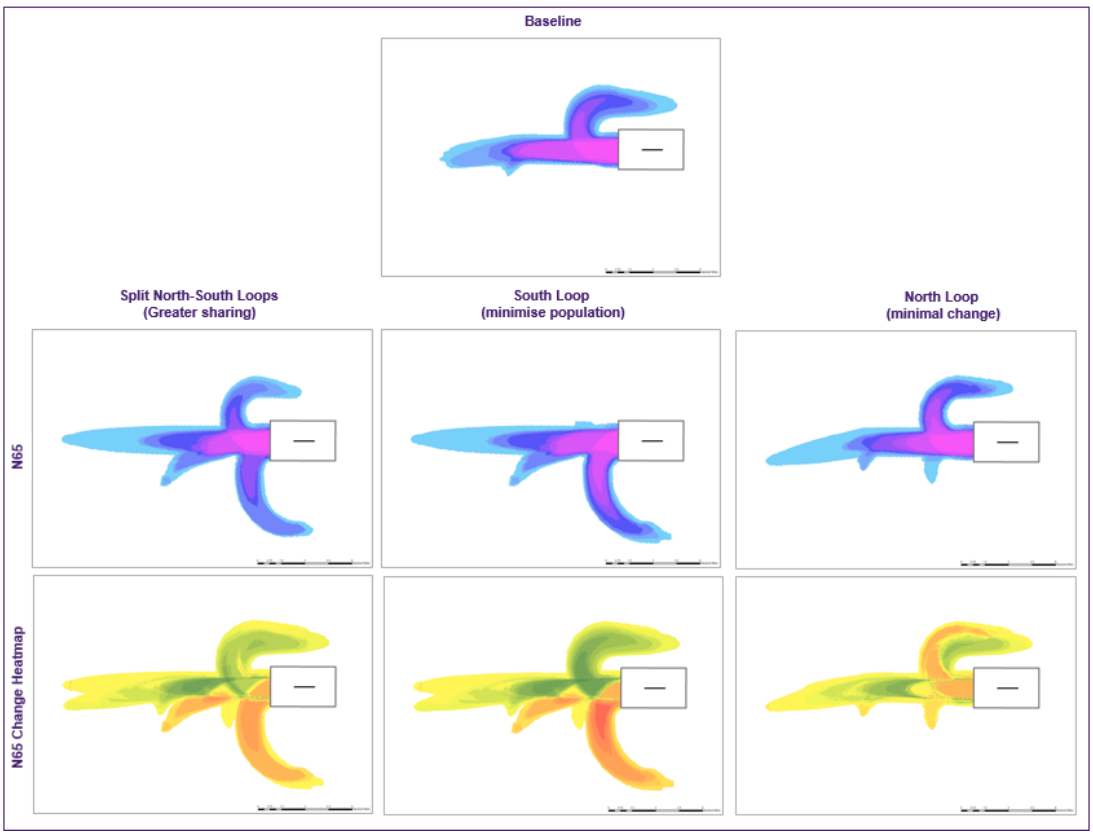


Figure 5.5 Spatial presentation of N65 and N65 change heatmaps.

STEP 3: Describe the degree of change from a risk of unacceptability perspective.

In this third step, N65 is characterised into meaningful and relatable bands and N65 change related to movements between bands to illustrate the degree of change.

Characterisation of N65

Given the apparent value to communities of the N65 metric to enhance informational fairness, a scale of N65 bands is proposed (presented in Figure 5.4) based on the experience of aircraft events, ie. on average the number of events above N65 per period. For example, in a 16 hour period N65>4 is equivalent to 1 aircraft event every 4h and N65 >64 to at least one every 15mins etc. This is considered more meaningful than using bands based on a standard decimal system of 10, 20 etc which is often how N-above are characterised. This proposed banding could be adapted at each airport to reflect the local operation.

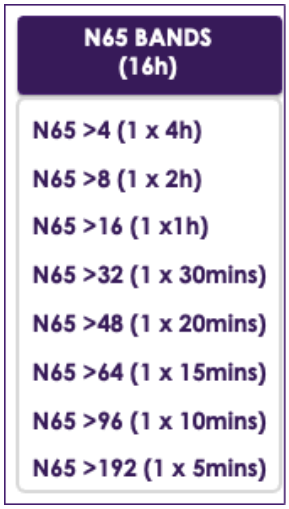


Figure 5.6: N65 Change Bands

Appropriateness of N65 in the local context

There are many N-above metrics that could be applied, N65 was chosen and used in the focus groups to illustrate the noise implications of design concepts because it is the UK Government's preferred "number above metric" when taking into account adverse effects (Air Navigation Guidance (section 3.11 as below) , and is therefore included in CAP1616 as the preferred supplementary metric without necessarily indicating how it should be used. The framework provides airports with an approach to using number above metric to explain change and consequences.

> *"For communities further away from airports that will not be affected by noise above the lowest observed adverse effect level (LOAELs) identified above, it is important that other aspects of noise are also taken into account where the total adverse effects of noise on people between different options are similar. Metrics that must be considered for these purposes include the overall number of overflights and number above metrics: N65 for daytime noise and N60 for nighttime noise"*

The study noted the limitations of the N65 metric (and indeed any threshold-based metric) - there will be some aircraft where the L_{Amax} is just below 65 dB and these would not count in this total, and there are some aircraft that would produce noise considerably higher than this and these would count the same as an aircraft just over 65dB and so the degree of noisiness is not considered. To help understand this point, consider two airports with 100 movements across a 16h day but different fleet mix. At Airport 1, a community has N65 = 0 (suggesting no noise) and Airport 2, at a location the same distance from the runway, has N65 = 100. At airport 1 all aircraft had a maximum noise level of between 64.0dB and 64.5dB, whereas at Airport 2 all the aircraft had a maximum noise level of between 65.0dB and 65.5dB. Perceptually there would be no difference experienced, but the metrics would be indicating a completely different experience.

Whilst recognising this limitation, airspace sponsors should validate, using existing (baseline) noise data, the use of chosen N-above metric(s). To do this we recommend developing L_{max} event distributions at a number of community locations to understand the range of noise events currently experienced. In early consultation noise events in the surrounding area should be recorded and played back to the consultees so that the N65 metric can be explained in real terms.

It may be the case that at other airports and the nature of the air traffic and the distribution of the population that other thresholds might be more appropriate to capture critical changes. It may therefore be appropriate to use a range of measures such as N60, N65 and N70.

It should be noted that for night-time the preferred measure would be the N60 over an 8h period.

Characterising N65 Change

Five bands of N65 change have been developed to enable greater understanding of the distribution of change arising from a design. These are summarised together with the definitions currently adopted to enable calculation of the populations exposed to this degree of change. Population can then be summed for each category.

The general premise around the bands – banding reflects an expectation that for those populations with a smaller number of events a smaller change could be more noticeable/impactful as the proportional change will be greater than for the same change with higher numbers of events.

N65 Change Characterisation	
NEW (N65new)	**NEW (N65new)** Baseline N65 = 0 or N65 <4; increasing to N65>8, and an increase in average noise of at least +3dB LAeq.
INCREASE (N65+)	**INCREASE (N65+)** N65 band increases by at least 1, with an N65 increase of at least 8 or +45% (i.e. an increase of at least 1 aircraft every 2h)
NO CHANGE (N65nc)	**NO CHANGE (N65nc)** No change N65 band OR Band change +/- 1 with N65 change <+/- 8
REDUCTION (N65-)	**REDUCTION (N65-)** N65 band goes down by at least 1,N65 reduces by at least 8 or -33% (i.e. a reduction of at least 1 aircraft every 2h)
REMOVED – (N65rem)	**REMOVED – (N65rem)** N65 band goes down to Zero and N65 <=3, N65 >=4 in baseline,

Figure 5.7 Characterising N65 Change

Note: Change category criteria should be validated before formalising the analysis using spatial presentation to identify outliers or oddities in the allocation of these categories.

STEP 4: Spatial Presentation of N65 change categories

To provide local people with an informed understanding of the wider consequences of proposals the N65 change bands can be presented spatially, as illustrated in Figure 5.8. below. This enables understanding of the extent and area of changes.

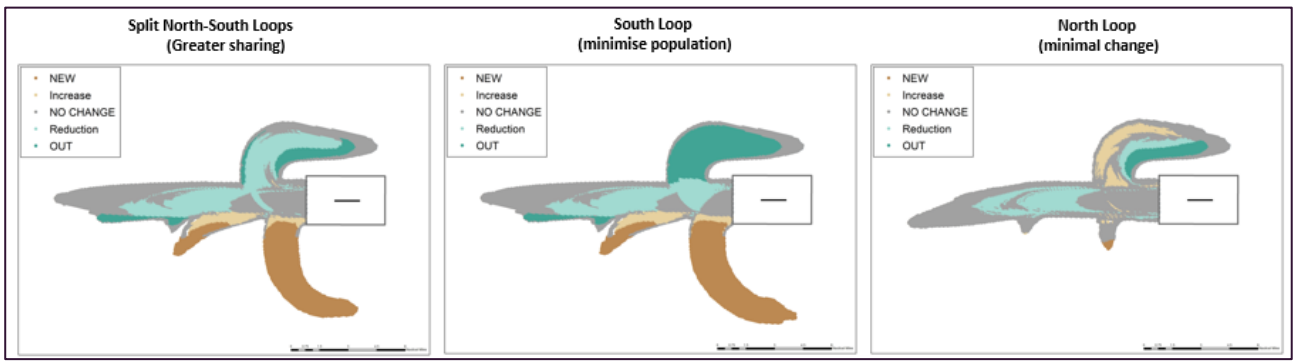


Figure 5.8 Spatial presentation of N65 change categories

STEP 5: Spatial Understanding the consequences of N65 change categories for local people

The above illustrations enable informed understanding of the spatial implications of proposals. The next step is to consider the implications for local people – change categories can be presented at postcode points using GIS which can be used to identify community specific implications of change proposals and together with population at each postcode point can then be used to identify aggregate populations for each change category. Figure 5.9 illustrates the conversion of Figure 5.8 to postcode points to enable community level understanding of consequences.

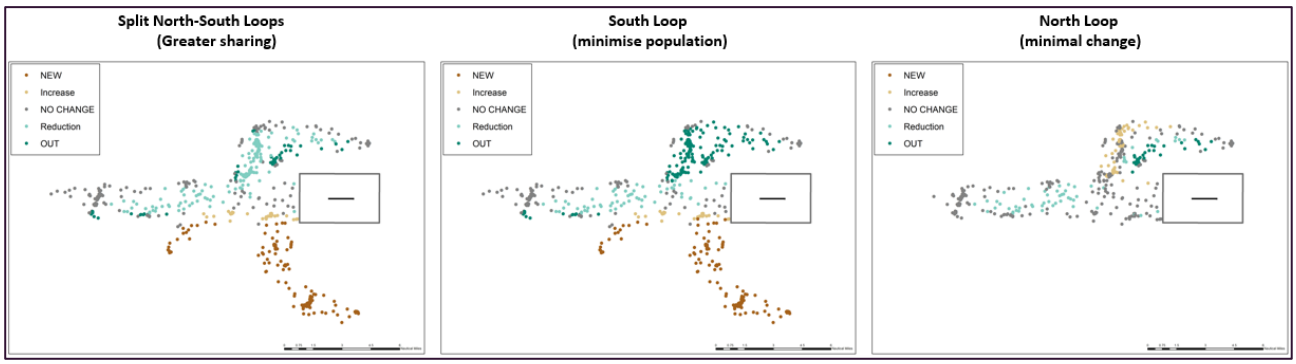


Figure 5.9 Spatial presentation of N65 change categories at postcode points

Step 6: Understanding aggregate change consequences of airspace proposals

Summing the population for each noise change category and then presenting as a column chart to illustrate relative population in each change category provides greater understanding of the distribution of the consequences of proposals for the population as a whole. Figure 5.10 illustrates a way in which this could be presented.

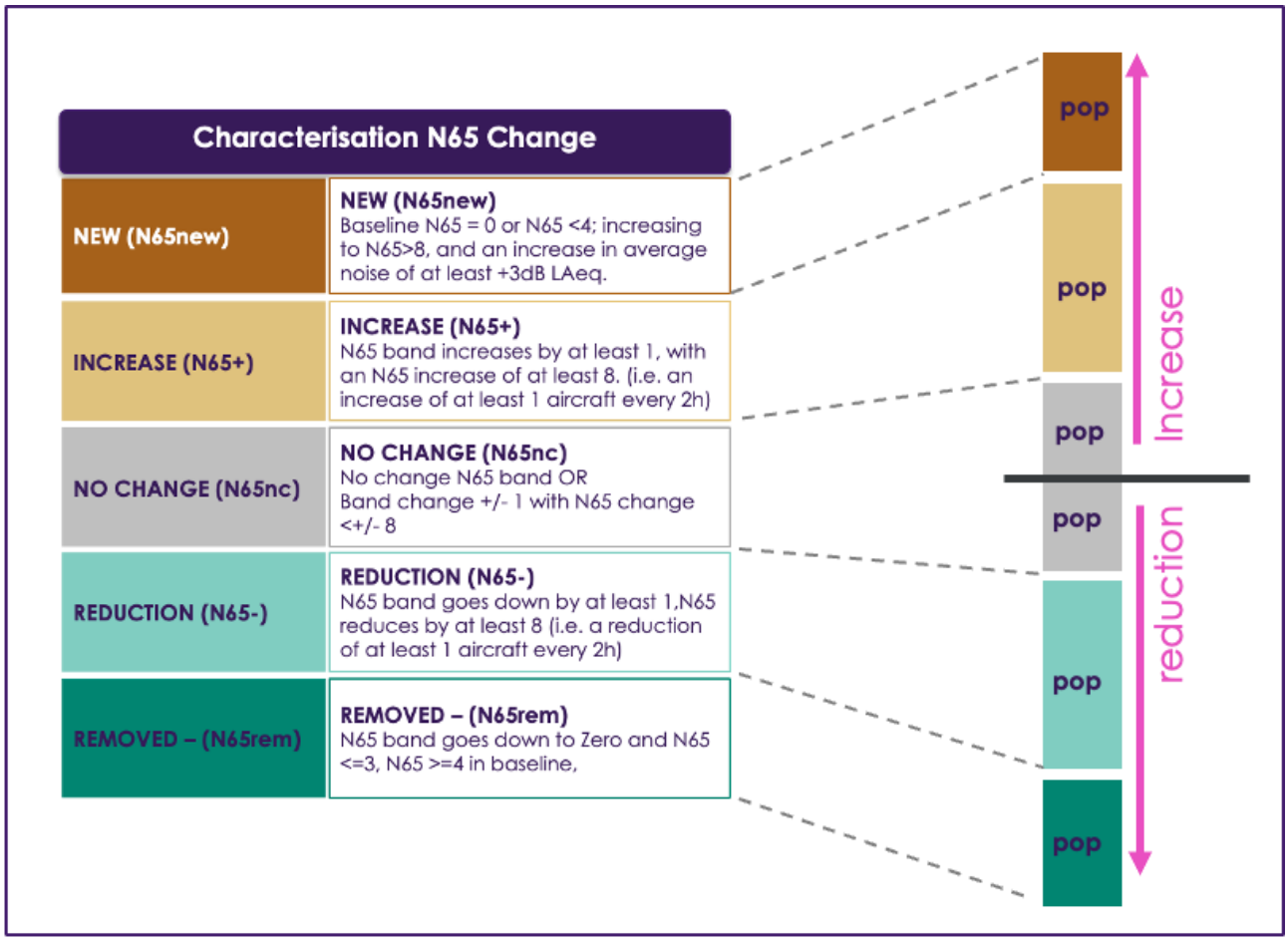


Figure 5.10 Considering Aggregate Consequences - Population and N65 change category

STEP 7: Determine the extent of the consequence of N65 changes on the population using Features of Person Events Index (PEI)

The present study highlighted the importance of the concept of "Person-Events" suggesting merit in the incorporation of the Person-Events Index (PEI) in the evaluation of relative risk. PEI brings together events and population to quantify noise load, change and distribution.

"The PEI allows the total noise load generated by an airport to be computed by summing, over the exposed population, the total number of instances where an individual is exposed to an aircraft noise event above a specified noise level over a given time period……

For example, if a departure off a specific runway at an airport by a particular aircraft type leads to 20,000 persons being exposed to a single event noise level greater than 65 dB(A) then the PEI(65) for that event would be 20,000. If there were a further similar event the PEI(65) would double to 40,000 since there would have been that number of instances where a person was exposed to a noise level louder than 65 dB(A)). The PEI is therefore expressed by the following formula

$$PEI(x) = \Sigma P_N \; N$$

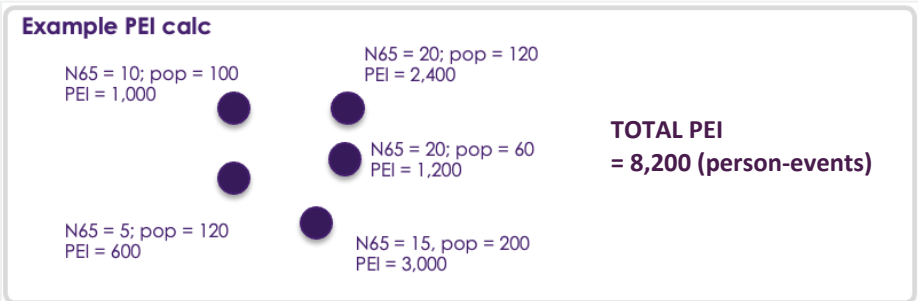
where x = the single event threshold noise level expressed in dB(A)

P_N = the number of persons exposed to N events > x dB(A)

Text Box 5.2: Explaining Person Events Index.

Adapted (with PEI(65) replacing PEI(70)) from Expanding Ways to Describe and Assess Aircraft Noise. Discussion Paper. Australian Government. Department of Transport and Regional Services.

In this framework PEI(65) has been adopted which is the sum of N65 x population at any given population point and calculation is illustrated in the box below. Where PEI is used throughout the report it is referring to the PEI(65). It should be noted however that if an alternative N-above is adopted then the PEI(N) would also change.



Analysis and presentation of the spatial population & distribution change features of N65 and PEI can provide enhanced understanding of the change in overall noise load with airspace proposals – the PEI features can provide objective assessment of risk factors associated with distributional fairness in terms of overall noise load.

In the **first** instance, combining N65 with population enables greater understanding of differences in overall noise load (i.e. comparison of **total PEIs**). Figure 5.11 shows the **difference in PEI by comparing total PEI of baseline with the Option** being considered.

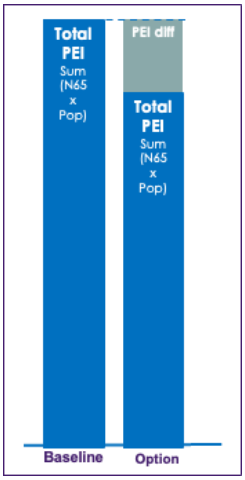


Figure 5.11 Total PEI and Total PEI Change Comparisons with Baseline

The **second PEI feature** is arrived at by combining the N65 change categories with population at each postcode point, providing further understanding of the aggregate consequences of the change which can also then be included in the objective assessment of risk factors associated with distributional fairness. Multiplying the N65 and the population for each point in each change category for the Option provides the PEI for each change category. This is illustrated in Figure 5.12, highlighting how the distribution of PEI across the categories of change contributes to the total PEI for the Option.

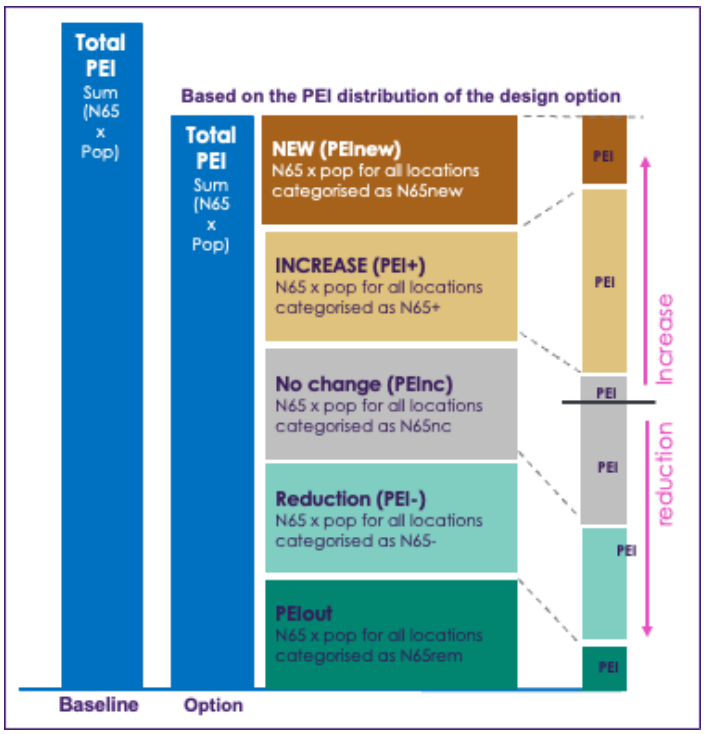


Figure 5.12 Understanding the distribution of change

Categories based on Option Total PEI

The **third PEI feature** focuses on the quantification and distribution of the difference in total PEI (PEI diff) between categories of change. This is achieved by multiplying the change in N65 at each postcode point by the

population therein and is illustrated in Figure 5.13. The value of this assessment is that it sheds light on the PEI difference (both increases and decreases) experienced within each change category (rather than only the PEI outcome) as a result of the shift from baseline to the option being considered.

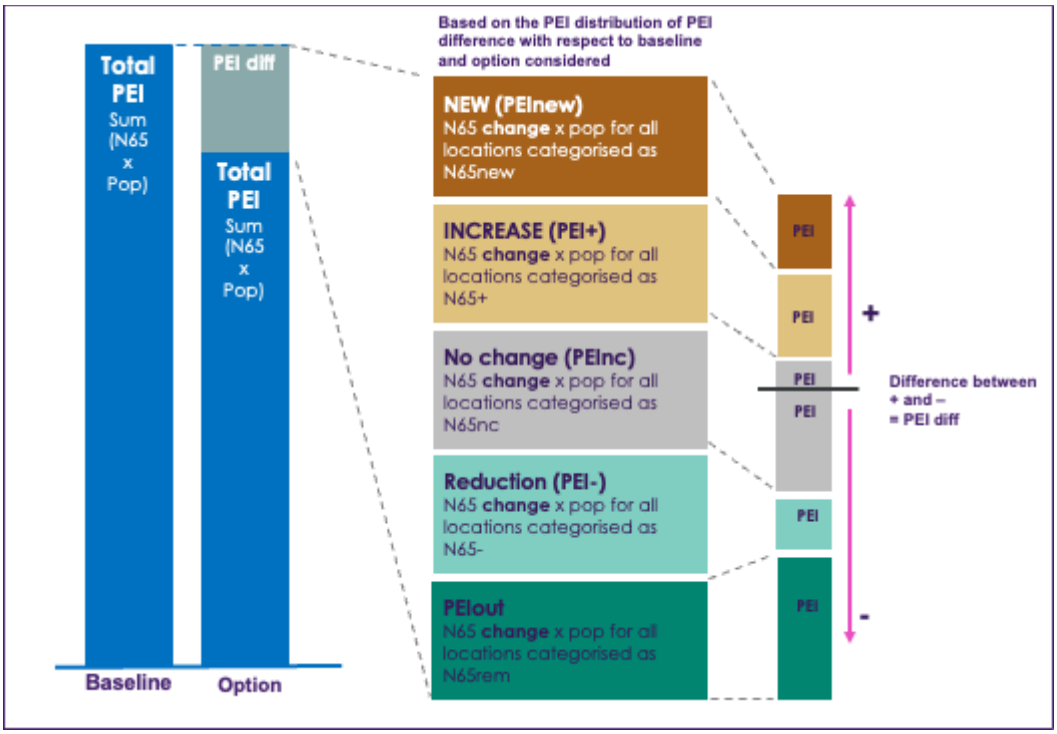


Figure 5.13 Understanding the distribution of change categories based on PEI difference between baseline and option

These three PEI features help explain the aggregate, distributional consequences of changes from design proposals for local people. PEI could therefore also be used to highlight the extent and consequence of concentration or sharing regimes – providing the basis for transparent and comprehensive engagement with populations potentially affected by ACPs.

Summing relative changes can provide greater understanding of how options change the distribution of the noise load and therefore informs relative risk of socially unacceptable outcomes (rather than the more binary outcomes of quantitative, absolute assessment of options).

Thus, combining N65 totals and differences with population data to determine Person Events Index and associated changes sheds light on the costs and benefits of alternative options for the distribution of aircraft and thereby informs relative risk of distributional fairness.

STEP 8: Aligning Quantitative Features of N65 and PEI with the Hierarchy of Relative Risk

The attributes of the hierarchy of risk presented in Figure 5.2 have been interpreted into dimensions using N65 and PEI change. Based on the fairness outcome being to minimise the change in the distribution of noise (as

establish through FGs with communities around Gatwick Airport), the following characteristics have been identified:

- Risk is minimised by maximising "PEI no change"
- Risk increases with increases in overall PEI; the risk reduces with greater PEI reduction, recognising that how this is achieved might influence perceptions of risk (i.e. for the same NET PEI the risk is likely to be greater if this is achieved with larger PEI- and PEI+ values indicative of more extensive change in the noise environment).
- There is an increased risk with increasing PEI+
- Increased risk with increasing population of N65+
- Increased risk with increasing PEInew

To objectively assess risk, these can be translated into the following specific quantitative N65, PEI and PEI change features:

- Minimise the population in N65 change increase categories (i.e. N65+ and N65new)
- Maximise reduction of NET PEI (representing the greater overall reduction in overall noise load).Maximise PEInc (representing that minimising change in distribution of noise burden is considered least unfair).
- Minimise PEI+ (representing that in the context of changing distribution that it is less unfair to increase noise for those already exposed – but recognising that inevitably there will be some for whom noise burden increases - but the smaller this is, the less likely it is to be seen as unfair)
- Minimise PEInew (reflects the perception that there is greater risk with overflying areas with little or no previous experience of aircraft overflight)

This is summarised in Figure 5.14 .

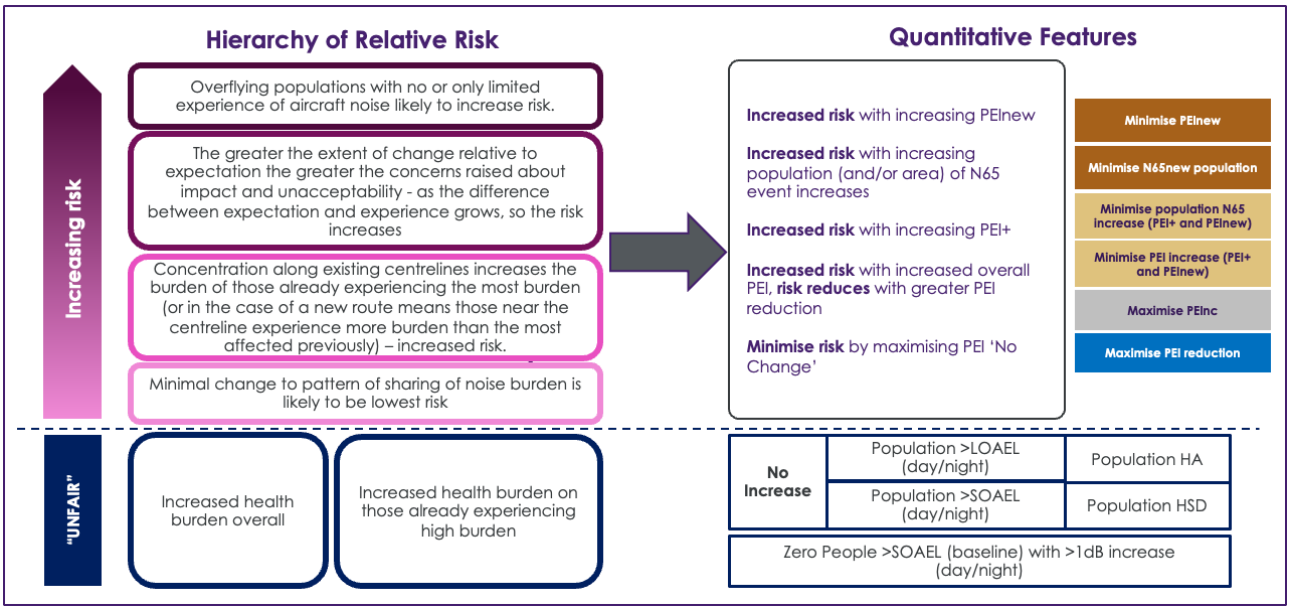


Figure 5.14: Aligning quantitative features with the hierarchy of relative risk.

Further analysis would be required on the implications for AONB or other areas where there are specific characteristics of concern for local people. However, these are considered to be secondary to population factors.

Direct engagement with local stakeholders early in the process should be used to confirm the relative importance of various factors – the quantitative metrics can then be suitably (re)aligned.

STEP 9: Analyse the aggregate changes for each proposal

Steps 5-7 provide an understanding of the metrics and how they can be used to illustrate aggregate distribution of changes, Step 8 demonstrates how the hierarchy of risk can be interpreted using quantitative features of these metrics. In Step 9 these are combined and analysed by reference to the illustrative examples first presented in Figure 5.4. Two methods for describing the change in distribution of the noise load have been proposed – the first is using spatial distribution of N65 categories (see step 4 and 5); the second using an approach that describes, in aggregate, the extent of change within each N65 category based on the populations affected, the outcome total PEI and PEI difference (steps 3, 6 and 7). Using both PEI measures overcomes the limitation of each one. As "Outcome" PEI which under illustrates the extent of reduction in N65; whereas "PEI difference", which highlights the extent of reduction in PEI in areas experiencing reduced N65 events, under-represents the no change category (number of event changes are small).

Figures 5.8 and 5.9 presented the distribution of the noise burden across the population by N65 category, which can be aggregated as illustrated in 5.10 and represented for the three options under consideration in Figure 5.15a. Figure 5.15b below illustrates the aggregate analysis of the PEI features identified in Step 7 i.e. the extent of change of PEI for each N65 category.

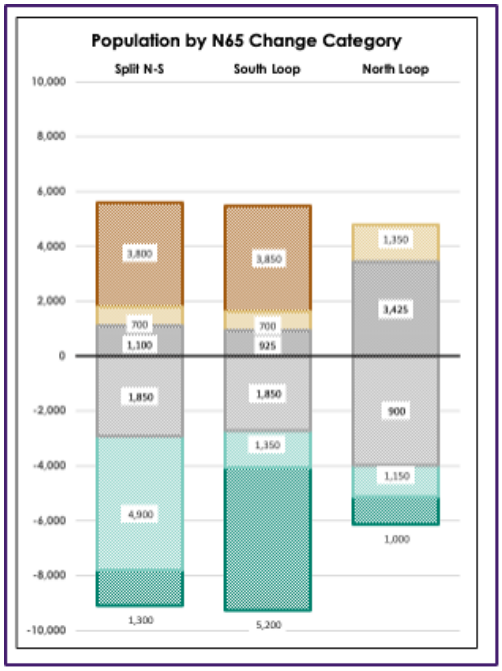


Figure 5.15a Analysis of N65 Features – Population by N65 change category in the Option

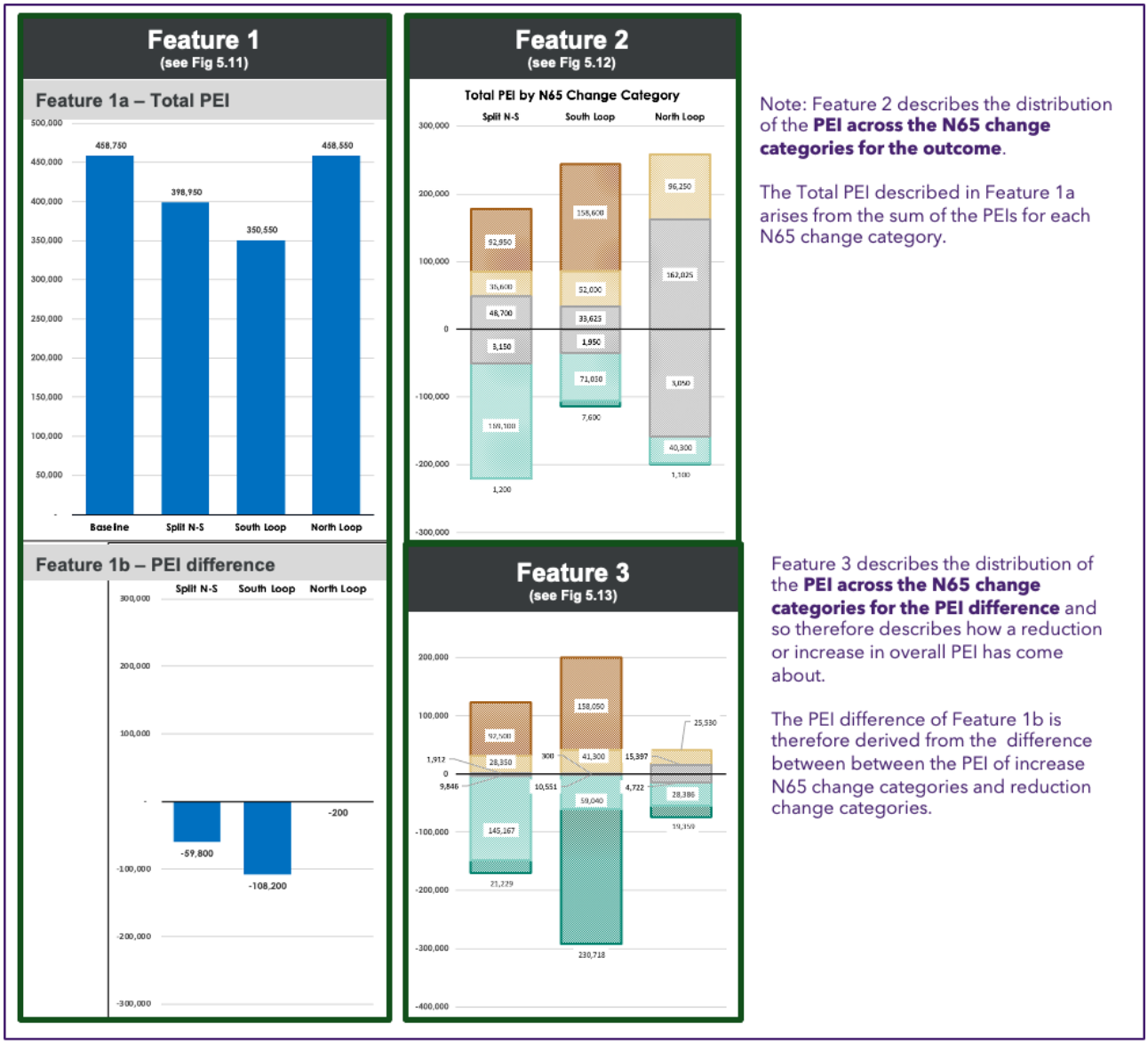


Figure 5.15b Analysis of PEI Features –

PEI Difference, Option Total PEI by N65 Change Category and PEI Difference by N65 Change Category.

These illustrations provide insight into the consequences of the options first described in Figure 5.4, the rationale behind which was to move some (Split N-S), or all (South Loop), of the traffic to the north onto a southerly route overflying less densely populated areas. The following is noted:

- As expected, this results in a reduction in the total population experiencing increases in N65 events compared that experiencing decreases in N65 events (i.e. populations above and below the line respectively in Figure 5.15a). Representing a lower overall PEI for both the Split N-S and South Loop options compared to baseline which shows up in the negative PEI differences (Feature 1b Figure 5.15b).
- However, when the distribution of population among N65 change categories is examined the scale of the newly overflown population is revealed for both options that include a southerly loop option (Split N-S and South Loop in Figure 5.15a) with the PEI by N65 change category and PEI difference by N65 Change category further revealing the greater burden on the newly overflown when all (South Loop) rather than half (Split N-S) the traffic is placed on the south loop (Features 2 and 3 in Figure 5.15b).

- On the other hand , maintaining traffic on the existing route (North Loop) within the confines of what is possible using PBN, results in a only a marginal reduction in overall PEI, but communities experience much reduced relative change compared to baseline, reflected in the large populations (Figure 5.15a) and PEI outcome values in the no change categories (Figure 5.15b Feature 2) and the small PEI differences in all N65 change categories for North loop (Feature 3 in Figure 5.15b)

Thus, the distribution of population across N65 change categories and the associated PEI features quantify the extent of change for populations affected by all options with the relative risk of social unacceptability increasing with the transition from the North Loop option to the Split N-S and then the South loop.

This analysis is then placed within the Hierarchy of Relative Risk (Figure 5.14) in Step 10 to assess overall performance of each of the proposed options.

STEP 10: Assess relative risk of social unacceptability for each proposal to inform decision making using the hierarchy of risk.

The final step is to contextualise the relative risk of each proposal to inform decision making. Figure 5.16 illustrates a two-part assessment: The first part requires an evaluation of whether the outcomes of the option would be considered "unfair" (1); the second considers the relative risk with reference to the quantitative features of population and associated PEI derived from the Hierarchy of Risk (2) illustrated in Figure 5.14.

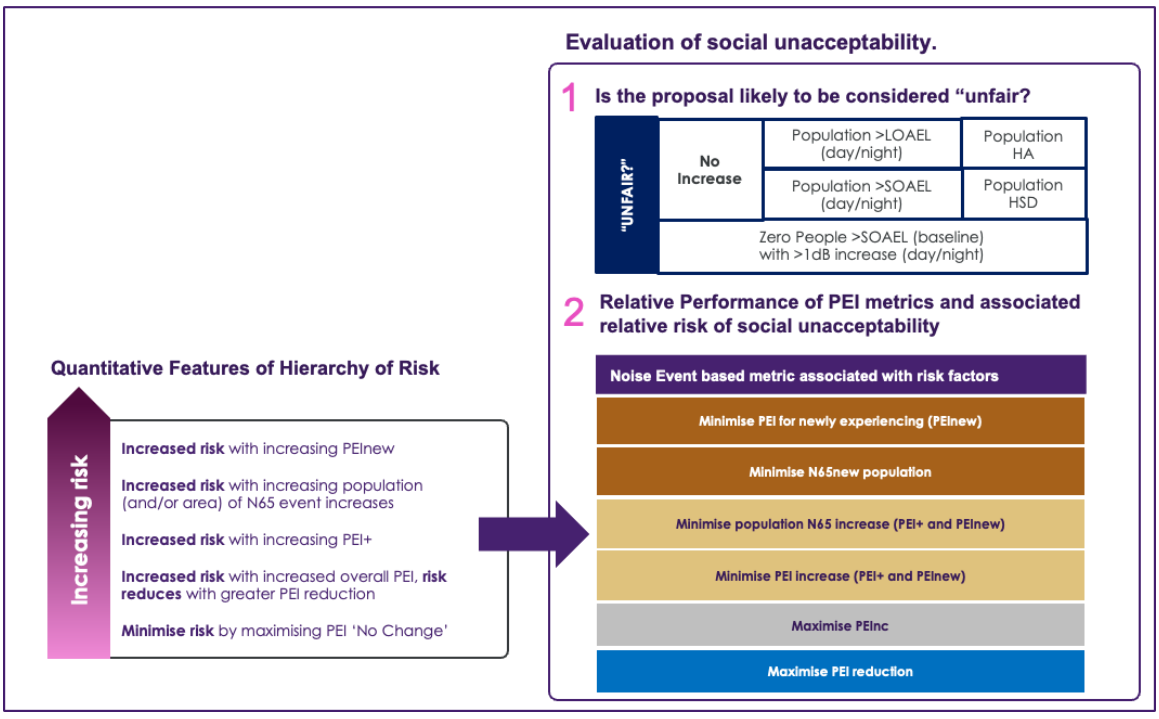


Figure 5.16: Contextualising risk of social unacceptability to inform decision-making

Part 1 – Assessment of likelihood of being considered unfair.

Figure 5.17 below illustrates a proposed presentation of results comparing the options with the "unfair" criteria. In all cases none of the criteria are failed. It is considered that there is no need to present the detail, but to

present pass/fail outcomes or some form of relative indication. Thus, in the population >LOAEL row it can be seen that there is a bigger “reduction” with the South Loop than the Split North-South Loop indicated by larger font size.

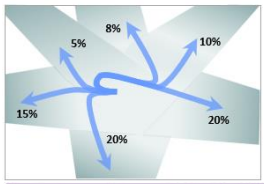
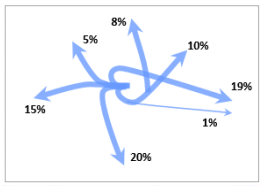
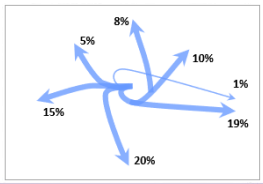
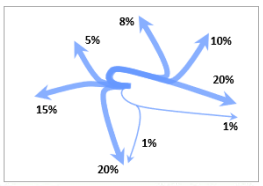
Baseline			
			
Test	**Split north-south**	**South Loop**	**North loop**
Population >LOAEL	reduction (-)	**Reduction (--)**	No change
Population >SOAEL	No change	No change	No change
Population > SOAEL in BL with >1dB change	zero	zero	zero

Figure 5.17 Assessment of Likelihood of being considered “Unfair”

Part 2 – Assessment of relative risk of social unacceptability

Figure 5.18 below presents the relative performance of considered options on each of the key population and PEI metric risk factors identified in Figure 5.16 (2) - see Step 9 above. This relative performance can be used to better understand the relative risk of social unacceptability of each option. It should be noted that this relative performance does not imply an absolute level of risk, i.e. the "best" performing option does not mean there is no risk – where there is a change in airspace and operation there is an inherent risk that the resultant change could be considered socially unacceptable, this is to illustrate relative risk. There are many ways to visualise the relative performance of options being considered, this is presented as an example.

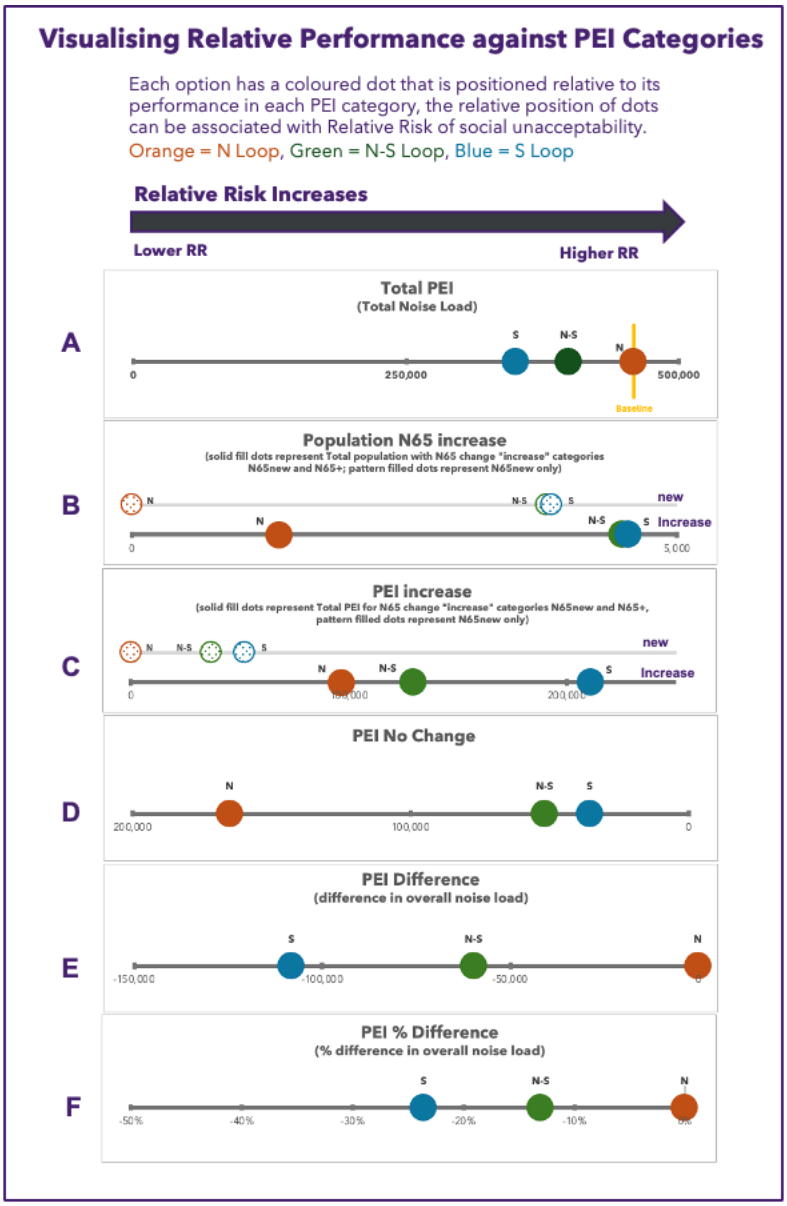


Figure 5.18 Assessment of Relative Risk

The above figure demonstrates that it is possible to illustrate the relative performance of a group of airspace change options against categories of N65 and PEI metrics. This can then be linked to the relative risk of social

unacceptability assuming dialogue with local communities has identified a preference for a particular pattern of noise/aircraft movement distribution. In the case of Gatwick Airport focus groups, as highlighted in the previous chapter, a clear preference for minimal change was identified resulting in the association with the relative risk of socially unacceptable outcomes illustrated in Figure 5.18. Such illustrations should help clarify the nature of changes to the noise environment resulting from specific ACPs and thus facilitate more comprehensive and transparent engagement communities over airspace change decisions.

It should be emphasised that the options with highest risk should not be discarded, or that the lower risk options should be considered preferred. Having considered relative risk it is recommended that mechanisms be considered for moderating the risks of each proposal. Figure 5.19 presents some questions that could be considered to elucidate potential means to moderate risk.

1) Can some form of limited sharing be applied to allay concerns of concentration e.g. by reducing precision of route design? Reduce Risk.

2) Could aircraft be spread among populations currently experiencing some exposure to allay concerns over the extent of difference against expectation? Reduce Risk.

3) Could new routes be added to share over a wider area? New routes increase sharing could increase risk, but merits of this were expressed for overall fairness and so this could reduce risk depending on other factors

4) Could an operating pattern be provided that could deliver some form of respite or relief to mediate the risk from wider sharing with new routes? (Negative consequences when the new route in operation must be acknowledged.)

5) With new route structure, could some of limited sharing be provided to reduce the risks of heavy burden with concentration.

6) With new route structure, could wider sharing (more routes) reduce the risks of heavy burden with concentration be mediated by limited sharing to reduce exposure levels or more routes to enable more wide sharing and/or respite to be provided

Figure 5.19 Risk Moderation Questions

All analysis should be presented as part of the narrative within engagement processes such that individuals are able to provide an informed response, based on understanding the pros and cons (across a variety of impacts) of each option.

Based on the outcome of the Focus Group analysis and subsequent road testing (see 5.5. below) this 10-step process has been proposed to support airspace sponsors in adding a distributional dimension to their

assessment and presentation of airspace change proposals to include consideration of the relative risk of social unacceptability of airspace changes.

5.5 Results from road-testing the assessment framework

Early iterations of the framework for illustrating the relative risk of socially unacceptable outcomes using the assessment of N65 and PEI spatial distributions and associated magnitudes of change were presented to Gatwick Airport stakeholders, the ERG, SFG and to a sub-group of the CAA's AMS Fund Board at the end of 2023 and early in 2024. These meetings revealed:

- General support of the ideas in the framework and the benefit it could bring to existing to current CAP 1616 procedures. Consideration should be given to the setting of the goal or outcome at the outset (such as minimizing change, maximizing reductions in noise events etc) and how to include this in a best practice document which should include initial engagement and feedback. The approach does however need to be applicable to all airports perhaps with a lightweight version for the smaller airports. Care needs to be taken on how to share this with the community.
- A common concern over the use of N65 as opposed to other potential N-above thresholds. It was accepted that this was a good starting point especially as N65 is the metric in policy (Air Navigation Guidance section 3.1) this gives airports some way of using this metric to explain change and the potential noise consequences of airspace modifications. Sensitivity testing might be required to test the suitability of other N-above metrics at different airports. Further, whilst this work has focussed on spatial distributional fairness, consideration should be given to temporal management options including night-time and provision of respite.
- Feedback on a proposed ranking step in the assessment suggested that this might be a step too far as it implies equal weighting of each assessment step. This resulted in the modified presentation of performance against objective noise metrics illustrated in Figure 5.18, which is then associated with the relative risk of socially unacceptable outcomes. Nevertheless, population and PEI differences by N65 change categories was acknowledged as being dependent on the definition of those change categories. At this point in the work these are recognised as suggested categories and some sensitivity testing will be needed to establish whether modified change categories might be more appropriate in different circumstances. All the feedback was considered in refining the process and the worked examples presented above reflect some refinement to the original N65 bands and change categories.
- Some concerns were expressed as to how this assessment framework might be received by noise affected communities. It was suggested that dissemination and socialisation of the framework be carefully considered if its benefits are to be optimised (e.g. through bodies such as the Single Design Entity (SDE) group and the ACOF community advisory panel).

Overall, the research team appreciate that if full value is to be extracted from this framework for the objective assessment of changes to noise distribution as a result of ACPs then airports will need to undertake their own

community engagement activities to establish preferences for certain patterns of noise distribution change and use this to inform assessment of the risk of social (un)acceptability through the use of N65 (or similar) and PEI data as prescribed here.

6 CONCLUSIONS AND RECOMMENDATIONS

The UK has embarked on a process of Airspace Modernisation with the intention of optimising the benefits from the adoption of performance-based navigation (PBN) that enables aircraft to fly with increased predictability and accuracy. According to the UK Government (DfT, 2018), a key benefit of this feature of PBN is that it concentrates traffic and thus increases airspace capacity thereby 'unlocking' growth, improving safety and offering environmental gains through more direct routing.

Whilst concentration brings benefits to airspace efficiency, concerns are often raised by local communities and noise groups in respect of the impacts on local people arising from concentration, particularly where that concentration has moved aircraft to new locations or when the increased concentration has resulted greater perceived impacts to people already most affected. Campaign groups around Gatwick have highlighted a policy of "fair and equitable distribution (FED)" of traffic as a priority, rather than a concentration of aircraft over certain areas. While this high-level FED objective has been sought by communities participating in Gatwick's Noise Management Board since 2016, no adequate description of how to design and deliver a FED environment exists in government policy or legislation.

The present "FED2" project sought to address this gap by building on the outcomes of the "FED1" project and had the following key aim:

"To understand how airspace design options influence those features that impact perception of fairness and equity to inform more socially acceptable airspace modernisation".

Key to the development of the study were concepts from the EU funded ANIMA project and innovative work on aircraft noise and fairness undertaken around German airports (Hauptvogel et al, 2021). In particular, the present study considered the distributional, informational and procedural dimensions of fairness perception highlighted by Hauptvogel et al.

FED in UK Aviation Noise Policy Context

At present there is no policy framework, description or guidance upon which to base design considerations consistent with a FED aim. Instead, Government policy[21] takes a wider view stating that "...the impact of aviation noise must be mitigated as much as is practicable and realistic to do so..." and that tackling localised impacts of aviation is central to a sustainable future for the sector. Given the policy focus on local impacts, the existing

21 https://www.gov.uk/government/publications/aviation-noise-policy-statement/

airspace design process places significant emphasis on consultation to develop the principles on which designs are based and assessed.

The Department for Transport issued Air Navigation Guidance (CAA, 2017) to the UK Civil Aviation Authority (UK CAA – the body responsible for overseeing airspace changes in the UK), which acknowledged the potential negative environmental impact of airspace changes and highlighted objectives supporting 'a strong and sustainable aviation sector' (p.8). These are to:

- 'Limit and, where possible, reduce the number of people in the UK significantly affected by adverse impacts from aircraft noise.
- Ensure that the aviation sector makes a significant and cost-effective contribution towards reducing global emissions; and minimise local air quality emissions and in particular ensure that the UK complies with its international obligations on air quality.'

Thus, from a noise perspective, the UK CAA and airports responsible for coming forward with airspace change proposals (airspace change sponsors) were charged with balancing economic and social benefits from a growing air transport system and any associated emissions outcomes with the potential adverse noise impacts on communities near airports. Given the complexity of the potentially competing objectives and aspects of noise management, the guidance states that all changes below 7000 feet should take into account local circumstances and not be agreed by the CAA before appropriate community engagement has been conducted by the sponsor.

FED and CAP1616

The CAA produced CAP1616 to provide guidance for the design, development, and implementation of airspace change. Whilst there are many considerations to be made in this process, in respect of UK noise policy it states:

"*The Government's noise policy is "to limit, and, where possible, reduce the number of people in the UK significantly affected by adverse impacts from aircraft noise. For the purpose of assessing airspace changes, the Government wishes the CAA to interpret this objective to mean that the total adverse effects on people as a result of aviation noise should be limited and, where possible, reduced, rather than the absolute number of people in any particular noise contour*."

"To be consistent with this, priority should be given to reducing the total significant adverse impacts rather than the number of people who will experience aircraft noise. Therefore, from a noise perspective, it may on occasions be better to have multiple concentrated routes that share noise among more people, than a single concentrated route which affects fewer people but to a greater extent."

The implementation of an airspace system that fully harnesses the capability of PBN, whilst guided by the initial design principles consultation, will mean that routes are flown more accurately and consistently and, ultimately, result in concentrating noise in areas under route centrelines. 'Reducing the total significant adverse effects" could therefore be achieved by pursuing an approach that concentrates aircraft over least densely populated areas, and so avoiding more densely populated areas (a concentrate and avoid approach).

It is clearly a sensible intent to reduce the overall health consequences of aircraft operations for local people and so the "concentrate and avoid" approach is understandable. However, this approach lacks consideration of the changes in distribution of noise, the consequences of concentration for the smaller number of people (and possibly new people), the implications for change of expectation of land-use and the perception of the changes by the broader population. The assessments simply result in the best outcome being the one with the least overall impact of the options available. This approach has generally resulted in significant adverse reaction from local communities.

It is worth noting that CAP1616 states:

> *"Rather than a 'one size fits all' approach to whether single or multiple routes are better, sponsors must consider the impacts of different options and decide what will work better in a given situation. These decisions should be informed by considering the anticipated noise impacts, and through engagement with communities."*

CAP1616 therefore provides a framework upon which to base consideration of FED. However, the concept of the fairness of redistribution of the noise burden is not considered within the process and as such, this process is likely to favour outcomes that concentrate aircraft over the smallest number of people regardless of their current exposure to noise.

The work represented in this report aims to contribute to understanding how the dimensions of fairness can be considered alongside the existing CAP1616 process. This includes enhancing community engagement through developing a better appreciation of the issues of greatest concern to residents. Which is, in turn, used to propose an assessment and engagement framework using supplementary metrics to increase public understanding of the consequences of airspace options such that the processes leading to decisions on specific airspace change options are transparent and allow community input to the final outcomes.

6.1 Understanding the Dimensions of Fairness

Consideration of the dimensions considered critical to perceptions of fairness (Hauptvogel et al, 2021) enabled the design and delivery of community engagement vehicles (workshops and focus groups) to explore in detail those features of aircraft lateral distribution that influence perceptions of fairness and equity (known as

"distributional fairness") as well as aspects of informational (e.g. use of particular metrics) and procedural (e.g. approach to consultation) fairness.

Critical to the success of the focus groups in revealing the participants' underlying motivations and concerns was the use of a virtual airport to illustrate different aircraft distributions and their consequences for noise changes on the ground. Removing reference to specific locations reduced NIMBY bias and enabled discussions to reflect on the overall fairness for different patterns of increases and decreases in aircraft noise event outcomes. Participants were willing and able to express preferences and it became possible to relate these changes in the spatial distribution of increases and decreases in N65 events to perceptions of fairness.

6.1.1 Distributional Fairness

The FED2 Study found that the concept of "Fair Distribution" in the context of airspace change does not appear to be related to equitable distribution, or sharing, of aircraft over an area or population so that "noise" is "evenly shared". Rather, the perception of fairness among communities around Gatwick Airport appears to stem from minimising the change in the spatial distribution of the existing noise load whilst delivering noise reduction through technology and flight procedures to reduce noise on those who are overflown.

The findings of the present study revealed a spectrum of risk of social unacceptability associated with the perception of distributional fairness (Figure 4.10). A clear preference for airspace designs that result in minimal change in the redistribution of the burden of aircraft noise (presented as changes in event-based metrics) and minimise increases for those are already most affected was revealed. As such, options resulting in these relative outcomes are likely to be considered less distributionally unfair and, consequently, at lower risk of being considered more socially unacceptable.

In airspace design terms this implies that some form of limited spreading of aircraft movements around areas already overflown is likely to be considered a less socially unacceptable outcome than allowing aircraft to concentrate around a route centreline because of more precise and consistent navigation, or for new areas to be overflown by similarly concentrated flows of aircraft. It was recognised that, as the degree of sharing becomes more geographically extensive (whether this be to distribute aircraft across existing NPRs or to share the noise burden over a wider geographical area with the addition of new routes), the point(s) at which perceived benefits from sharing become outweighed by concerns over sharing is unclear and might only be revealed when specific ACPs are discussed with communities.

Whilst the tipping point between the benefits of limited sharing and the risks of wider spreading of the noise burden is unclear, communities were consistent in their belief that any discussions about the merits, or otherwise, of noise sharing, included reference to the numbers of aircraft movements being shared. There was

widespread appreciation that the benefits of sharing could be eroded over time if absolute numbers of aircraft continue to grow rapidly.

It should be noted that this preference for minimal change in the spatial distribution of aircraft noise was found among focus groups held in the environs of Gatwick Airport and that it cannot be assumed that this will be the case at other airports. Thus, we would advocate for other airports to undertake their own community engagement activities (ideally using a virtual airport context) to understand community preference for different changes in the lateral distribution of aircraft movements, as outline in Section 6.3 below.

The present study also revealed that it would be considered absolutely unfair for the burden of noise on those currently most significantly at risk of adverse health outcomes to increase further, even if this results in large numbers of people exposed to relatively lower noise levels.

Whilst the geography of the redistribution was considered of primary importance, focus group discussions also identified several secondary factors that could moderate the perception of distributional unfairness and therefore moderate risk. These included land-use/designation, the urban-rural divide, and the extent to which forecast changes conflicted with social expectations of living in an area. The extent to which these secondary factors moderate the risk is unclear.

Whilst the focus of the conversations was on the relative merits of these dispersal concepts, it was noted that other means of minimising noise on the ground were often raised in the focus groups (e.g. quieter aircraft, optimised departure and arrival vertical profiles, etc). Local people were consistent in indicating there is an underlying assumption that all the Balanced Approach possibilities would be utilised to minimise the noise impact of any lateral distribution options discussed.

6.1.2 Informational and Procedural Fairness

Although the study highlighted the importance of the change to the distribution of the noise burden on the perception of fairness, the importance of the role of informational and procedural fairness, as described by Hauptvogel et al (2021), in reaching a socially acceptable airspace redesign was expressed consistently across the focus groups.

From an informational fairness perspective, the utility of noise event-based metrics, in particular N65, to illustrate nuances in changes that are relatable to the perception of change from a community perspective compared with the conventional, policy approach using average noise level metrics was clearly identified. This can be linked to population through analysis of changes in Person Events Index.

The study has identified that assessment, engagement and decision-making by airspace change sponsors within the CAP1616 process, whilst being comprehensive, is based on the consideration of aggregate effects using average noise level metrics. The concept of the fairness of redistribution of the noise burden is not considered within the process and as such, this process is likely to favour outcomes that concentrate aircraft over the smallest number of people regardless of their current exposure to noise. This study proposes a framework for the assessment of the perceived (un)fairness of specific airspace changes based on the novel use of N65 and associated PEI data, which is intended to support assessment (shortlisting) of ACPs and their presentation in community consultation as part of the process by introducing the consideration of distributional fairness. In turn, this assessment should help improve perceptions of informational and procedural fairness through the development of socially negotiated design outcomes whilst maintaining consistency with the existing policy assessment framework.

The findings from our Q study emphasise the importance attached to open, genuine, and honest engagement with communities over airspace change (See Text Box 5.1).

6.2 A Framework to support airports in assessing and communicating the distributional consequences of airspace change proposals

In Chapter 5 a 10-step assessment framework is described to improve understanding of the distributional consequences of airspace changes and, thereby, the inherent risks of socially unacceptable outcomes arising from the modernisation of airspace process.

Steps 1 and 2 illustrate the geographic extent of route changes and noise event distribution.

- Step 1 – (Figure 5.4) illustrates the geography of existing and proposed routes.
- Step 2 – Figure 5.5 - using noise modelling outputs that reflect the associated flight track changes calculates changes to the spatial distribution of the number of noise events (taking N65 as the exemplar, noting that average noise level indicators will be produced alongside these as part of a policy based aggregate assessment).

Steps 3-7 combine these noise event distributional changes with population data to quantify and present the overall “extent and distribution of change” to the noise environment for different communities affected by modifications to routes.

- Step 3 – Categorising the spectrum of N65 exposure into meaningful bands (Figure 5.6) and defining thresholds of change by reference to these bands (Figure 5.7 – N65new, N65+, No Change, N65- and N65rem)

- **Step 4** - Taking noise modelling outputs from flight track data for proposed route changes to calculate the spatial distribution of N65 change (Figure 5.8)
- **Step 5 -** Relating these N65 changes to population distribution (Figure 5.9)
- **Step 6 -** Identifying the populations exposed to different categories of N65 change (Figure 5.10)
- **Step 7 -** Calculating the PEI for each N65 change category to quantify the noise burden as a result of an airspace change (Figure 5.12 – Total PEI for the categories PEInew, PEI+, PEInc, PEI- and PEIout) and the associated PEI difference for each N65 change category.

Steps 8-9 provide an assessment of the performance of airspace change options against N65 change categories using population and PEI measures.

- **Step 8** (Figure 5.14) takes these "extent of change" quantities and relates them to the Hierarchy of Relative Risk (of socially unacceptable outcomes) and
- **Step 9** assesses the aggregate populations exposed to N65 change categories (Figure 5.15a) and associated PEI features (Figure 5.15b).

Finally, in **Step 10** the relative performance of different route options against the existing baseline can be evaluated using a 2-stage risk assessment ranking framework. The first assessing performance against features associated with 'unfair' outcomes (Figure 5.17) and the second linking relative performance in N65 change categories for population and PEI with the relative risk of socially unacceptable outcomes (Figure 5.18).

Critically, it is not proposed that the relative performance of options be used to categorically include or exclude options, rather that the relative risk (of social unacceptability) is used to support the sponsors shortlisting of options, consider mechanisms to mitigate risk and crucially as a means of presenting the potential outcomes of options to communities to allow a transparent discussion of the relative merits of each option to inform ultimate decision-making. Following this assessment options for reducing the risks can be considered.

It is recognised that there may be a need to refine/tailor the approach to the local circumstances at individual airports relating to:

- **Preference for minimal change** – this was consistently revealed in focus groups with residents from around Gatwick Airport, but it may be at other airports, with different spatial patterns of existing noise exposure and population distributions, that different perceptions of the (un)fairness of (re)distribution of aircraft movements and consequent noise exposure are evident. We would encourage all airports to conduct preliminary community engagement, ideally by reference to a virtual setting and concept scenarios (to minimise NIMBY bias) to determine community perceptions of different patterns of the lateral distribution of aircraft movements. Revealed preferences and their implications for the risk of outcomes being perceived to be less fair can then be linked to the objective assessments the distribution of noise events using the framework described above.

- Use of N65 metric - whilst there is precedent for the exemplar use of the N65 metric (it is the preferred "number-above" metric in Air Navigation Guidance, then transposed across to CAP1616) in the illustrations used in this report, it is appreciated the other/additional thresholds for single events assessments may be more appropriate in different airport settings. Airports will need to examine their particular circumstances to tailor N-above thresholds to best capture changes in the distribution of aircraft relevant to fleet mixes, routes, population distributions and the needs of communities.
- N65 bands and change categories – a rationale (based on a reflection of the lived experience) was given for the thresholds used in the example application of the framework above, but it is recognised that the applicability of these definitions will need sensitivity testing to local circumstances. It might well be the case that change definitions and boundaries will need amending to better reflect specific traffic levels and route/population interactions.

The Framework has been presented to support airspace change sponsors when engaging with the requirements of CAP1616. However, there is no doubt a challenge to be recognised between the preferences that may be revealed from a risk of social unacceptability assessment and options that may be more optimal from an aviation noise policy perspective. The findings here highlight the very significant role that the distribution of the costs and benefits of a change play in influencing perceptions of fairness and, by extrapolation, the acceptability, or otherwise, of outcomes from airspace modernisation. This could be tricky for selection processes that place higher priority on options with the greatest reduction of aggregate measures of noise impact (e.g. health, annoyance, sleep disturbance). A hybrid consideration is therefore recommended that considers both policy and FED contexts.

Linking these perceptions to quantitative measures such as the number and pattern of increases and decreases in N65 events and their implications for person event indices provides a potential means to assess the likely (un)acceptability of ACPs and so might help in shortlisting of ACPs, as well as aiding the transparent presentation of the consequences of airspace changes with a range of outcomes to communities.

The novel use of the Q-methodology in this study helped to reveal the influence of attitudes, including understanding potential groupings of common attitudes, and preferences around the perception of fairness. In future, including a Q Study as a precursor to the Focus Groups is advised as this step enables exploring the range of local attitudes and preferences and therefore can help frame the development of materials for investigation in the focus groups.

Whilst there is a challenge to be recognised within the context of policy assessment, this study and its findings are not intended as a "challenge to policy" and nor do we consider there to be implications for existing policy. This study has found that minimal change in the distribution of aircraft noise reduces the risk of social unacceptability (at least in the context of populations local to Gatwick). The findings and proposed framework

are not intended to be a decision-making tool, more that it supports existing processes by providing greater understanding of the potential consequences on the social acceptability of changes to distribution of aircraft arising from airspace modernisation, and should improve transparency and openness in the engagement processes. All of which ultimately should deliver less socially unacceptable outcomes. It should also **not** be considered as a framework that will deliver a universally accepted solution.

6.3 Recommendations – supporting airports in their CAP 1616 journey

This report has developed a mechanism for the transparent assessment and communication of changes in the distribution of aircraft noise arising from proposed airspace changes, which can be linked to the relative risk of perceived unfairness of outcomes and their social acceptability. This framework has been presented as a support to airports when implementing existing CAP1616 procedures (note that this is not intended as a change to the existing CAP1616 process).

Most airports undertaking ACPs for the purpose of Airspace Modernisation are currently within Stage 3 of the prescribed process (Figure 6.1). Although ideally the opportunity to initially include this assessment framework would be in options development and appraisal (Stage 2), there may still be an opportunity for airports to consider implications for option shortlisting and how to amend options to manage down the risk of social unacceptability as part of the full options appraisal work at Stage 3 alongside the subsequent engagement and consultation with a range of stakeholders over the shortlisted option(s).

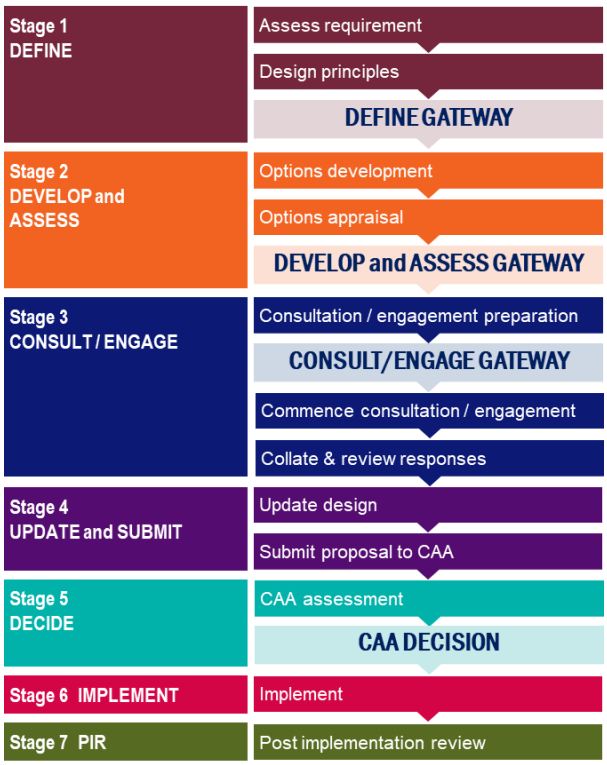


Figure 6.1 Overview of the CAP1616 airspace change process[22]

Using the framework in **Stage 2** can aid airport understanding of the relative risk of options in respect of distributional fairness and provide quantification to sit alongside aggregate policy-based assessments and therefore aid options appraisal.

Incorporation of the outcomes of the assessment within **Stage 3** (Community engagement), will assist communities in fully understanding the aspects of change that are most important to them and therefore enhance perception of informational and procedural fairness. The relative merits (or otherwise) of different options can be communicated transparently, enhancing comprehension and empowering individuals to come to their own conclusions as to the relative merits of the options on offer. **This degree of openness and honesty in communicating the strengths and weaknesses of each option should enhance perceptions of these dimensions of fairness and ultimately the perceived overall fairness of CAP1616 procedures and outcome**

.

This is not to say that there will be no resistance to change, nor that everyone will be satisfied with the outcome, but that through a transparent and open process every effort is demonstrably made to minimise the risk of perceived unfairness in the outcomes from the airspace modernisation process.

It is therefore recommended that, where possible, airports:

- Implement this framework to complement the existing approach (it is recognised that the extent to which it is applied will need to consider existing and proposed airport size and impacts).
- Undertake exploratory precursor engagement with communities and stakeholders to explore different forms of noise (re)distribution in order to understand the drivers of risk to social (un)acceptability of airspace change concepts and community objectives from this process. Our experience suggests that this may be best achieved through a limited number of focus groups, using a virtual/concept airport environment so as to be neutral to the local area.
- Apply the assessment described within this report to airspace change proposals to support their relative evaluation, refinement and shortlisting. Use the outputs to mitigate risks of socially unacceptable outcomes and refine options according to distributional fairness principles established in the first consultation, in the context of policy consistency.
- Design and develop transparent communication tools, drawing on the outputs from the assessment of changes in noise distribution, to enhance the quality of community engagement over selected airspace change options.
- In consultation, present communities with a range of viable options (even if one is presented as preferred) and with this transparent information on noise distribution consequences, enabling individuals to make informed decisions about their own preferences.

22 CAA (2023) CAP1616, p.23 https://publicapps.caa.co.uk/docs/33/CAP1616FUT%20Airspace%20Change%20Process%20(v5).pdf

- Input of community preferences to the selection of the final airspace change, thereby demonstrating meaningful engagement and consideration of community preferences in final decisions/outcomes, helping to build trust in decision-making.

6.4 Next Steps

The following is recommended as urgent follow up work:

1.Supporting airports in their CAP 1616 journey as detailed above. This includes:

- Consider whether it is appropriate to update guidance to sponsors of airspace change for them to consider the social acceptability of their proposals in addition to appraisals of costs, benefits and impacts currently required by CAP1616.
- Testing the approach for specific Gatwick FASI proposals and refine if appropriate.
- Encouraging the adoption of this approach at other airports.

2. Dissemination of and feedback from the findings through;
    - Preparation of a layperson summary and slidedeck.
    - Presentation at relevant committees, groups and conferences – UK and internationally.
    - Academic publications.

3. Further ground-breaking research through:
    - Publishing Q approach and findings.
    - Exploring the use of Q analysis to frame community engagement and overarching objectives.
    - Development of GIS led tool for PEI information.

7 ANNEXES

ANNEX 1: EXPERT REVIEW GROUP

ANNEX 2: STAKEHOLDER FOCUS GROUPS

ANNEX 3: COMMUNITY FUNDAMENTALS WORKSHOPS

ANNEX 4: FOCUS GROUPS

ANNEX 5: Q STUDY

ANNEX 1: EXPERT REVIEW GROUP (ERG)

From the outset, it was the intention for work to be reviewed by an independent panel of experts, with up to 5 members covering a range of experience and specialisms. It was anticipated that this would include the review of the planned work tasks, periodic review of progress and outcomes, and final review of the project report. The Expert Review Group (ERG) was set up at the beginning of the project. The members are given in Table A1.1.

Name	Organisation
Ian Jopson	National Air Traffic Services (NATS)
Chris Barnes	Trax International
John Stewart	UECNA
Neil Robinson	Manchester Airport Group (MAG)
Dirk Schreckenberg	ZEUS GmbH, Germany

Table A1.1: Members of the ERG

The purpose of the ERG was:

"To provide independent assurance of the scientific robustness of the research project, and expert advice to the Research Team and Gatwick Airport Ltd on the methodology and research outcomes".

The ERG members were asked to:

- provide feedback and recommendations on the research aims and proposed methodology.
- provide feedback and recommendations on progress.
- provide a short statement on the research and its outcomes in the final report.

Meetings were held on 28th November 2022 and 5th June 2023, with final meetings to prepare the ERG final statements provided with this report.

The key questions addressed at the first meeting are given below.

Questions for ERG to consider today

- What do you think about the aims and objectives?
- What do you think about the proposed methodology and qualitative approach?
- What are the strengths in the approach we are taking?
- What suggestions do you have for any refinements?
- What do you think might be the potential barriers to successful project outcomes and how might these be overcome?
- How might we gain effective 'buy-in' from key stakeholders for the research journey?
- Are you willing to participate in a short pilot on-line Q-methodology test following this meeting?

The feedback from the first meeting is summarised below.

ERG MEETING

AGREEMENT ON AIMS

Looking to fairness and equity is both important regarding (less) annoyance.

Framing it around around 'fairness' and 'equity' is the right thing to do but it also tactically the best approach: it is difficult for any community to argue in public against 'fairness'; it has therefore the best chance of overcoming Nimbyism and getting some broad consensus.

Useful to frame it as 'social (un) acceptability, this is really what needs to be addressed, as the 'fair and equitable' term has become problematic among community groups in my view

AGREEMENT ON APPROACH

When working with people on a new topic and there is interest in their perception and attitudes, a qualitative approach is THE method to start with.

All in all, it depends on the research question and the point of departure whether a qualitative or a quantitative approach is better. And, there is no either or. Often the combination is a good way to move forward.

The approach which is essentially based on interaction with people is the right one to both understand where they are coming from and to go though the various possible options.

I really like the focus group and q-methodology approach

NEED FOR BROAD VIEWS

Taking a wider part of the region into account seems reasonable as it seems that complaints are not restricted to highly exposed areas.

It is important you include people who are affected or might be affected by aircraft up to at least 7,000ft

But one barrier to success might be failing to engage a broad enough range of views (i.e. not just industry and noise affected communities). There are many other people with a positive or negative stake in aviation's activities and their views should be reflected.

BEWARE DISTRUST

At the core of the acceptance of the results of the research by all parties will be a belief that the research group are trusted and impartial.

I think the biggest initial barrier will be distrust of the airport. The equity and fairness framing should help to overcome some of this. I think a majority of people will buy in this. There will be always some people whose distrust of and indeed hatred towards the airport will always remain but that is not a really problem as long as they are small and, where possible, isolated minority.

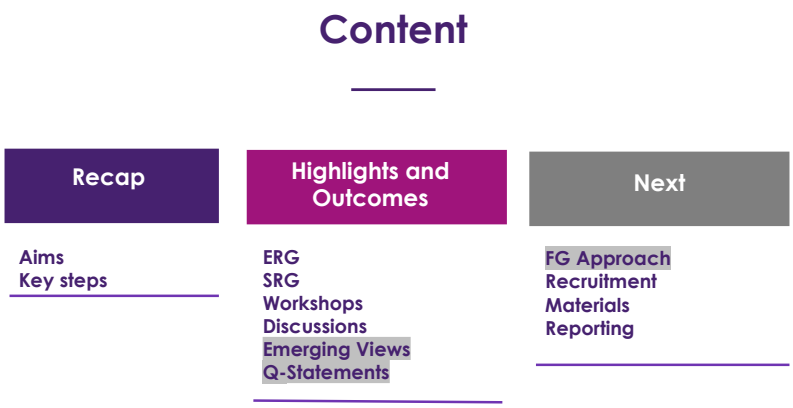
NEED FOR BUY-IN?

What will they get from your research? You may give incentives (money, vouchers…) to participating residents, but that's probably nothing for key stakeholders. They have to see advantages in your research for their own work. That means, that you have to share the results with them.

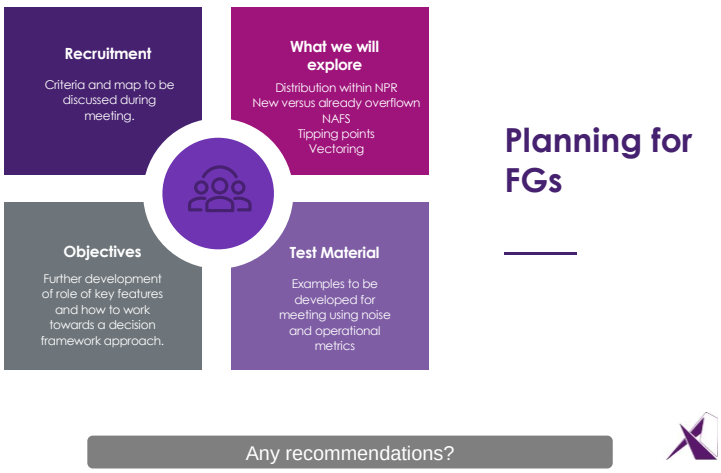
An offer that they will have a chance to have ongoing opportunities to influence the journey.

I suspect the other thing, though is might be beyond the remit of this report, is for the airport to look at doing something around night flights.

The second meeting was held on 5th June 2023 and covered the following:



One key area for which feedback was sought focussed around the approach to the Focus Groups and, in particular, the following was addressed:



Generally, the feedback was very positive and there was general agreement with our planned approach. This final report was then shared with the ERG members and their final statement is provided at the start of the report.

ANNEX 2: STAKEHOLDER FOCUS GROUPS (SFG)

As part of the initial work, two SFGs were held to help to frame the empirical research. The purpose of each was:

"To gain feedback from different key stakeholders on the features, concepts and barriers to effectively mitigating social unacceptability of aircraft noise".

It was expected that the outputs would help to:

- Design realistic and workable concepts for testing in the focus groups.
- Understand potential barriers (and potential options to overcome these) to implementing effective strategies for mitigating social unacceptability of aircraft noise (based around concepts of unfairness and inequity),
- Understand how to gain effective 'buy-in' from key stakeholders for the research journey.

Two online meetings were held on Dec 5th 2022. Attendees are listed in Tables A2.1 and A2.2

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Name	Organisation
John Stewart	UECNA
Ian Greene	Department for Transport
Rick Norman	Heathrow Airport Ltd
Mikko Viinikainen	Sustainability & Environment Finavia Corporation

Table A2.1: Attendees at SFG1

Name	Organisation
Spencer Norton	British Airways
Martin Doherty	Dublin Airport
Ben Fenech	UK Health Security Agency (UKHSA)
Ed Weston	ERCD, Civil Aviation Authority

Table A2.2: Attendees at SFG2

The key summary messages and outcomes are summarised below. Included topics were climate change, CBA, trade-offs between carbon and noise. Although these important themes were raised in SRG discussions, the research was shaped to ensure participants could focus on airspace modernisation and social (un)acceptability in the context of noise without us prompting people to discuss carbon, climate change etc (which could have made discussions too diverse to obtain meaningful outcomes on the already complex topic being addressed).

SRG Summary Messages

NEEDS

There is a general need for the work but it should not repeat previous work, but should learn from their outcomes.

It should not be focussed around PBN but about airspace design using PBN as a 'tool'.

A tool is needed for decision making with clear guiding principles set out based around clear outcomes.

Let's not be constrained by conventional thinking and research methods.

Education around airspace modernisation and PBN is essential – **explaining the art of the possible?**

SUCCESS?

What are we going after? What are the guiding principles here - need to agree before starting out.

A list that is ranked ordered by participants? (cf the airspace design principles) – **a Framework approach?**

To work alongside 'respite' definitions, research outcomes.

Understanding and confirmation what the public deem as key features to fair and equitable, and benefits to all parties.

If most vocal groups can agree that this work is useful.

To facilitate decision making and enhance the conversation.

FEATURES OF SOCIAL UNACCEPTBILITY

NAFs are key and should include such factors such as health, jobs, connectivity etc

Climate change issues are very important, as is an understanding of **any related conflicting principles.**

Balance of benefits and 'harm' but to consider whether any weightings are required e.g. towards disadvantaged people.

Consider concepts of social inequalities, social injustice, interventions that relate to these, and how to balance to address equality.

Look at many impacts above noise such as education, green spaces etc.

One option is to look at 'all round', but those 'needing persuasion' probably are most impacted by noise so the wider benefits beyond noise should be used to 'frame' it all.

Social unacceptability is weighted by some through NAF such as purpose of flight, perception of whether it is benefitting economy, fairness to community versus industry, timing of flight.

Newly overflown.

Financial information would be good with some **cost benefit analysis.**

Requirement for long term versus short term indicators, time of day, certainty about where and when.

How to deal with NIMBYism – move noise away from me so how does this ever succeed?

Equity and equality are different. Equality is treating everyone the same (but not same outcome). Equity is about working towards the same outcomes.

SRG Summary Messages

BARRIERS TO SUCCESS

Mindful of regulatory context, aviation capabilities, and need for effective two-way communication and engagement, reaching all potentially affected and not those who shout loudest.

Guidance on how to deal with WHO low guideline levels (or targets?) – real life application and what the levels could mean.

Need to engage all communities including **newly overflown.**

METRICS TO CONSIDER

Many, acoustic and non-acoustics candidate options to consider moving forward. Selection would depend on what outcomes are being evaluated and a balanced scorecard might be required.

Suggestions included:
Total overflow versus newly overflown.
% usage of various routes.
W versus E.
Timings.
Dynamic noise mapping.
Background noise (no aviation).
Health markers of communities.
Air pollution.
% HSD, HA, Lden, Lnight, N60, N70.
Number of overflights, number above.
QoL metrics and confounders e.g. wellbeing and health.

RESEARCH APPROACH

We should consider an initial open discussion about current day/status quo without framing around any illustrative material.

Any discussion should start with the simple and maybe **an education piece** could be considered.

By providing maps, focuses on what the maps or other material says or does not say, so maybe general discussion would be better so people do not go off at tangents and not focus on personal aspects or perspectives.

What outcomes are we after from presenting a map and does the map show this?

If maps are shown, they would also be needed by mode, by time of day, height info (i.e. 3D), w/e, flight density? Etc. Community details e.g. number of schools, hospitals

What outcomes are we going for here? (**what nudges in certain directions?)**

Track density scale needed, height info. Noise contour would be helpful.

Replication of existing routes using PBN - This could be used to demo one potential worse case, (may be compare to FAA implementations), and then introduce how focussing (and zooming in) on different operations/routes could be varied and what do people think of these? These could then lead to different appreciations of the features of social unacceptability etc and inform on the outcomes we might be looking for.

If we use PBN as a tool for designing airspace we could consider these other options and then introduce the **concepts such as those in CAP1378** to demo and probe responses.

How airspace around one airport can affect a nearby airport – co-dependencies.

Understanding the trade-offs between carbon and noise - it is not clear cut, particularly for different departure procedures.

ANNEX 3: COMMUNITY FUNDAMENTALS WORKSHOPS

A3.1 INTRODUCTION

As part of the early work, community fundamentals workshops took place. This Annex sets out their purpose, dates and attendee recruitment, agenda and conduct, general questions about 'living around here', some examples of the concept airport used to develop discussion, summaries of key findings and themes to consider exploring further in the subsequent Focus Groups.

A3.2 PURPOSE

"To obtain feedback on materials to be used in later focus groups and to gain insights into the views and beliefs of participants",

"To explore core perceptions and attitudes towards existing and potential future managed airspace operations to inform the development of focus group materials intended to identify attributes of social unacceptability, fairness, and equity".

It was expected that the outputs would help to:

- Understand what drives core perceptions of existing overflight distributions and their associated impacts.
- Understand key features driving perceptions of social unacceptability, fairness and equity of distribution of aircraft operations.
- To identify what drives effective and supportive management actions.
- To explore what drives ideal management solutions.
- Design realistic and workable concepts for testing in the focus groups.
- Understand how to gain effective 'buy-in' from community stakeholders for the research journey

A3.3 THE WORKSHOPS

Four workshops were held at the Hilton Hotel from 16th February to 1st March 2023. The first workshop members were from local Community Noise Groups. The remaining three workshops were attended by mixed groups recruited from varied locations using an independent recruiter. There were 25 attendees in total for the 4 groups. All attendees gave their informed consent for participation.

The recruitment areas are given in Figure A3.1.

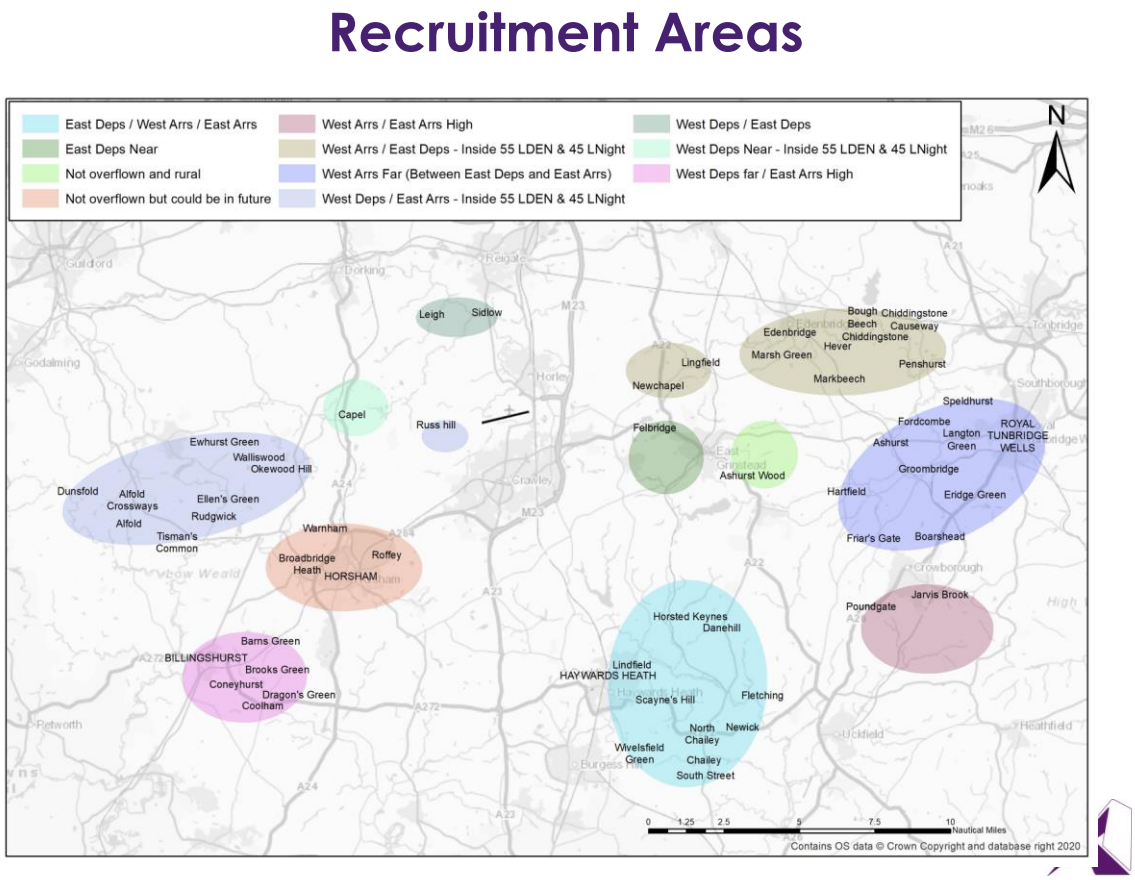


Figure A3.1: Recruitment areas for CFWs

A selection of the presentational material used in these groups is reproduced next as a guide to the format of each CFW. This is then followed by a summary of key findings for the mixed groups and the community noise group.

A3.4 AGENDA AND CONDUCT

Agenda

Item	Item	Timings
1	Introductions, housekeeping & The research project	10 mins
2	Living around here	20 mins
3	Evolution of Aircraft Navigation	10 mins
4	Discussion of concept airport examples	50 mins

Some ground rules

- The workshop is operating under Chatham House rules.
- We are not here to solve the issues. We are after your opinions. The focus of this workshop is not about debating right or wrong but capturing judgments to get a sense of 'better' or 'worse', there are no wrong or right answers, all opinions will be valued even if there are points over which there is disagreement.
- So that people feel able to speak freely, we ask for respect, empathy and congruence for all others' expressed views regardless of whether you agree or disagree.

Purpose and structure of this workshop

- The intention at this workshop is to:
  - better understand the lived experience of residents and how that influences their quality of life, attitude to the airport and perception of the acceptability (or otherwise) of airport operations.
  - explore possible future flight distribution patterns that could result from airspace modernisation to better appreciate those features that make for more, or less, acceptable outcomes from your perspective.
- In doing so we hope to identify the types of information that may assist individuals in coming to an opinion about future airspace options and thereby inform a series of focus groups we will be holding with residents drawn from locations all around the airport over the next few months.

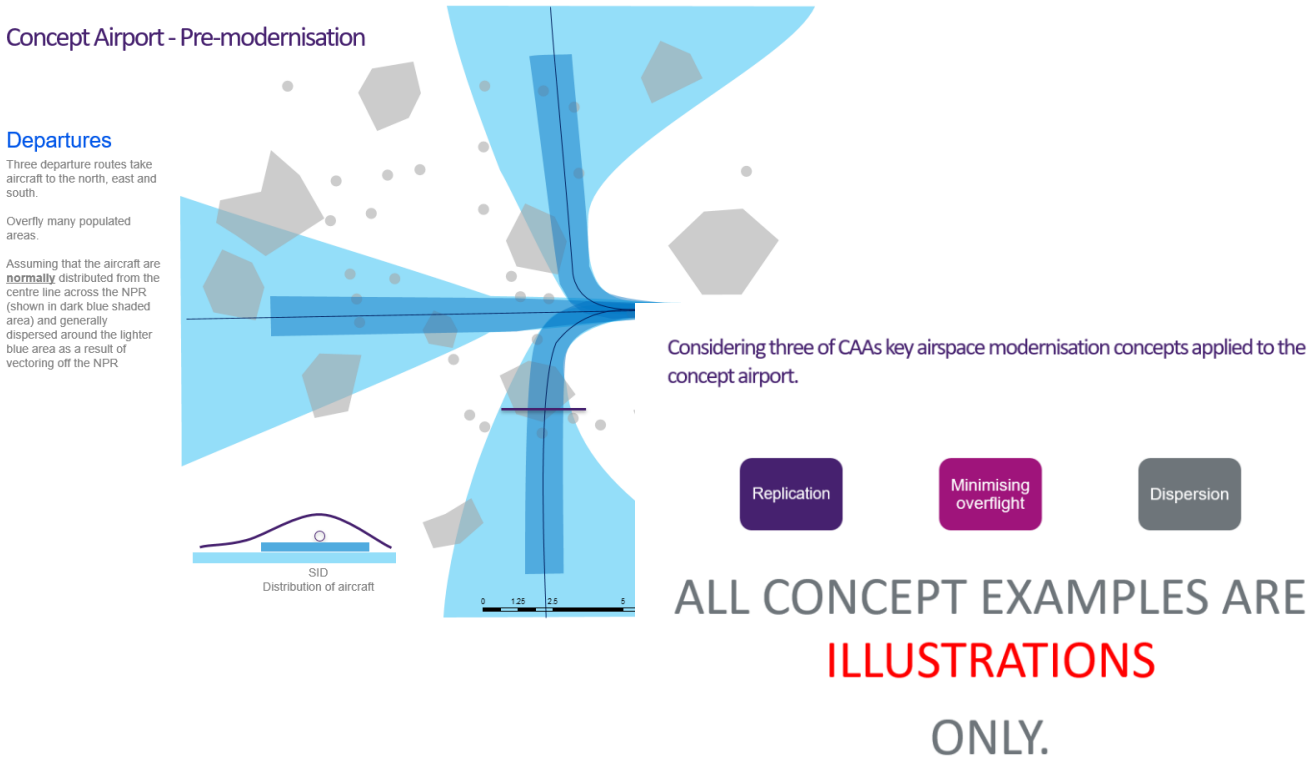
A3.5 QUESTIONS ABOUT LIVING AROUND HERE

The following questions were asked, and attendees prepared answers on post-it notes and placed on flipcharts.

- What do you generally like about where you live?
- What do you generally not like about where you live?
- What might make things better?
- What contribution does the airport make to how you feel about where you live?
- What are the factors that contribute to the social (un)acceptability of an airport?
- How might an airport act to move these factors towards being more socially acceptable?
- Is there anything that would make an airport totally socially unacceptable from your perspective?

A3.6 CONCEPT AIRPORT – SOME EXAMPLES DISCUSSED [23]

Feedback and discussion were sought from the attendees using a virtual concept airport, based on lateral distributions of air traffic using pre-modernisation routes, and permutations of options based on replication, minimising overflights and dispersion. A selection of the illustrative material used in the workshops is provided below, with a summary of the key findings given in the next section.



23 In early discussions, we referred to a concept airport and difference distribution scenarios. Subsequently we referred to a virtual airport and distribution concepts to avoid confusion with ACP terminology.

Airspace Concepts - Departures

Replication

Minimising overflight

Dispersion

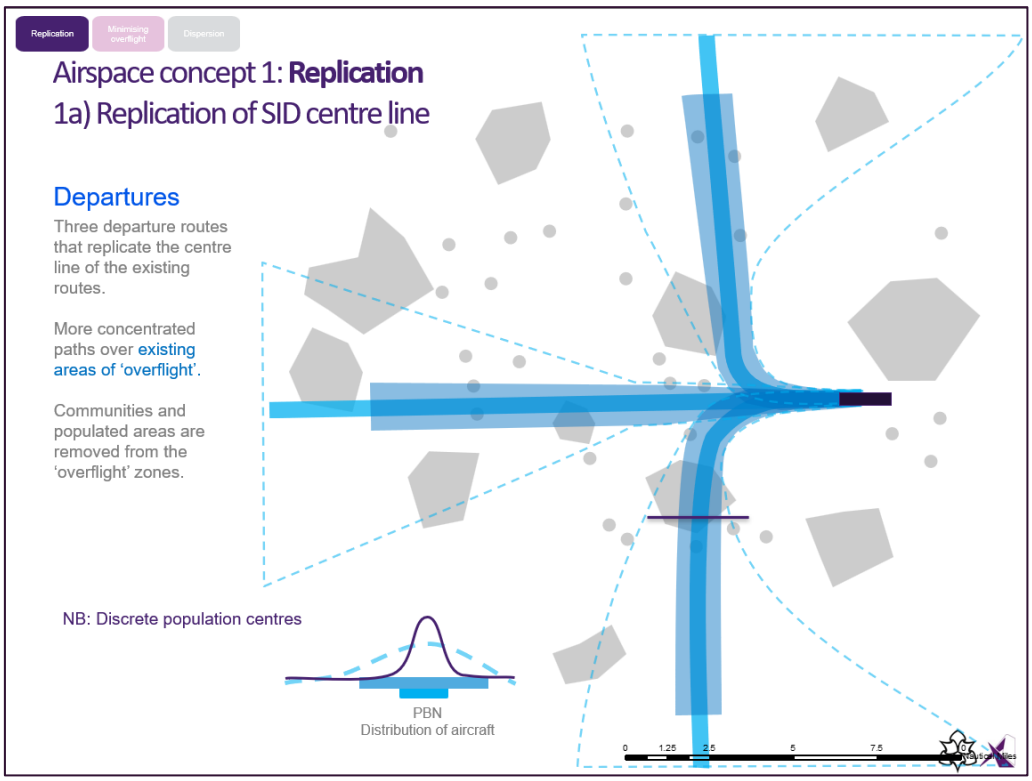
The CAAs Airspace Design Guidance: Noise mitigation considerations when designing PBN departure and arrival procedures CAP 1378 describes replication as:

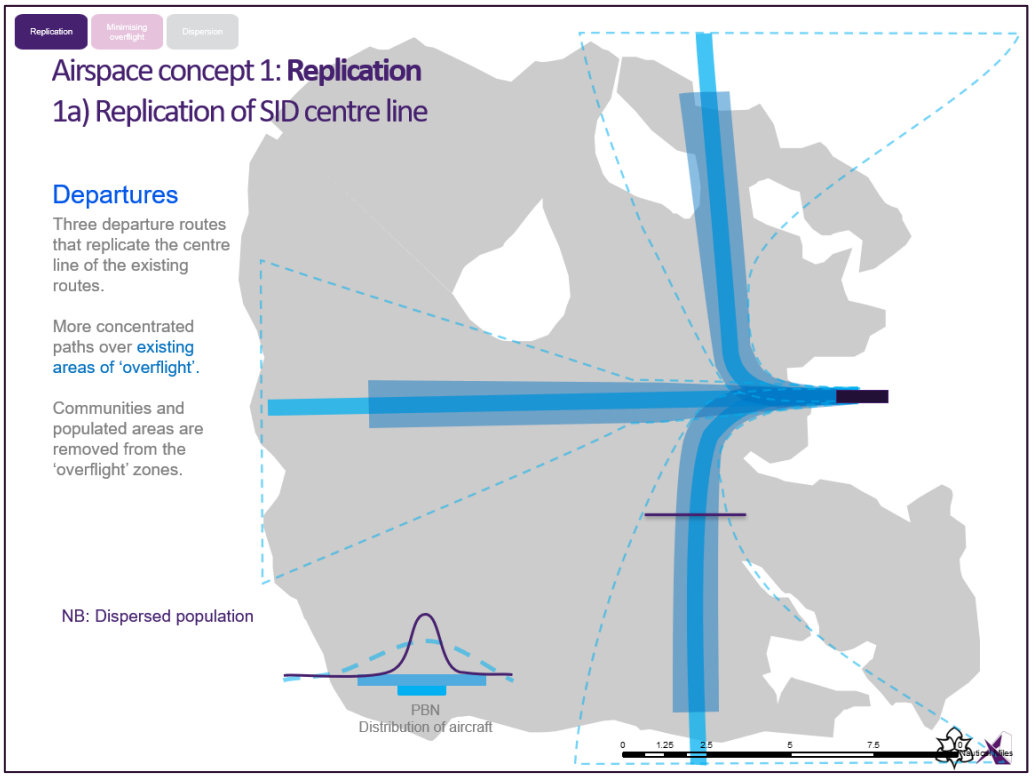
"The PBN replication of a route would aim to match the nominal centreline as closely as is possible.

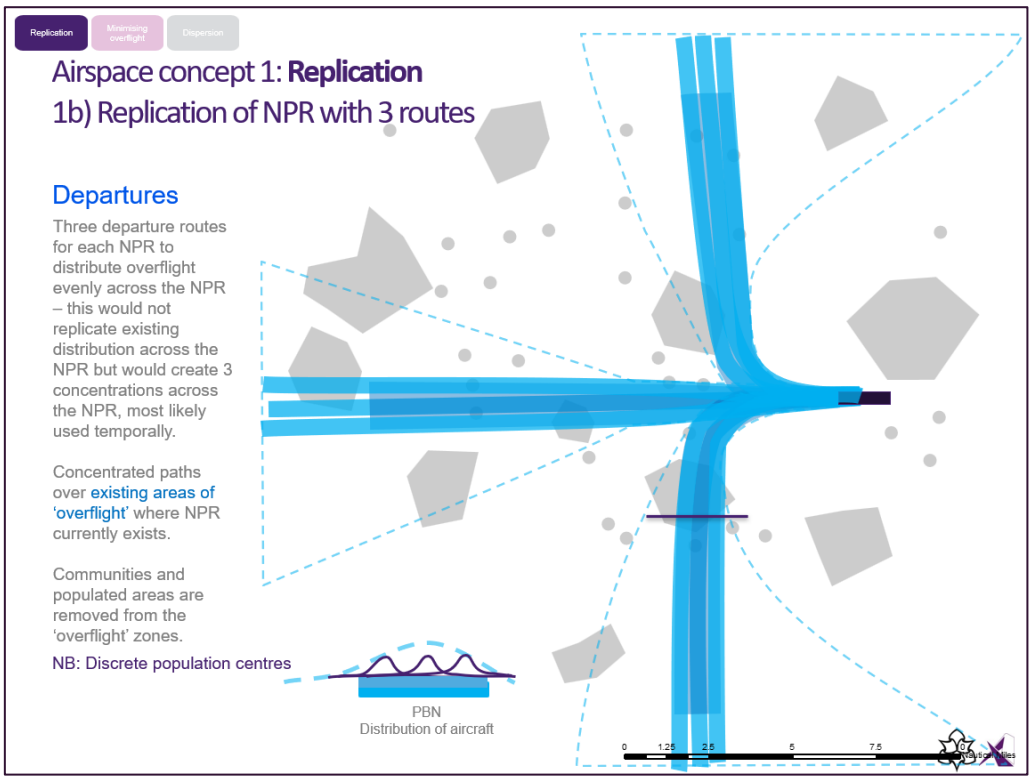
Replication does not take into account local geography as the aim is to match the existing procedure rather than redesign it.

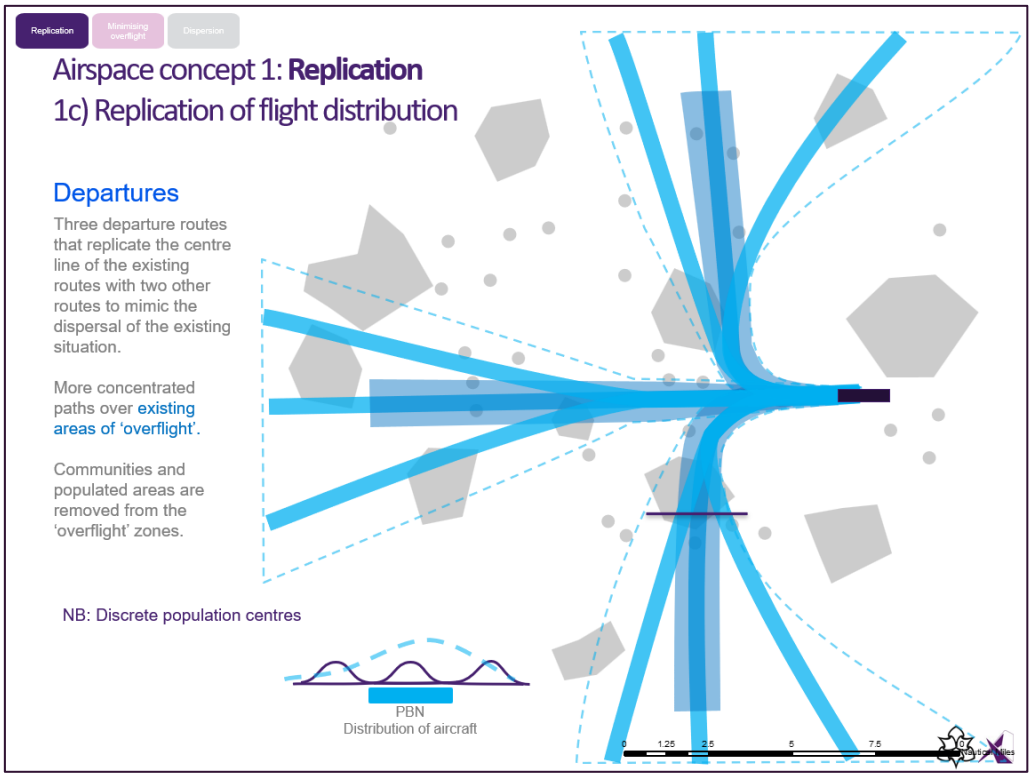
Whilst the replication would aim to match the historic procedure in terms of centrelines, the application of PBN would be expected to lead to an increase in concentration as a consequence of improved track keeping……

Replication is the default option for modernising conventional routes."




Replication
Minimising overflight
Dispersion
Airspace concept 1: Replication
1a) Replication of SID centre line
Departures
Three departure routes that replicate the centre line of the existing routes.
More concentrated paths over existing areas of 'overflight'.
Communities and populated areas are removed from the 'overflight' zones.
NB: Dispersed population
PBN
Distribution of aircraft
0
1.25
2.5
5
7.5


Replication
Minimising overflight
Dispersion
Airspace concept 1: Replication
1b) Replication of NPR with 3 routes
Departures
Three departure routes for each NPR to distribute overflight evenly across the NPR – this would not replicate existing distribution across the NPR but would create 3 concentrations across the NPR, most likely used temporally.
Concentrated paths over existing areas of 'overflight' where NPR currently exists.
Communities and populated areas are removed from the 'overflight' zones.
NB: Discrete population centres
PBN
Distribution of aircraft
0
1.25
2.5
5
7.5


Replication
Minimising overflight
Dispersion
Airspace concept 1: Replication
1c) Replication of flight distribution
Departures
Three departure routes that replicate the centre line of the existing routes with two other routes to mimic the dispersal of the existing situation.
More concentrated paths over existing areas of 'overflight'.
Communities and populated areas are removed from the 'overflight' zones.
NB: Discrete population centres
PBN
Distribution of aircraft
0
1.25
2.5
5
7.5
10
Nautical Miles

Airspace Concepts - Departures

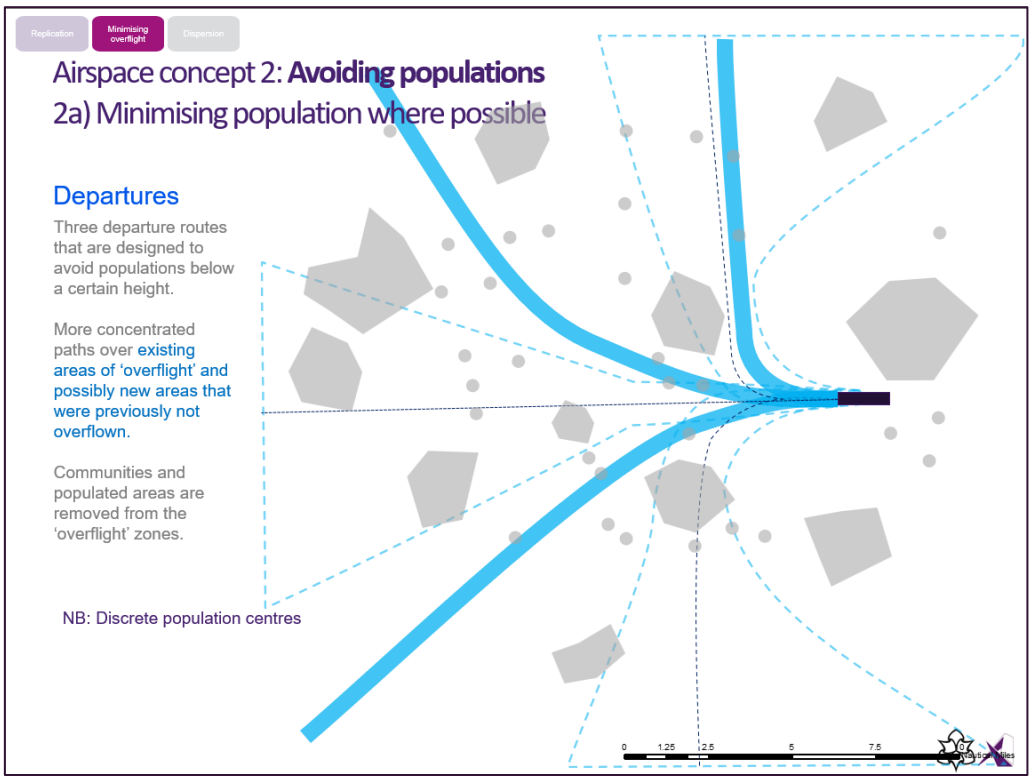
- Replication
- **Minimising overflight**
- Dispersion

CAP 1378 approaches the concept of avoiding populations below 4,000ft as follows:

"A new PBN route which avoids dense population below 4,000ft would replace the original route. After passing 4,000ft, any new route would go back towards the intended direction, ignoring populations which are overflown above 4,000ft.

In order to avoid the dense population below 4,000ft, the departing aircraft needs to fly straight ahead for longer, possibly outside the current NPR swathe (typically 3km wide). This adds on some distance and could affect runway throughput. It will now fly over new areas…..

Noise is the priority below 4,000ft, therefore avoiding populations should be considered as an option for any SID proposal below 4,000ft which goes beyond replication."



Airspace Concepts - Departures

Replication

Minimising overflight

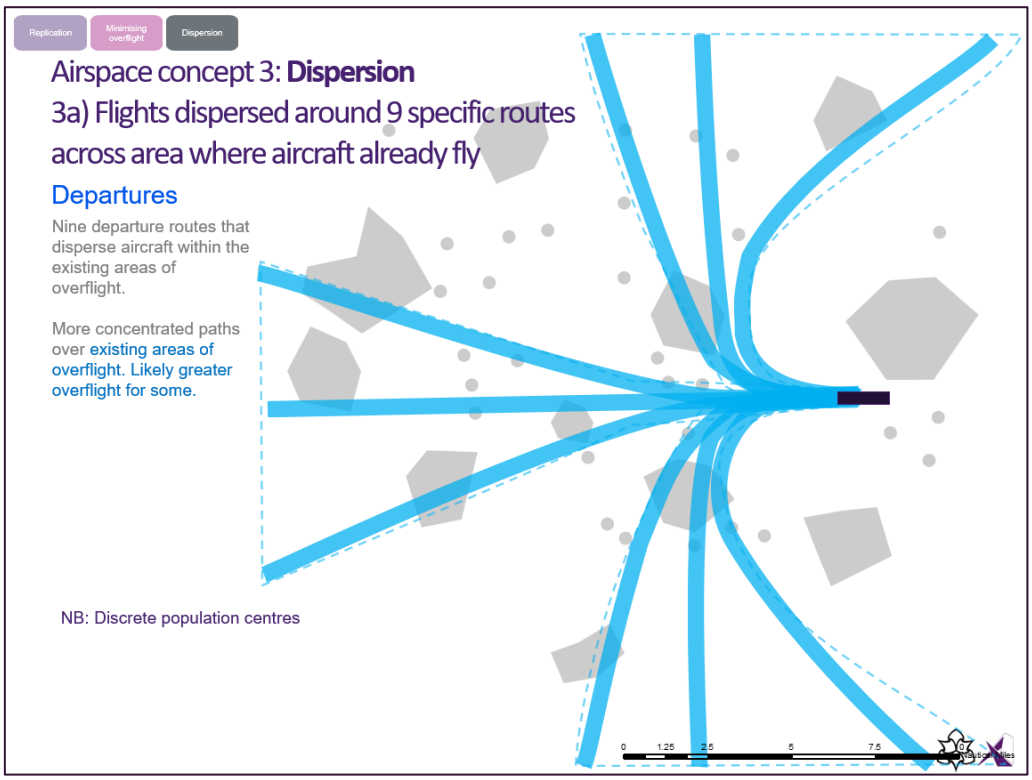
Dispersion

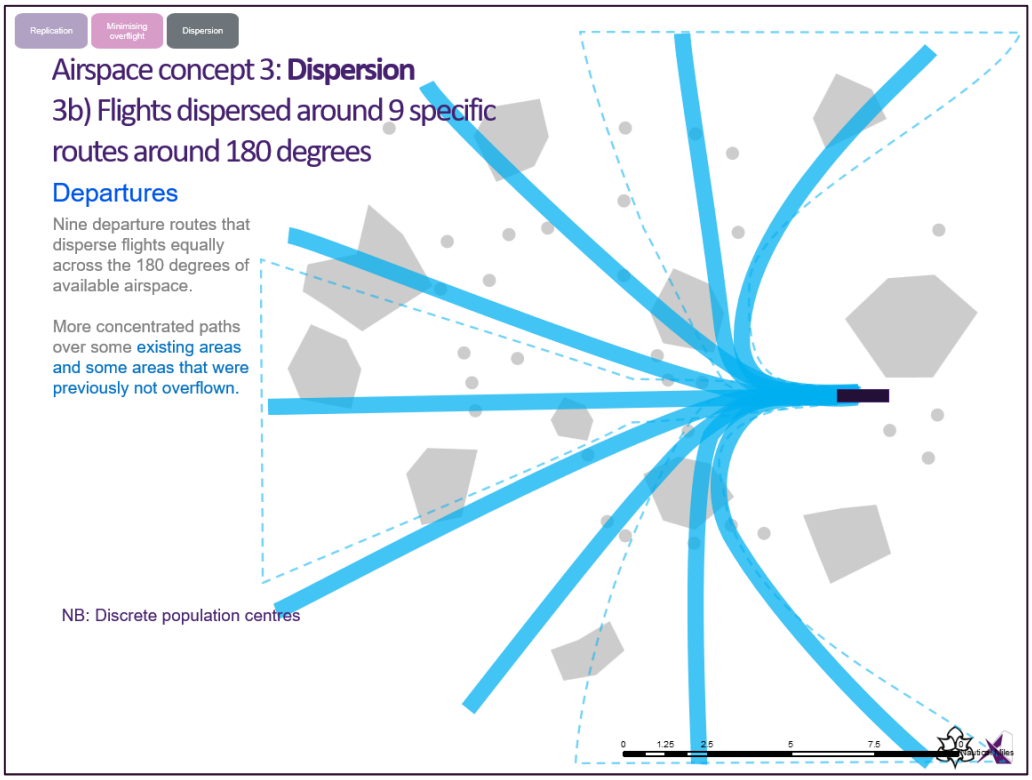
CAP 1378 approaches the concept of dispersal for departures as follows:

"This is an option where multiple PBN routes are used via random allocation throughout the day to create a swathe of departures, attempting to replicate the dispersal observed on conventional routes…..

A random allocation of such routes will be extremely challenging for current airport and ATC systems to cater for, adding complexity and flight planning issues for airlines. The number of procedures required in the aircraft and ATC database is now increasing…..

At the point where the relief routes converge, it is possible that the precise community beneath that point will experience more noise from aircraft on the relief routes than those on the primary route itself owing to the turning airframe and angle of the engines towards the ground."



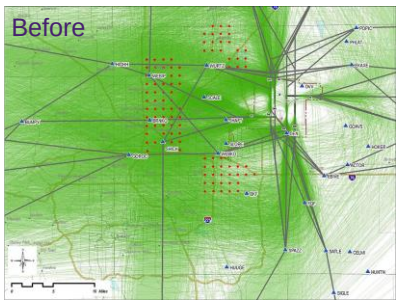


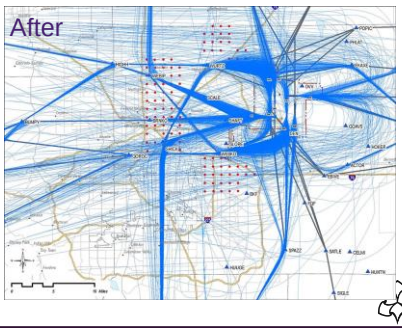
Negative response to airspace modernisation in the US.

In the US, airspace modernisation followed a 'replication' approach where they precisely replicated routes which resulted in a significant concentration of aircraft.

These images show what happened at Denver Airport which resulted in a significant negative community response towards using PBN.

Based on our previous discussion, how could the FAA have improved the acceptability of airspace modernisation at this airport?





A3.6.2 KEY FINDINGS (COMMUNITY NOISE GROUP CFW)

The session began with introductions during which personal views on being at the workshop and overviews of individual backgrounds were briefly shared.

The immediately ensuing discussion centred on views about living 'around here'*. Many attendees began by suggesting negative aspects, despite having been asked initially for positives. Positive views mostly centred on rurality, community values, countryside, tranquillity, natural beauty, ease of access to London, quietness and the ability to hear birdsong when there was no aircraft noise. Negative views focused on the airport being commercial and, thus, uncaring about the ramifications it causes to residents and the environment. Other issues raised were that the airport was a major polluter, that there was noise from Heathrow, undesirable road traffic, as well as noise from Gatwick departures every day of the year without respite. Sleep disturbance, air pollution (wasn't measured), unknown effects and an indication that there had been mass housing development on any available green space were also raised. To improve the situation, participants suggested that Gatwick and the aviation industry need to listen more (they were described as arrogant), that there should be a ban on night flights, dispersal, a focus on people, closure of airports, fair use of skies, efforts made to benefit all not just aviation, respite (days of no aircraft), continuous climb operations, prospect research, cap on flights, exploration of effect that Heathrow might have on Gatwick traffic, less focus on profit at all costs, realistic cap on flight numbers and passenger numbers. When asked to specifically reflect on Gatwick's impact, a range of comments were made: provides jobs, a level of wealth, transport for people who want to go on holiday, travel facilities but at a cost; jobs (availability) bring a rollercoaster effect to the area which isn't healthy – zero hours contracts, seasonal work and unaffordable housing locally (puts pressure on neighbouring counties to provide housing); more of a burden than an asset; there is a need for balance as environmental issues become even more of a priority; cares too much about profits; shareholders don't care about the community; CAA should be looking after the community but doesn't; conflict of interest causes problems; airport's not sustainable; trust (in Gatwick and its owners) is an issue; some improvement in engagement noted but this is countered by the observation that the CEO no longer attends community engagement events (contributor suggesting this indicates disinterest and points to ensuing lack of trust); people are powerless – victims of a commercial airport and government policy; concentration from changes over the years has caused problems; go back to pre-trial conditions; there are newly overflown groups from the trials; forums are tick box exercises; everything is too computerised; listen and look at data; we are viewed as NIMBYs.

The discussion moved on to consideration of what would be seen as more socially acceptable with regard to the airport's activities and airspace modernisation. There were multiple suggestions which can be summarised as follows:

- close the airport;
- work to build trust through professional and fair engagement and consultation, involving effective listening, building on professional reports/papers and openness to co-producing solutions;

- aviation industry members should work together and not blame each other:
- changes shouldn't just be for commercial benefit;
- increase dispersion;
- respond on night flight issues;
- do not allow increase in noise ghettos.

*Question subsequently re-worded to 'What do you think about where you live?'

The remainder of the workshop concentrated on the concept airport. It was reiterated a number of times that this work was not focused on Gatwick but on ideas at a concept airport. Departures were discussed first.

With regard to replication, participants suggested that this was what had happened during trials and that this was what was currently operational. It was suggested that height of aircraft information is needed to determine if an option is better or worse. Concentration was felt to be undesirable, and it was stated that 99 per cent of people would prefer to live outside of the blue area on the diagram under discussion. There was a desire for a framework for fairness and that this was a moral issue. Given that aircraft movements do not happen in isolation, there was an assertion that the totality of aircraft noise, both arrivals and departures, need to be considered. In addition, the change in noise on the ground is important, as is background noise and that this needs to be specific for each area. It was generally considered that replication illustrated in 1a was not fair. In 1b, respondents felt that new noise over new people could not be done without consultation. There was some positive comment around balance, fairness and spreading of pain in terms of more equitable distribution, although such distribution could only work around total numbers. There was some concern that in sending aircraft down each route may result in a total increase in numbers of flights and noise. With reference to 2a, the consensus was that this option was not an improvement as no one should experience concentration. However, at the same time, there was a suggestion that effects of concentration would be felt less in noisier, urban space. In 3a, using the totality of 180 degrees, there was a sense that this may be fairer or more equitable if there was a limit on total numbers. The wider spread could benefit people by lowering numbers of flights in any one area, although there was expressed lack of trust about this. Concern was expressed about those people living nearer the airport who would be affected whatever happened and that there be predictable respite for the newly overflown. One suggestion was that enforced noise abatement procedures could help people in these locations.

Turning to arrivals, 3a was considered preferable. Nevertheless, there was a desire to avoid areas where there are fewer people and an assertion that, on arrival, aircraft noise continues for longer than on departure. The ensuing discussion suggested that technology should not be driving change, for example, if radar vectoring ensures dispersal, then it should be employed.

Overall, concentration is problematic. There needs to be a greater consideration of people on the ground and lived experience. Numbers of aircraft need to be limited and due regard must be given to those experiencing

both arrivals and departures. The distributive offer needs complementing with assurances around totality. In summary, there was general negativity towards the idea of airspace modernisation, Gatwick airport and the policy-making community.

A3.6.3 KEY FINDINGS (MIXED GROUPS)

This section focuses on findings from the three 90-minute workshops held with 25 members of the public who had been recruited from areas close to and further out from the Gatwick vicinity. Recruitment was carried out by an independent company on behalf of the research team.

What do you like about where you live?

The main themes here were a) environmental: rurality, green space, clean air; b) accessibility and walkability: to London, the coast, family, the countryside, transport options, facilities and services; c) ambience: peace/quiet, safety, friendliness and community spirit.

What do you not like about where you live?

Here the discussion focused on a) environmental issues: planes (taking off and landing, night flights, potholes, congestion, noise from aircraft, too many people, pollution, river pollution; b) economic issues: house prices, expensive area; c) accessibility (lack of), parking, speeding, poor transport links, poor bus network, isolation caused by traffic, early trains (stop too early); d) social issues: crime, safety, over-development, area being victim of own success and lack of diversity.

What would make things better where you live?

Participants sought a number of changes to improve where they lived. These included a) aviation-related intervention/change: less noise, less night flights, investment in new, quieter aircraft, no second runway, the use of regional airports and more parking at the airport, and b) infrastructure improvement: more local amenities and affordable rent for shops, infrastructure to support the growing population, more doctors, more taxis at night and less traffic. Participants also saw a need for increased respect for the environment especially near hospitals, education and other facilities, preservation of green spaces, interventions to improve lives and more funds being made available.

What impact does Gatwick have on you?

In general, Gatwick's impact was seen in quite a positive light. There were supportive comments expressed in relation to enjoying proximity to the airport as it opened up opportunities for vacations, meant that there were good amenities locally, improved links to London and other modes of travel, and provided the prospect of plane-spotting. The airport was also recognised as a driver of the local economy and jobs. Nevertheless, several comments were made about the impact of noise (night flights, flights generally, summer operations) and

pollution, as well as concern expressed about effects beyond one's own lived experience (e.g. impact on others even if one was not affected by overflights).

What would influence social (un)acceptability/nudging?

Both positives and negatives were recognised to exist and there was a query as to where the balance lay currently, with the participant then suggesting that positives far outweigh the negatives. Potential for improvement was described in terms of reduction or banning of night flights [(between 0000 and 0600), provision of compensatory measures such as better noise insulation schemes (some suggested that either the airport doesn't do this anymore or that no one knows what is done)]. It was also deemed to be important that people buying homes on new developments be made aware of noise from the airport to help manage their expectations. There was a call for respite and communication of when areas would be overflown to enable people to plan outdoor activities. Another suggestion was that the airport give more money to local councils to improve local issues such as crime and safety. Expansion was described as being totally unacceptable by some, with one participant stating "That would be too much, that is not what we signed up for. Step changes are not great, gradual changes might be OK. If the price of travel went up dramatically, no personal benefit so would move away." Another respondent indicated that the airport should work with airlines to provide more discounted flights, stating that if this happened, they would be willing to put up with more inconvenience or undesirable effects. Other comments made follow:

- Need more information on environmental impact to answer (e.g. aircraft overhead – how much carbon is that dumping into the environment?
- Debate about airport expansion, making uncertainty, more debate now, raised profile – not so much a problem before
- International travel in itself is something that no one needs but most of the air miles and things that we do aren't really necessary
- Huge environmental impact with air travel and things like that
- House prices are an issue, as well as environmental costs
- If towns are bulldozed – that is too much!
- Air fares often too cheap say compared to trains, not influencing people to consider other transport options.
- Make parking cheaper
- Rude to make people pay to drop off
- Raise price of flights?
- Charge airlines more to stop them doing these cheap flights
- Need more communication about how Gatwick offsets its entire operation
- Offset travel with options (e.g. plant a tree etc)
- Flights take off earlier, less into night – less sound
- Don't like a huge step change e.g. 2nd runway

- Husband is very sensitive to noise, so he responds differently to me
- It's the noise of the trains
- Garden in summer, noise is quite constant particularly if they are banking
- Positive – get home from holiday or business quickly, employs people
- Not everyone affected equally
- There are quite a few places that on top of a visitor levy, for example, you can offset your travel to a place like Blenheim Palace. You could give consumers of Gatwick Airport an option to sort of, you know, make themselves feel better about them. Again, it's sort of recognition of the impact and doing something about it.
- People accept that the airport is a necessity
- People shout about it but still go on holiday twice a year
- Local traffic use at unusual times of night (night shift work at Gatwick) – please go the long way round not through my local rural village – maybe ensure this?
- People parking across our drives, restricting our access – knock on consequences – it's unfair – note with your booking on how to behave (avoid antisocial behaviour).
- Better connections for regional airport so everyone doesn't come to Gatwick – more traffic on roads as well.
- Airport industry should think about extending Cardiff
- What about air pollution - share the burden with other airports?
- Don't offer things which are unacceptable, like a flight at 3am.
- Light pollution stopped us seeing northern lights
- Totally unacceptable: second runway, increased flights, no step changes, more later/night flights
- Park and ride/bus around a 5-mile radius of airport may improve parking/lessen environmental impact of car travel.

The Concept Airport

Departures

With regard to departures, when Concept 1a was shown, participants felt that to be able to determine whether this was better or worse would be dependent upon where one lives. In all workshops, there was a tendency to focus on local experiences at Gatwick and not on a concept airport. Concerns were expressed about whether schools would be overflown and whether the attention was being given to both air and noise pollution. During the discussion, clarification had to be given that these routes have been around for quite some time and participants asked whether there has been an impact on those people/areas overflown in terms of planning etc. The issue of whether information about such routes was made available to house buyers was raised. A participant indicated that when they had bought their house, they had known that they would be overflown. There was some concern expressed about how those who are overflown should be protected with suggestions that timings and offers of compulsory purchase should be examined. It was felt that it would be useful to know whether arrivals/departures/use of stacks are more disruptive and to have data such as how noisy these operations are, as well as information on height, speed and power's influence on noise. One participant asked whether you should "kill one person to let 10 live". When the dispersed population option was explored, there was a suggestion that, if you are in a populated area, you are probably used to more noise - so there's likely to be less impact compared to more rural locations. Thus, views were generally mixed. There was also a point made about the need to be able to weight the number of people affected, and to what degree, if discussions of fairness and equity are to take place.

Turning to replication within the NPR (1b), there were queries about the limited number of routes but participants felt that this option looked better than the previous one. It was also deemed to be fairer to just spread aircraft rather than employing concentration or respite routes alternation. There were some queries about how this scenario would be managed (e.g. would every other route be used/different ones at different times of day). There was also some scepticism around whether this approach may belie an attempt to add another runway at the airport. Responses didn't vary between different population patterns.

In terms of 1c (replication of flight distribution), there was a view that people in the middle would be less overflown in this option, although others would be noticeably subject to more overflights. When asked whether this option provided better sharing, the response was "Not fair if you bought your property understanding the flight paths, so unfair. It is against expectation". For this scenario, there was a call for information about noise on the ground to be provided. There was also a suggestion that it would be better to spread aircraft in the 3km band where noise/overflights are expected. For some, this was a much better option, while others stated that some people may be more impacted. For people who may not be expecting this type of change, some felt it would be unfair, although other participants preferred this scenario as they were already expecting overflights. There were queries about whether routes could be adjusted to fly over less populated areas. Other points raised were:

- But some may be impacted more
- Maybe unfair if you have more noise/overflights
- Why should only one minority suffer when we all benefit from airport
- If you look at general principles, seems fair, but if you live at x and there is significant increase then not fair. There would be an uprising for local communities.
- After this discussion, 1b (within NPR) was preferred by most attendees.

Moving to 2a (avoiding populations), this option was met by negativity. Participants did not like it, they suggested that large scale change for new populations was not acceptable and that the benefit of missing some people was outweighed by effects on newly overflown. It was felt important that developers and property purchasers be shown plans if this option was taken. There appeared to also be an apparent dichotomy of views summed up as "better for more people, but worse for new people, change against expectation. Unfair deal!". This was followed by an assertion that areas may not currently be populated but could later be subject to development and, therefore, overflown.

On 3a (dispersion), participants queried at what point would vectoring off be allowed. They felt that this option spreads the noise more and that higher flights are not as noisy. However, it was felt that this option would present a big change for people who have not experienced much noise previously. One participant queried as to why technology cannot be applied to make aircraft quieter, with another asking whether the benefits of new technology are being held back by keeping older aircraft in the fleet for longer. Another participant stated that "we all want to use the airport, so we all have to 'pay' – one argument that could be considered (although not in my back yard?...)". Turning to 3b (dispersion – 9 routes), the sentiment expressed was that, objectively, this option provided an equality of distribution "but people won't feel that. Too many people exposed for a large change".

With regard to 3b (dispersion), there was a general sense that this was a really fair option in terms of sharing. However, there was a caveat associated with this assertion that there would be a lack of trust if the scenario was used to facilitate more aircraft movements. It was felt that aircraft height was particularly important in this option. Another sentiment expressed was that, objectively, this option provided an equality of distribution "but people won't feel that. Too many people exposed for a large change".
Other comments were:

- Centre might get 1/9? of what they got (1/3rd)
- Everyone wants to travel, so why shouldn't they all get disbenefits? Fair way to share
- Can't win
- If you have respite and no more flights – sharing more equally – then good way ahead

Arrivals

There was limited discussion of arrivals across the workshops due to time. However, in the sessions where some comment was made, this is captured as follows. Looking at 1a (replicate), it was felt that this option was unfair (e.g. for people who had bought under previous overflight conditions and would now experience change) and the ability to determine whether the option was better or not was largely linked to where one lived. For example, "people who buy houses in Crawley know about flights, motorway, they signed up for what they expected. If changed, not fair, and could set communities against other communities". There was some indication though that, if people had move into a changed environment, that would be acceptable but not if they already live in the area.

Looking at 2a (minimising populations), this option was not popular. Comments made included:

- Less ambient noise so they will have a much greater change, so not fair, even more so for those overflown (possibly newly).
- Leave it alone!
- Even worse than concentration where it is in 1a.
- Already happened with route 4 – one aircraft area to another – affected people, local wedding experience with winners and losers discussing at same table!
- Why can't you make the planes less noisy? (This comment has come up at every workshop).
- Does majority rule? Piss off a few, protect the most? What is the principle?
- What happens if you develop under the 'new' minimise people route?
- Step change upwards, not great.
- Dispersed population - higher background noise levels throughout?

In 3a (dispersal), participants seemed to see more positive effects. They stated that this was better than 1a. They felt there was a possibility of relief with this option and that sharing was better (provided that routes were not then "overfilled"). Other comments made:

- More routes the better, and it starts to get nearer to where it was in the pre-modernisation days. But what it the limit on number of routes?
- So let's minimise change from current situation - this appears to be the general principle here.
- Other relevant comments were:
- Depends on the data – need to work out change in percent overflights, change in or noise levels, environmental benefits of reducing stacking
- Minimise people – more change for currently less overflown
- Moving to more routes than 1 – recreate some of the spread (3a)
- But there are current 'preferential' routes to replicate.
- Yes good for stack, yes for more spreading

- “But is it a trick, if more efficient, won’t they land more aircraft and ultimately re-introduce stacking. More efficient, more slots, more aircraft, more money – so promises have to be made on total numbers…”

US example

Reflecting on the US experience, participants were asked what they could have done differently. It was suggested that better communication and explanation, and input from communities would have improved the situation. This prompted a participant to ask whether Gatwick could just decide to change things with no CAP1616 process. Someone else stated that if change takes place free parking should be offered to those who are affected.

Concluding remarks

In summary, participants seemed to like the airport. They felt it was important that any change be marginal, and that step change would be unacceptable. They suggested that people should not be newly overflown and that any change be shared amongst those who are already impacted, with due compensation being provided.
In general, the same issues and messages were raised in all workshops with the exception that one group did not approve of the use of 9 routes for dispersion. Participants indicated mistrust in any change that could be used to increase aircraft movements overall. The findings raised queries about what point does vectoring start and is this dependent on distance or noise.

A3.7 THEMES TO EXPLORE FURTHER IN SUBSEQUENT FOCUS GROUPS

Themes to Explore Further

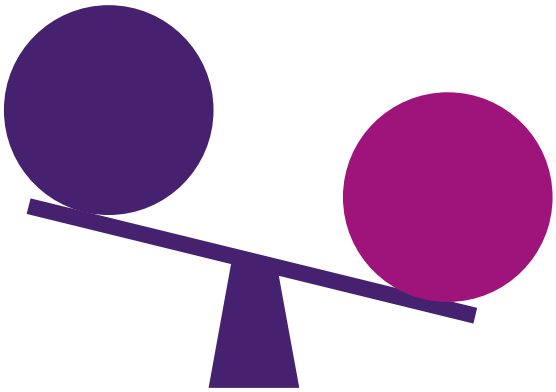
'Concentration on centre line' strategy is perceived as not fair – strategy not an attractive option.

'New people' overflown is perceived as not fair, particularly with respect to existing expectations when purchasing a property – strategy not an attractive option

Both ends of spectrum do not appear to deliver FED i.e. neither concentration or full dispersal.

Resounding preference to replicate what they currently have - 'minimise change'

Social Unacceptability



People consider dispersion across an area already affected perceived as fairer i.e. within current areas of flight track concentration e.g. existing NPRs for departures.

Rural areas have lower background noise so aircraft more noticeable – perceived as a strong reason not to use 'minimize population' strategy (in addition to overflying new people rationale).

Desire for some predictable time off.

Any FED delivery solutions must also consider increased total numbers

Majority of the negative impacts appear to be borne locally, and benefits more widely dispersed - deemed as unfair

ANNEX 4: FOCUS GROUPS

A4.1 INTRODUCTION

The central part of the research work was the Focus Groups. This Annex sets out their purpose, dates and recruitment, agenda and conduct, general questions about 'living around here', and some examples of the virtual airport and concepts used to develop discussion. Each focus group was recorded (with consent), notes were taken on the day, and an independent researcher who did not attend the FG listened to each recording amending and adding to the notes of each session, then summarising the key outcomes across the focus groups which are given in the final section.

A4.2 PURPOSE

"To explore fundamental perceptions and attitudes towards existing and concepts for potential future managed airspace operations to identify attributes of social unacceptability, fairness, and equity and, to develop the key tools and metrics that facilitate communication"

The outputs will help to:

- Build further understanding of key features driving perceptions of social unacceptability, fairness and equity of distribution of aircraft operations through better understanding of the lived experience of residents and how that influences their quality of life, attitude to the airport and perception of the acceptability (or otherwise) of airport operations.
- Further explore possible future flight distribution concepts that could result from airspace modernisation to better appreciate those features that make for more, or less, acceptable outcomes from your perspective.
- Explore key metrics to reflect these features.
- Inform on steps for mitigating social unacceptability and to set out context of how outputs might be used in ACP.

A4.3 DATES AND RECRUITMENT

Thirteen workshops were held at local venues from Hilton Hotel from 20th June to 11th July 2023. There were 128 attendees in total and all gave their informed consent to participate. The independent recruitment company recruited mixed attendees from the areas given in Figure A4.4, booked the local venues, and arranged payments. These areas align with the recruitment areas used in the previous CFW recruitment.

Recruitment Areas

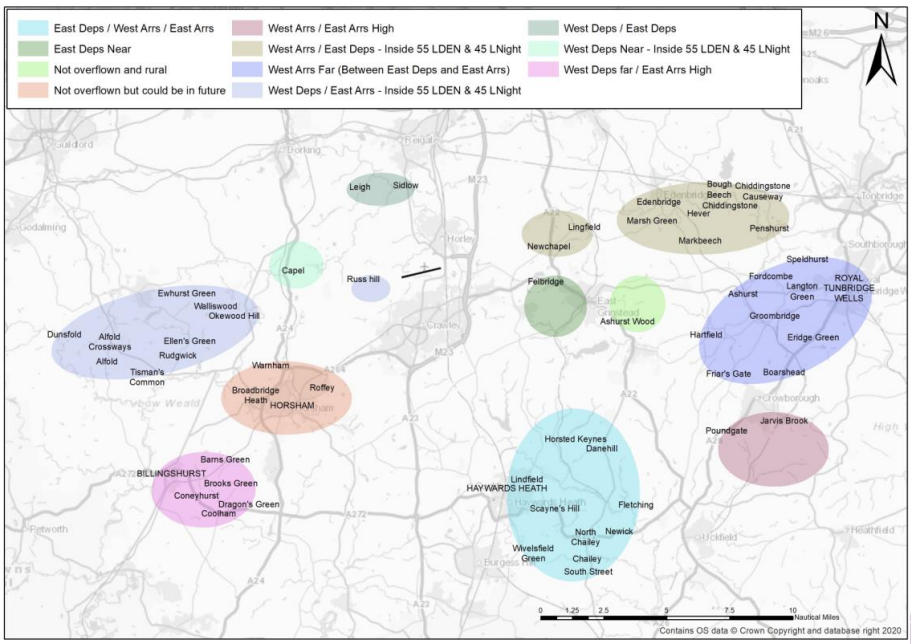


Figure A4.2: Recruitment areas for FGs

A4.4 AGENDA AND CONDUCT

Agenda

Item	Item	Timings
1	Introductions, housekeeping & The research project	10 mins
2	Living around here	20 mins
3	Evolution of Aircraft Navigation	10 mins
4	Discussion of concept airport examples	50 mins

1. Welcome and housekeeping

- Tea/Coffee
- Housekeeping
- Some ground rules
- Introduction to the project
- Informed consent
- Introductions and check-in

Some ground rules

- The workshop is operating under Chatham House rules.
- We are not here to solve the issues. We are after your opinions. The focus of this workshop is not about debating right or wrong but capturing judgments to get a sense of 'better' or 'worse', there are no wrong or right answers, all opinions will be valued even if there are points over which there is disagreement.
- So that people feel able to speak freely, we ask for respect, empathy and congruence for all others' expressed views regardless of whether you agree or disagree.

A4.5 QUESTIONS ABOUT LIVING AROUND HERE

For FGs 5 to 12, whilst the attendees settled in, they were asked to complete a questionnaire about their views of living where they did. The questions were:

1. What are the good things about living around here?
2. What are the not so good things?
3. What are 3 things you might suggest to make it better than it is now?

The summary of their answers is given next.

Good things about living here *(first line is FG number, second line is number of participants expressing that opinion in that FG)*							
Good amenities that are close by							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
5	*3*	*6*	*3*	*2*	*2*	*6*	*4*
Transport links							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
3	*3*	*2*	*2*	*2*	*2*	*2*	*5*
Proximity to the coast, city and countryside							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	*6*	*3*	*1*	*4*	*0*	*4*	*5*
Easy access to other places e.g., airport							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	*3*	*3*	*0*	*1*	*0*	*1*	*3*
Community spirit							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
6	*2*	*4*	*5*	*5*	*2*	*4*	*5*
Green space							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
5	*4*	*2*	*1*	*2*	*2*	*2*	*4*
Outdoor activities							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	*1*	*0*	*1*	*0*	*1*	*0*	*0*
Quiet and peaceful							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	*2*	*2*	*3*	*5*	*0*	*0*	*1*
School and job opportunities							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	*5*	*4*	*1*	*2*	*1*	*1*	*2*
Mix of urban and rural environment							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	*1*	*2*	*2*	*1*	*1*	*1*	*1*
Pretty and clean environment							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	*3*	*4*	*3*	*0*	*0*	*3*	*2*

Good things about living here *(first line is FG number, second line is number of participants expressing that opinion in that FG)*							
Safety							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	*3*	*0*	*1*	*0*	*0*	*2*	*2*
Parking							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	*0*	*1*	*0*	*1*	*0*	*0*	*0*
House prices							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	*0*	*0*	*0*	*1*	*0*	*0*	*0*

Bad things about living here **(first line is FG number, second line is number of participants expressing that opinion in that FG**							
Aircraft noise							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
6	*2*	*0*	*1*	*1*	*3*	*0*	*0*
Vehicle noise							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	*0*	*0*	*2*	*0*	*1*	*0*	*2*
Night noise							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
3	*0*	*1*	*0*	*0*	*0*	*0*	*0*
Loss of sleep							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Loss of green space and nature							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	*1*	*0*	*1*	*0*	*0*	*1*	*0*
Overdevelopment							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
4	*2*	*0*	*3*	*1*	*1*	*1*	*1*
Overpopulation							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	*1*	*0*	*0*	*0*	*0*	*2*	*0*
Congestion							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	*4*	*7*	*0*	*0*	*1*	*1*	*2*
Road maintenance							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	*2*	*3*	*0*	*2*	*0*	*0*	*2*
Infrequent and disrupted public transport							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	*2*	*2*	*0*	*3*	*1*	*4*	*3*
Amenities/services don't match the population increase (oversubscription)							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**

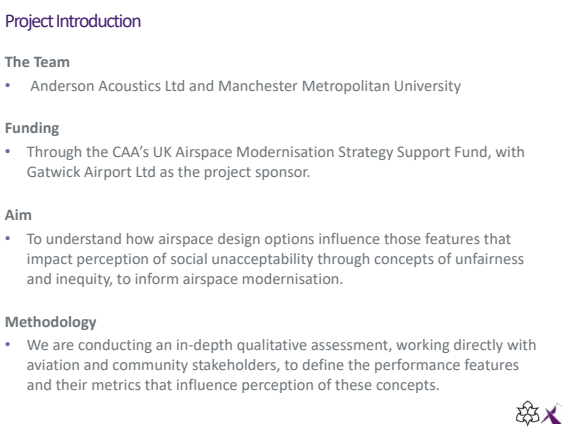
Bad things about living here (first line is FG number, second line is number of participants expressing that opinion in that FG							
2	5	1	1	1	0	2	3
Antisocial behaviour							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	2	1	1	1	1	1	6
House prices							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	1	2	1	0	0	1	1
Parking difficulties							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	0	3	0	0	0	0	0
High street/leisure doesn't match today (activity diversity, police presence, independent shops)							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	1	4	1	3	0	4	5
Amenities don't match the demographic in the area							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	0	0	0	0	1	0
Bad schools (not religious)							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	0	2	0	0	0	0	2

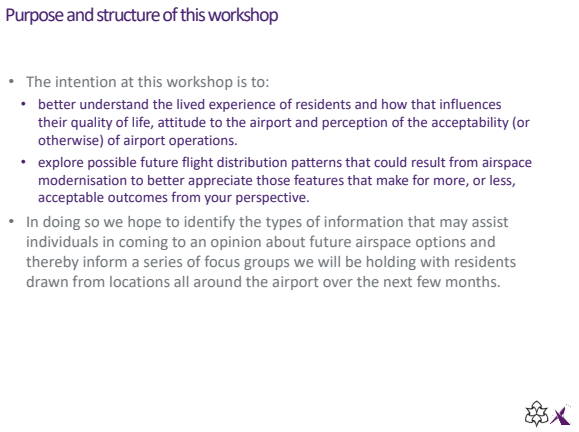
How to make it better *(first line is FG number, second line is number of participants expressing that opinion in that FG)*							
Create new flight paths/more variation							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	1	1	1	0	0	0	1
No night flights							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	1	0	0	0	1	0	0
Use different flying methods (steeper take off etc...)							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	1	0	0	1	1	0	0
Make roads safer for pedestrians (traffic lights and pavements)							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	0	1	0	0	0	0	0
Investment in public transport							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	1	5	0	5	1	1	3
Less housing development							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	1	0	2	0	0	1	0
Protect nature and the landscape							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	1	0	0	0	1	2	1
Increase the facilities and services to match the growing population (police, doctors etc...)							

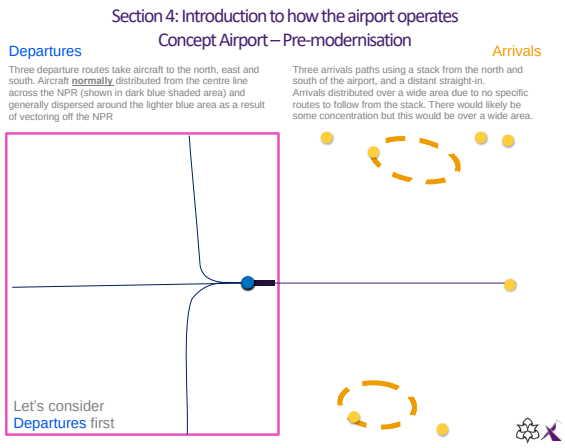
How to make it better *(first line is FG number, second line is number of participants expressing that opinion in that FG)*							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2	*5*	*1*	*0*	*3*	*2*	*4*	*4*
Increase/diversify the amenities and shops around							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	*4*	*3*	*1*	*2*	*0*	*3*	*2*
Introduce traffic restrictions							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	*1*	*1*	*2*	*1*	*2*	*1*	*0*
Give opportunities for questions, feedback and community involvement							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	*1*	*1*	*1*	*0*	*0*	*0*	*1*
Make the area more affordable							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	*1*	*1*	*1*	*0*	*0*	*0*	*1*
Fix the roads							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	*0*	*4*	*0*	*3*	*0*	*2*	*1*
More housing and parking							
5	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0	*0*	*2*	*1*	*0*	*0*	*0*	*0*

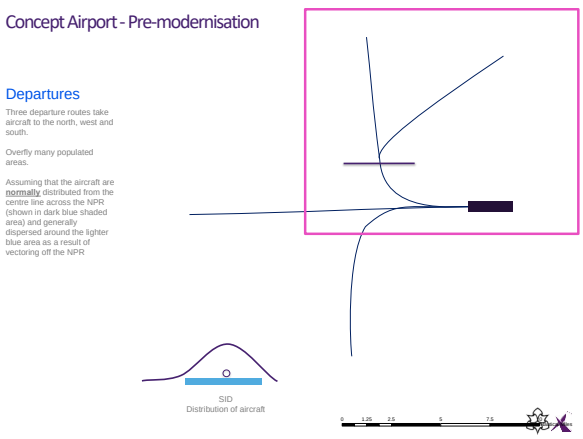
A4.6 VIRTUAL AIRPORT AND CONCEPTS USED TO DEVELOP FG DISCUSSION

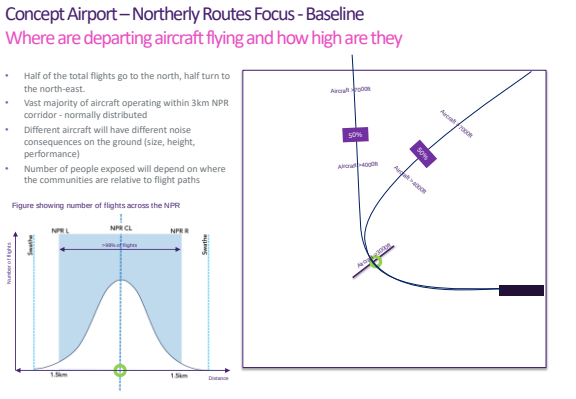
A selection of the presentational material used in the FGs is reproduced next. The FGs introduced the attendees to the virtual airport and explored four different concepts for delivering varied distributions of air traffic, explaining the different associated noise exposure patterns. The attendees were asked about their understanding of the virtual airport and each concept, factors affecting perceived fairness, relative fairness between concepts, and the usefulness of noise and height data.

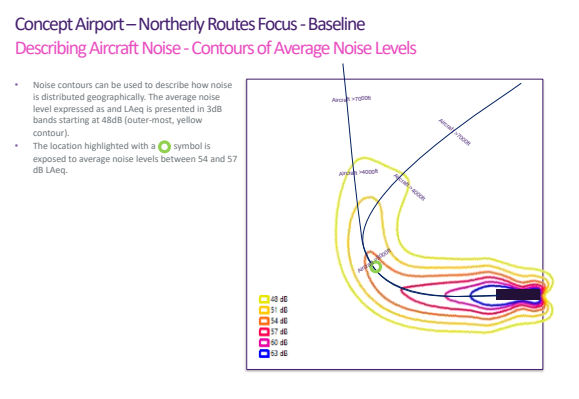








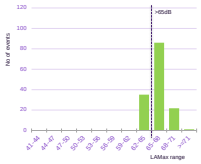


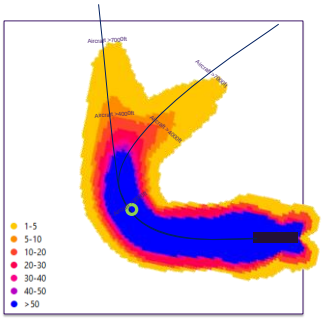


Concept Airport – Northerly Routes Focus - Baseline

Describing Aircraft Noise - Event based analysis N65 and LAmax distribution

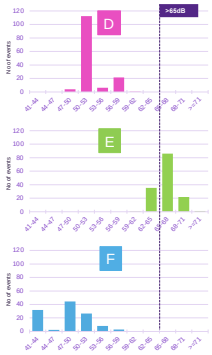
- The figure to the right highlights areas exposed to number of events with a maximum noise level >65dB (known as N65).
- The location highlighted with a ○ symbol has more than 50 events with an LAmax >65dB (N65>50).
- The figure below illustrates, in a histogram, the distribution of the event LAmax at that location from all of the flights.
- It shows that there were in total approximately 105 events with LAmax> 65 with approximately 20 with LAmax> 68dB, and approximately 35 just below 65dB.

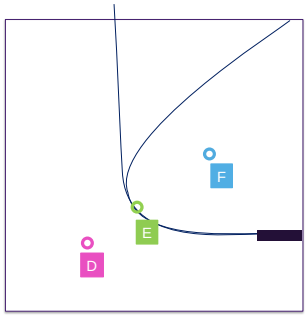




Concept Airport – Northerly Routes Focus - Baseline

Distribution of event LAmax at specific locations

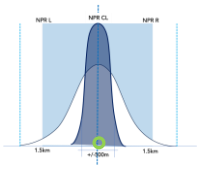


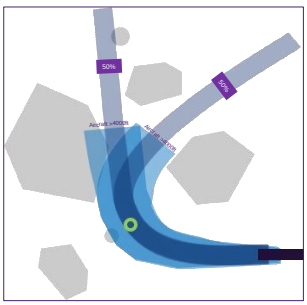


Airspace Concept 1: Replication of conventional route

Introduction

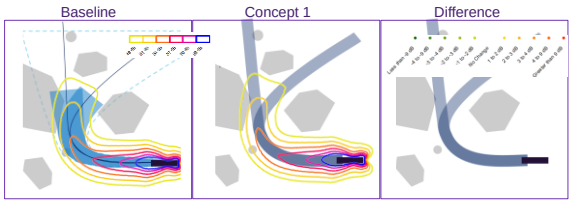
- Aircraft fly more accurately and consistently resulting in a concentration of aircraft across a narrower corridor ~1km wide. This distribution is illustrated in the figure below.
- There are different implications for each community – burden is concentrated on those already overflown, but there are benefits for those to the sides of the route towards the edges of the "old" NPR





Airspace Concept 1: Replication

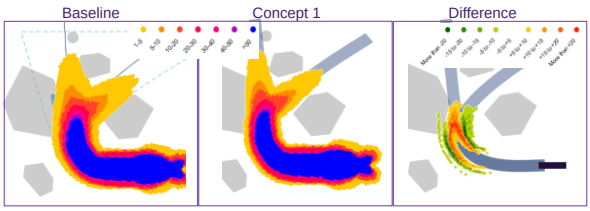
Geographic Average Noise Level Implications – LAeq



- Concentrating slightly extends and narrows the contours compared to the baseline
- There are no areas with a difference of in average noise level of more than 1dB (neither beneficial nor detrimental).

Airspace Concept 1: Replication

Geographic Noise Events Implications – N65

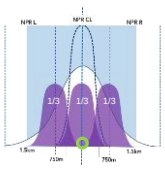


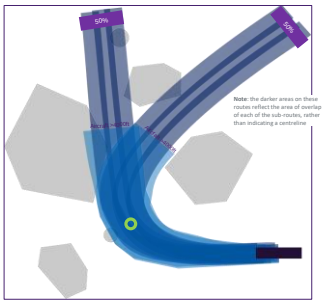
- Concentrating slightly extends and narrows the areas of N65 values.
- There are increases in the N65 for those under the more concentrated corridor, areas with more than +20events (more than 20% increase).
- Top the side of the NPR there are decreases in N65 of similar magnitudes.
- Those under the new NPR have increased event burden, with no discernible LAeq difference. Areas to the side reduced event burden.

Airspace Concept 2: Replication, increased dispersion - centreline +2 sub-routes

Introduction

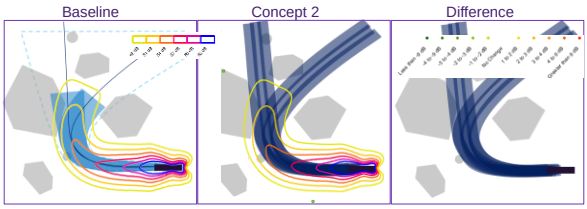
- Each NPR is replicated with the centre line from the Replication 1 concept and 2 sub-routes +/- 750m. Designed to contain all flights within the existing NPR corridor and increase dispersion across NPR.
- Each sub-route contains flights spread over 1km (as with Replication 1). On average, approx. one-third of the flights of each NPR corridor on each sub-route. Distribution illustrated in the figure below.
- There would be fewer flights directly underneath the NPR centreline compared with the baseline, with more flights out towards the edges.





Airspace Concept 2: Replication, increased dispersion - centreline +2 sub-routes

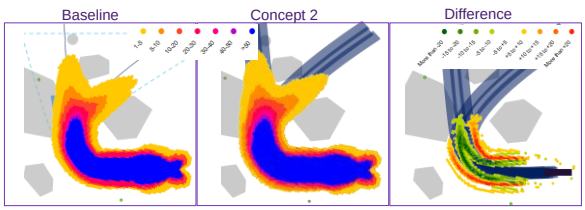
Geographic Average Noise Level Implications – LAeq



- Visibly very little difference compared to the baseline
- There are no areas with a difference of in average noise level of more than 1dB (neither beneficial nor detrimental).

Airspace Concept 2: Replication, increased dispersion - centreline +2 sub-routes

Geographic Noise Events Implications – N65

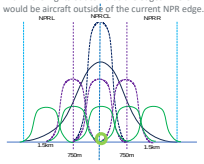


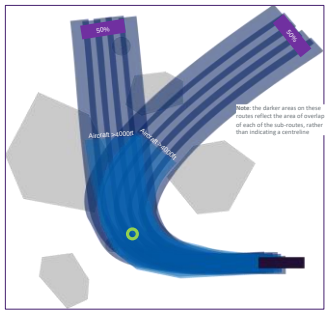
- Increasing the distribution across the NPR changes the shape of the N65 bands – the N65>50 becoming a bit wider along with all the bands outside it.
- Whereas Replication 1 increased the N65 directly beneath the centreline, this option sees decrease under the centreline and increase towards the edges.

Airspace Concept 3: Replication, increased dispersion - centreline +4 sub-routes

Introduction

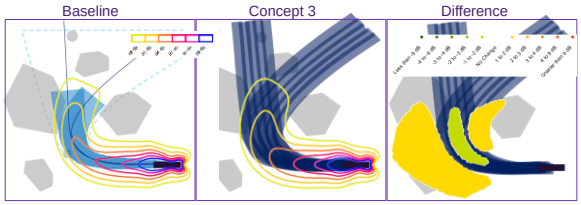
- Each NPR is replicated with the centre line from the Replication 1 concept; the 2 sub-routes +/- 750m from replication 2; AND 2 further sub-routes +/- 1500m to line-up with the NPR corridor edges.
- Designed to increase dispersion across the NPR.
- Each sub-route contains flights spread over 1km (as with Replication 1). On average, approx. one-fifth of the flights of each NPR corridor on each sub-route. Distribution illustrated in the figure below.
- There would be fewer flights directly underneath the NPR centreline compared with the baseline, with more flights out towards the edges. There would be aircraft outside of the current NPR edge.





Airspace Concept 3: Replication, increased dispersion - centreline +4 sub-routes

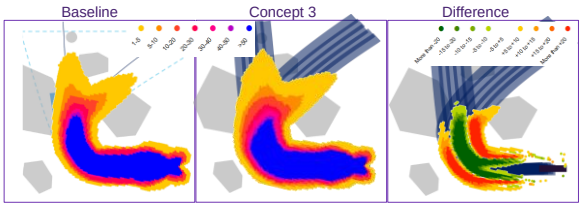
Geographic Average Noise Level Implications – LAeq



- Visibly some differences with compared to the baseline
- The burden for those underneath the centreline has been reduced approximately 1-2dB (a small difference).
- The burden for those to the edge has increased 1-2dB.

Airspace Concept 3: Replication, increased dispersion - centreline +4 sub-routes

Geographic Noise Events Implications – N65

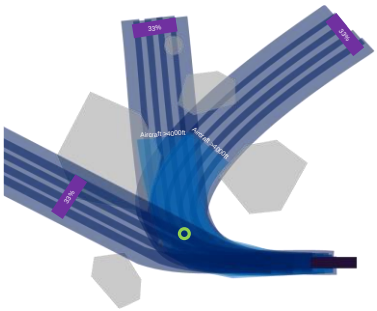


- Geography of N65 has changed.
- There is N65 reduction of 15-20 under the central potion of the NPR, and there is a commensurate increase to the edges of the NPR as the aircraft are distributed across the corridor and to outside of the corridor.
- Large areas of change.

Airspace Concept 4: Replication of the existing NPRs + an additional new route

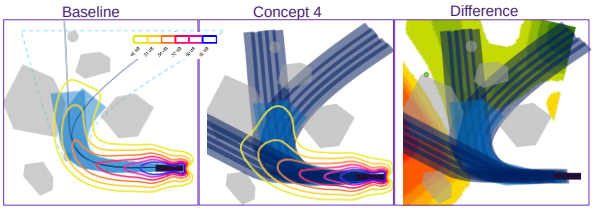
Introduction

- The existing NPRs are replicated as Replication 3. A new route that goes over new areas has been added with the same concept of having a centreline and 4 sub-routes.
- This is designed to increase sharing and potentially introduce some options for providing respite.
- Completely new area are overflown.
- This option reduces the proportion of flights on each of the existing NPRs and so reduces the burden for those who already have it, but shares the overall burden with new areas.
- Flights proportions down route would be split approximately one-third each.



Airspace Concept 4: Replication of the existing NPRs + an additional new route

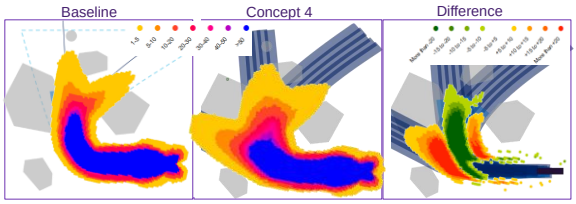
Geographic Average Noise Level Implications – LAeq



- Lower noise contours have been drawn in towards the airport for the existing routes, but have extended out over new areas with the new route.
- Areas of significant worsening of noise for those areas newly overflown. But there are also benefits for people affected by aircraft using the existing NPR corridors

Airspace Concept 4: Replication of the existing NPRs + an additional new route

Geographic Noise Events Implications – N65



- Geography of N65 has changed significantly.
- Totally new areas exposed to 30-40 events per day.
- There is N65 reduction of 15-20 under the central potion of the existing NPR, with a commensurate increase to right hand edge of the existing NPR (as with replication 3) and an extension of the N65 under the new area of the new NPR, outside of the existing NPRs.
- Large areas of adverse change.

A4.7 SUMMARY OF KEY FINDINGS BY CONCEPT ACROSS ALL FOCUS GROUPS

4.7.1 Concept 1

- Unfair to concentrate noise – makes sense to spread over a wider area so less people suffer.
- Centreline noise already unbearable
- Should be flying over urban areas more used to noise.
- Depends on growth over time – of people and aircrafts.
- Depends on population of area being flown over.
- Compensation? – monetary or insulation
- New technology to reduce noise at source?
- Depends on timing of flights.
- Concern on effects such as health, wildlife and property prices
- Understanding there is no simple solution and view will change depending on where you live.
- People chose where they lived but noise has changed drastically since.
- What about the environmental impacts?
- Vulnerable people's health will need a higher level of concern such as schools
- Can't insulate from sound in gardens/ when windows are open in summer

4.7.2 Concept 2

- Fairer
- Mistrust about future growth (more routes, more planes?)
- People in centre used to noise and chose to live there – why burden more?
- Schedule when routes will be in use and warn people in advance (make people aware of unpredictability). – decide with community how long each is operational and what's fair
- Everyone needs to agree on schedule.
- Compensation?
- People in new areas didn't expect this development so unfair.
- Night flights?
- New technology for reducing noise at source?
- Need numbers e.g., population.
- Everyone uses airport so burden should be spread.
- Depends where you live such as rural areas where not as used to noise
- Rotate operation times?
- Depends on activity in area
- Impact health
- House prices

4.7.3 Concept 3

- equal but not fairer / fairer – balancing act
- growth – mistrust
- New technology at source?
- Distribution of people and land value underneath?
- Benefit to centre but not edge – big change for rural areas at edge that aren't built for controlling noise. More people effected (balancing act)
- Depends on operation. (People want alternating routes) people need to be aware
- Effects health and sleep – exposing new areas that aren't used to/unbearable now. Will find more challenging
- More Protest around edge
- Everyone uses airport – fairer to spread
- Compensation, monetary/ insulation. How do you distribute it?

4.7.4 Concept 4

- Big change for new people
- Rural areas are quieter and not built to deal with noise, but urban areas can mask better. – high protests
- big relief
- Shift patterns/quota system needs negotiating.
- Recognise that not everyone is happy and no perfect option.
- Mistrust about future growth
- Health concerns?
- Nighttime important
- Balancing act – depends on what's underneath.
- People in previous routes knew what they were getting into.
- Not fair
- Fairer to spread nobody has too much of a burden fairer to spread as they all use it
- Compensation(insulation)

4.7.5 Other comments

- Focus group 11 disagreed more with the rest of the focus groups
- Can't insulate listed buildings
- Balancing act is the aim to be less affected or less dramatically affected

ANNEX 5: Q METHODOLOGY

Section A - Q methodology: An overview

A5.1 INTRODUCTION

Q methodology is the scientific and systematic study of subjectivity (attitudes, feelings, perspectives, thoughts, opinions, values) towards a topic, issue or question. It reveals different viewpoints around a subject and can expose consensus (similarities in views) as well as conflict (differences in views).

Q methodology helps to open up an issue or topic and draw out different ways that people are thinking about it. The method also helps to move beyond the simple linking of views to jobs, demographic characteristics or other external indicators that characterise many other methods. Instead, it takes a detailed 'snapshot' of the diversity of subjective perspectives around a topic and can reveal nuanced views within debates that might appear at first sight to be homogeneous.

A5.2 DATA COLLECTION

The data collection method used in Q methodology consists of participants sorting a set of statements on (virtual) cards. The statements are drawn from various perspectives around the research topic, from sources such as interviews, focus groups and publications. Once the researcher is satisfied that they have obtained the range of views on the topic, they distil the statements into a smaller number which captures the essence of these perspectives. Each of the ensuing statements is then placed on a card for sorting.

Participants are instructed to sort the statements in two phases: the initial phase involves arranging the statements into 3 piles. For example, the participant groups the statements according to those that most represent their view, those that least represent their view, and those they feel neutral/uncertain about.

The second phase requires the participant to consider how strongly they feel about each statement. They place each statement card along a response grid (See Figure 1) which is typically in the shape of a normal distribution or bell curve (with the majority of statements placed towards the middle or neutral area and fewer at either end).

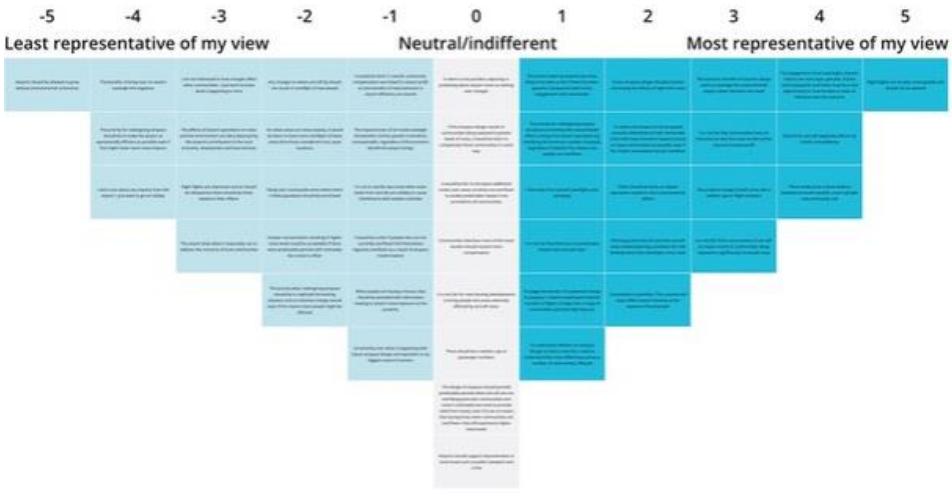


Figure 1 Q Sort Response Grid

Since the participant ranks statements relative to each other, they are compelled to arrange the statements in the prescribed Q-sort grid through a holistic thinking process. The resulting arrangement of cards on the grid is purely subjective, based on the participant's own feelings or opinions. There are no right or wrong answers.

A5.3 ANALYSIS

Data analysis is carried out via correlation and factor analysis. The unit of analysis is the Q-sort. Importantly, and in contrast to other methodologies which compare the responses of groups of people, Q compares all collected Q-sorts with each other. Pattern analysis reveals which Q-sorts tend to be similar. These Q-sorts are said to form a cluster of subjectivity which represents a shared view. A number of shared views or factors will emerge. These factors reflect the different viewpoints on the topic.

Factor analysis then reveals a composite or synthetic Q-sort for each factor. This is a way of arranging the statements that is most representative of that factor. Describing the composite Q-sort for each factor results in rich and nuanced explanations of the shared views.

A5.4 RESEARCH PARTICIPANTS

The participants (or P Set) also distinguish Q methodology from other research methods. In a Q study, more participants do not necessarily mean better. A Q study only requires enough participants as necessary to manifest the shared viewpoints. There is no prescribed ideal number of participants, although it is generally considered that the number of respondents should be around half the number of statements. It is not unusual for the P-set to be 12-40 people.

The selection of participants is intentional, purposeful and strategic rather than random. That is, Q researchers carefully choose participants. They look for participants who have opinions about the topic, feel strongly and represent a variety of distinct subjectivities.

A5.5 Q METHODOLOGY: THE GATWICK STUDIES

Two studies were carried out using Q methodology as part of the project. The first study sought to explore views around fairness in the context of airspace change and, the second, looked at considerations of noise with respect to airspace modernisation.

Participants in both studies were drawn from the cohort of people who had taken part in the earlier focus groups conducted as part of this research. Participants were invited to take part in either the first Q study or the latter but not both.

The statements used in both studies were drawn from the Community Fundamentals Workshops which were held towards the beginning of the overall research. Since attendees at these workshops had been drawn from noise stakeholder groups and people from communities around Gatwick Airport, a wealth of local knowledge and experience informed the narrative on which the statements were based.

While details about the analysis carried out for these studies is beyond the scope of this report, the approach adopted consisted of Principal Components Analysis to extract factors, application of the Kaiser-Guttman Criterion (supplemented by the use of scree plots) to assist with determining which factors to retain and followed by Varimax rotation to improve the interpretability of the factor solution.

The findings of each study will now be discussed separately.

A5.6 UNDERSTANDING FAIRNESS IN THE CONTEXT OF AIRSPACE CHANGE

In this study, Q methodology was used to reveal perspectives on fairness in relation to airspace change. The study consisted of 46 statements which were sorted by 29 participants – 13 Male and 16 Female, aged between 19 and 75.

Analysis of the 29 sorts revealed 3 factors or viewpoints. Ten Q sorts contributed to Factor A, 8 to Factor B and 9 to Factor C. The remaining two Q sorts did not map onto these three viewpoints and were, thus, excluded from further analysis. In terms of the geographical distribution of the factors, Q sorts associated with Discourse A were from participants from varied locations, both near in and further out from the airport, Discourse B was associated with people living further out and Discourse C mostly with people nearer in. The composite Q sort for each factor can be found in Section B.

Here we concentrate on the viewpoints that were revealed:

- All three discourses concurred that there was a need for engagement to be meaningful and characterised by openness, genuineness, honesty and transparency. They also asserted that there must be a real opportunity for communities to have an influence over outcomes.
- In addition, all three discourses called for airport growth to be subject to environmental constraints. They all suggested that there is a need to understand the noise differences across a number of affected communities to understand whether an airspace change is more or less fair. They also called for the change in the number of flights and their heights to be communicated to help judge fairness of a potential change. Allied to this, all discourses sought a realistic cap on flight numbers to be part of airspace change. Also, all discourses did not think it would be fairer to overfly urban rather than rural areas.
- All discourses indicated that airspace change should not result in new people regularly being overflown. However, and in contrast, the three discourses also asserted that any changes to where aircraft fly should result in overflight of new people. This suggests that there is an apparent dichotomous view about newly overflown people: the key appears to be the regularity of overflight, potentially pointing to a need for an element of respite within airspace change.
- All discourses expressed concern about the impacts of the airport. In addition, they felt that it is not fair that communities have no choice but to accept the noise burden whilst airports increase profit.
- All discourses asserted that they had concern about the impacts of airspace change in other communities, as well as their own.

A5.7 DISCOURSE A

This discourse is dominated by anti-noise sentiments: night flights are socially unacceptable and should be banned, noise negatively impacts on health and wellbeing and there is a sense of unfairness that communities are bearing a noise burden while airports increase profits.

In addition, if there is concentration of aircraft on particular routes, this discourse characterises this as unfair for communities exposed to significantly increased noise levels. The narrative also highlights that the effects of airport operations on noise and the environment are not fairly balanced by the airport's contribution to the local economy, employment and local services.

This viewpoint believes that consultation has little bearing on airport decision making and that decisions will be made for the benefit of the airport at the expense of local people.

While there is a call for a fairer balance between economic benefit, airport growth and community cost, there is a sense that economic benefits of airports always seem to outweigh environmental impacts when decisions are made.

This discourse does not agree with the assertion that the priority for redesigning airspace should be to make the airport as operationally efficient as possible, even if this might mean more noise impacts.

A5.8 DISCOURSE B

This discourse is characterised by the view that noise did not negatively affect individual health and wellbeing, and that aircraft noise was not very annoying. It alluded to the fact that night flights were not socially unacceptable, although there should be some limits on them based on their effects. It could therefore be considered a viewpoint that was generally more accepting of aircraft noise.
There was little concern expressed about the uncertainty associated with what is happening with future airspace design and operation.

The discourse was counter to the view that it is pointless objecting or protesting about airport noise as nothing ever changes, implying that there was some optimism that any concern around noise may result in positive action on the part of the airport. In contrast to Discourse A, this group believed that consultation has a positive effect on airport decision making.

The narrative described a need for the noise burden to be shared around as many communities as possible, even if this meant that new people may be overflown.

The discourse sought an understanding of the noise differences across communities affected to determine whether an airspace change is more or less fair.

As long as aircraft noise levels were unlikely to cause interference with outdoor activities, it suggested that it would be acceptable to overfly new areas.

A5.9 DISCOURSE C

This discourse suggested that aircraft noise should not be shared around communities. It did not find night flights socially unacceptable, and it did not believe that future airspace design should prioritise minimising the effects of night-time noise.

In addition, it indicated that the effects of airport operations on noise and environment are not fairly balanced by the airport's contribution to the local economy, employment, and local services, and called for a fairer balance between economic benefit, airport growth and community cost.

There was clear value placed on compensation in this discourse: if communities are exposed to greater levels of noise, it was considered fairer to compensate them in some way, communities that bear more of the noise burden should receive more compensation and it would be fairer if, overall, community compensation was linked to airport profit so that benefits of improvements in airport efficiency are shared.

In addition, this discourse called for information on airport noise exposure to be provided for potential house buyers and that planning conditions related to aircraft noise be met by new home developers.

This was the only discourse that expressly supported predictable breaks from aircraft noise, deeming the absence of such respite as unfair.

A5.10 CONSIDERATIONS IN AIRSPACE MODERNISATION

This study consisted of 16 statements which were sorted by 14 respondents – Male 3 Female 11, aged between 18 and 67.

Analysis of the 14 sorts revealed 5 factors or viewpoints. Four Q sorts formed Factor A, there were 2 for Factor B, 2 for Factor C, 2 for Factor D and 1 for Factor E. With only one sort, Factor E was eliminated from further analysis as at least two q-sorts are required for a factor. No common views were held across all four discourses.
Each of the remaining factors is described below:

A5.11 DISCOURSE A

This discourse called for a limit on air traffic growth. In airspace modernisation, specifically, it asserted that there should be a growth cap and changes in noise exposure should be limited. In addition, the discourse found it unacceptable to increase the overall number of flights and to expose people to marginal increases in noise where levels are currently lower. It also highlighted that levels of compensation should be greatest in areas where increases in noise exposure are largest.

A5.12 DISCOURSE B

For this discourse, noise exposure was a central concern: it indicated that it is unacceptable to expose people to marginal increases in noise further away from the airport (where noise levels are lower) even if there are benefits to communities closer to the airport that are currently exposed to higher noise levels. It stated further that every effort should be made in airspace modernisation to limit changes in noise exposure and that it is unacceptable if some people become newly exposed to aircraft noise even if this helps alleviate noise exposure in existing areas of overflight. The discourse also asserted that airspace modernisation should seek to avoid noise exposure in areas which previously had no noise impact. However, the discourse also suggested that there is no need to limit air traffic growth, if this is possible without an overall increase in noise exposure and called for a defined noise limit beyond which there can be agreement that noise impacts do not occur.

A5.13 DISCOURSE C

While this discourse posited that it is acceptable to expose people to marginal increases in noise further away from the airport (where noise levels are lower) if there are benefits to communities closer to the airport that are currently exposed to higher noise levels, it caveated this position with the assertion that aircraft noise exposure is more noticeable in quiet and tranquil areas and any compensation provision should reflect this. Further, it suggested that levels of compensation associated with airspace change should be greatest in the areas experiencing the biggest increase in noise exposure. At the same time, the discourse did not call for every effort to be made to limit changes in noise exposure in airspace modernisation, although it found it unacceptable to increase the number of flights overall (even if this does not increase overall noise exposure). It underlined this view by indicating that it does not agree that there is a need to limit air traffic growth, even if this growth is possible with no overall increase in noise exposure.

A5.14 DISCOURSE D

This discourse saw airspace modernisation as an opportunity to address current inequities in noise exposure by attempting to share noise out more equally across surrounding populations. It suggested that it is not acceptable to increase the number of flights overall, even if this does not increase overall noise exposure. Also, the discourse felt it is unacceptable to newly expose people to aircraft noise even if only a small number would be exposed and that marginal increases in noise further away from the airport are unacceptable even if there are benefits to communities closer to the airport that are currently exposed to higher noise levels. This is probably linked to the assertion that aircraft noise is more noticeable in quiet and tranquil areas where the discourse believed due compensation should be given. In addition, the discourse called for airports to commit to a growth cap as part of the negotiation over airspace modernisation.

Section B - Composite/Synthetic Q sorts for each factor

Understanding fairness in the context of airspace change

Factor 1

Statement Number	Statement	Sort Values
6	Airports should be allowed to grow without environmental constraints	-5
26	I don't care about any impacts from the airport. I just want to go on holiday	-4
22	The priority for redesigning airspace should be to make the airport as operationally efficient as possible even if this might mean more noise impacts	-4
3	The benefits of living near an airport outweigh the negatives	-4
45	The airport does what it reasonably can to address the concerns of local communities	-3
31	Night flights are important and so should be allowed but there should be limits based on their effects	-3
9	The effects of airport operations on noise and the environment are fairly balanced by the airport's contribution to the local economy, employment and local services	-3
11	I am not interested in how changes affect other communities. I just want to know what's happening to mine	-3
21	The priority when redesigning airspace should be to replicate the existing situation and so minimise change overall even if this means more people might be affected	-2
17	Greater concentration resulting in higher noise levels could be acceptable if there were predictable periods with noticeably less noise to offset	-2
7	Flying over countryside areas where there is little population should be prioritised	-2
37	As urban areas are noise anyway, it would be fairer to have more overflight of these areas than those considered rural, quiet locations	-2
14	Any changes to where aircraft fly should not result in overflight of new people	-2
46	Uncertainty over what is happening with future airspace design and operation is my biggest cause of concern	-1
40	When people are buying a house, they should be provided with information relating to airport noise exposure at the property	-1
8	It would be unfair if people who are not currently overflown find themselves regularly overflown as a result of airspace modernisation	-1
12	It is ok to overfly new areas when noise levels from aircraft are unlikely to cause interference with outdoor activities	-1
42	The impacts/costs of air travel outweigh the benefits; further growth is therefore unsustainable, regardless of the economic benefit the airport brings	-1
20	It would be fairer if, overall, community compensation was linked to airport profit so that benefits of improvements in airport efficiency are shared	-1
25	Airports should support improvements in local issues such as public transport and crime	0
23	The design of airspace should provide predictable periods when aircraft are not overflying particular communities and noise is noticeably less (and so provide relief from noise), even if to do so means that during times when communities are overflown, they will experience higher noise levels	0
43	There should be a realistic cap on passenger numbers	0
39	It is not fair for new housing developments to bring people into areas adversely affected by aircraft noise.	0
27	Communities that bear more of the noise burden should receive more compensation	0
38	It would be fair to introduce additional routes over areas currently not overflown to enable predictable respite to be provided to all communities	0

Statement Number	Statement	Sort Values
18	If the airspace design results in communities being exposed to greater levels of noise, it would be fairer to compensate those communities in some way	0
34	It seems to be pointless objecting or protesting about airport noise as nothing ever changes	0
10	To understand whether an airspace change is more or less fair, I need to understand the noise differences across a number of communities affected	1
36	To judge the fairness of a potential change to airspace, I need to understand how the numbers of flights change over a range of communities and how high they are.	1
44	It is not fair that there are no predictable breaks from aircraft noise	1
1	I find noise from aircraft overflights very annoying	1
15	The priority for redesigning airspace should be to minimise the overall health effects arising from airport operations by overflying the minimum number of people, regardless of whether this means new people are overflown	1
13	The actions taken by airports are more likely to be seen as fair if there has been genuine, transparent and honest engagement and consultation	1
28	Consultation is pointless. The outcome will always reflect airport interests at the expense of local people	2
41	Planning authorities should have aircraft noise related planning conditions for new developments that developers must meet	2
5	There should be limits on airport operations based on their environmental effects	2
24	To reduce the impact on those people currently affected by aircraft, the burden of aircraft noise should be shared around as many communities as possible, even if this means new people may be overflown	2
32	Future airspace design should prioritise minimising the effects of night time noise	2
16	It is not fair if the concentration of aircraft on routes results in communities being exposed to significantly increased noise	3
33	Any airspace change should come with a realistic cap on flight numbers	3
19	It is not fair that communities have no choice but to take the noise burden whilst airports increase profit	3
4	The economic benefits of airports always seem to outweigh the environmental impacts when decisions are made	3
29	There needs to be a fairer balance between economic benefit, airport growth and community cost	4
2	Noise from aircraft negatively affects my health and wellbeing	4
35	For engagement to be meaningful, airports need to be more open, genuine, honest and transparent, and there must be a real opportunity for communities to have an influence over the outcome	4
30	Night flights are socially unacceptable and should not be allowed	5

Factor 2

Statement Number	Statement	Sort Values
1	I find noise from aircraft overflights very annoying	-5
2	Noise from aircraft negatively affects my health and wellbeing	-4
11	I am not interested in how changes affect other communities. I just want to know what's happening to mine	-4
6	Airports should be allowed to grow without environmental constraints	-4
30	Night flights are socially unacceptable and should not be allowed	-3
46	Uncertainty over what is happening with future airspace design and operation is my biggest cause of concern	-3
34	It seems to be pointless objecting or protesting about airport noise as nothing ever changes	-3
42	The impacts/costs of air travel outweigh the benefits; further growth is therefore unsustainable, regardless of the economic benefit the airport brings	-3
26	I don't care about any impacts from the airport. I just want to go on holiday	-2
39	It is not fair for new housing developments to bring people into areas adversely affected by aircraft noise.	-2
21	The priority when redesigning airspace should be to replicate the existing situation and so minimise change overall even if this means more people might be affected	-2
28	Consultation is pointless. The outcome will always reflect airport interests at the expense of local people	-2
37	As urban areas are noise anyway, it would be fairer to have more overflight of these areas than those considered rural, quiet locations	-2
43	There should be a realistic cap on passenger numbers	-1
14	Any changes to where aircraft fly should not result in overflight of new people	-1
8	It would be unfair if people who are not currently overflown find themselves regularly overflown as a result of airspace modernisation	-1
20	It would be fairer if, overall, community compensation was linked to airport profit so that benefits of improvements in airport efficiency are shared	-1
22	The priority for redesigning airspace should be to make the airport as operationally efficient as possible even if this might mean more noise impacts	-1
15	The priority for redesigning airspace should be to minimise the overall health effects arising from airport operations by overflying the minimum number of people, regardless of whether this means new people are overflown	-1
40	When people are buying a house, they should be provided with information relating to airport noise exposure at the property	0
44	It is not fair that there are no predictable breaks from aircraft noise	0
41	Planning authorities should have aircraft noise related planning conditions for new developments that developers must meet	0
45	The airport does what it reasonably can to address the concerns of local communities	0
9	The effects of airport operations on noise and the environment are fairly balanced by the airport's contribution to the local economy, employment and local services	0
33	Any airspace change should come with a realistic cap on flight numbers	0
4	The economic benefits of airports always seem to outweigh the environmental impacts when decisions are made	0
29	There needs to be a fairer balance between economic benefit, airport growth and community cost	0
13	The actions taken by airports are more likely to be seen as fair if there has been genuine, transparent and honest engagement and consultation	1
32	Future airspace design should prioritise minimising the effects of night time noise	1

Statement Number	Statement	Sort Values
7	Flying over countryside areas where there is little population should be prioritised	1
17	Greater concentration resulting in higher noise levels could be acceptable if there were predictable periods with noticeably less noise to offset	1
19	It is not fair that communities have no choice but to take the noise burden whilst airports increase profit	1
38	It would be fair to introduce additional routes over areas currently not overflown to enable predictable respite to be provided to all communities	1
5	There should be limits on airport operations based on their environmental effects	2
23	The design of airspace should provide predictable periods when aircraft are not overflying particular communities and noise is noticeably less (and so provide relief from noise), even if to do so means that during times when communities are overflown, they will experience higher noise levels	2
3	The benefits of living near an airport outweigh the negatives	2
16	It is not fair if the concentration of aircraft on routes results in communities being exposed to significantly increased noise	2
27	Communities that bear more of the noise burden should receive more compensation	2
12	It is ok to overfly new areas when noise levels from aircraft are unlikely to cause interference with outdoor activities	3
18	If the airspace design results in communities being exposed to greater levels of noise, it would be fairer to compensate those communities in some way	3
25	Airports should support improvements in local issues such as public transport and crime	3
10	To understand whether an airspace change is more or less fair, I need to understand the noise differences across a number of communities affected	3
35	For engagement to be meaningful, airports need to be more open, genuine, honest and transparent, and there must be a real opportunity for communities to have an influence over the outcome	4
24	To reduce the impact on those people currently affected by aircraft, the burden of aircraft noise should be shared around as many communities as possible, even if this means new people may be overflown	4
31	Night flights are important and so should be allowed but there should be limits based on their effects	4
36	To judge the fairness of a potential change to airspace, I need to understand how the numbers of flights change over a range of communities and how high they are.	5

Factor 3

Statemen Number	Statement	Sort Value
26	I don't care about any impacts from the airport. I just want to go on holiday	-5
24	To reduce the impact on those people currently affected by aircraft, the burden of aircraft noise should be shared around as many communities as possible, even if this means new people may be overflown	-4
14	Any changes to where aircraft fly should not result in overflight of new people	-4
6	Airports should be allowed to grow without environmental constraints	-4
39	It is not fair for new housing developments to bring people into areas adversely affected by aircraft noise.	-3
9	The effects of airport operations on noise and the environment are fairly balanced by the airport's contribution to the local economy, employment and local services	-3
30	Night flights are socially unacceptable and should not be allowed	-3
32	Future airspace design should prioritise minimising the effects of night time noise	-3
45	The airport does what it reasonably can to address the concerns of local communities	-2
1	I find noise from aircraft overflights very annoying	-2
25	Airports should support improvements in local issues such as public transport and crime	-2
43	There should be a realistic cap on passenger numbers	-2
28	Consultation is pointless. The outcome will always reflect airport interests at the expense of local people	-2
34	It seems to be pointless objecting or protesting about airport noise as nothing ever changes	-1
37	As urban areas are noise anyway, it would be fairer to have more overflight of these areas than those considered rural, quiet locations	-1
11	I am not interested in how changes affect other communities. I just want to know what's happening to mine	-1
38	It would be fair to introduce additional routes over areas currently not overflown to enable predictable respite to be provided to all communities	-1
42	The impacts/costs of air travel outweigh the benefits; further growth is therefore unsustainable, regardless of the economic benefit the airport brings	-1
3	The benefits of living near an airport outweigh the negatives	-1
22	The priority for redesigning airspace should be to make the airport as operationally efficient as possible even if this might mean more noise impacts	0
5	There should be limits on airport operations based on their environmental effects	0
8	It would be unfair if people who are not currently overflown find themselves regularly overflown as a result of airspace modernisation	0
16	It is not fair if the concentration of aircraft on routes results in communities being exposed to significantly increased noise	0
2	Noise from aircraft negatively affects my health and wellbeing	0
23	The design of airspace should provide predictable periods when aircraft are not overflying particular communities and noise is noticeably less (and so provide relief from noise), even if to do so means that during times when communities are overflown, they will experience higher noise levels	0
46	Uncertainty over what is happening with future airspace design and operation is my biggest cause of concern	0
21	The priority when redesigning airspace should be to replicate the existing situation and so minimise change overall even if this means more people might be affected	0
36	To judge the fairness of a potential change to airspace, I need to understand how the numbers of flights change over a range of communities and how high they are.	1

Statemen Number	Statement	Sort Value
33	Any airspace change should come with a realistic cap on flight numbers	1
7	Flying over countryside areas where there is little population should be prioritised	1
12	It is ok to overfly new areas when noise levels from aircraft are unlikely to cause interference with outdoor activities	1
17	Greater concentration resulting in higher noise levels could be acceptable if there were predictable periods with noticeably less noise to offset	1
4	The economic benefits of airports always seem to outweigh the environmental impacts when decisions are made	1
15	The priority for redesigning airspace should be to minimise the overall health effects arising from airport operations by overflying the minimum number of people, regardless of whether this means new people are overflown	2
19	It is not fair that communities have no choice but to take the noise burden whilst airports increase profit	2
31	Night flights are important and so should be allowed but there should be limits based on their effects	2
13	The actions taken by airports are more likely to be seen as fair if there has been genuine, transparent and honest engagement and consultation	2
10	To understand whether an airspace change is more or less fair, I need to understand the noise differences across a number of communities affected	2
27	Communities that bear more of the noise burden should receive more compensation	3
20	It would be fairer if, overall, community compensation was linked to airport profit so that benefits of improvements in airport efficiency are shared	3
44	It is not fair that there are no predictable breaks from aircraft noise	3
35	For engagement to be meaningful, airports need to be more open, genuine, honest and transparent, and there must be a real opportunity for communities to have an influence over the outcome	3
41	Planning authorities should have aircraft noise related planning conditions for new developments that developers must meet	4
18	If the airspace design results in communities being exposed to greater levels of noise, it would be fairer to compensate those communities in some way	4
29	There needs to be a fairer balance between economic benefit, airport growth and community cost	4
40	When people are buying a house, they should be provided with information relating to airport noise exposure at the property	5

Considerations in airspace modernisation

Factor 1

Statement Number	Statement	Sort Values
12	There is no need to limit air traffic growth, if this is possible with no overall increase in noise exposure	-3
9	It is acceptable to increase the number of flights overall, if this does not increase overall noise exposure	-2
5	It is ok to expose people to marginal increases in noise further away from the airport (where noise levels are lower) if there are benefits to communities closer to the airport that are currently exposed to higher noise levels	-2
16	Aircraft noise exposure is more noticeable in quiet/tranquil areas and any compensation provision should reflect this	-1
3	It is ok to increase the number of noise events in an area if these are deemed to be at a level that is not intrusive above existing noise sources	-1
2	We should use airspace change as an opportunity to address current inequities in noise exposure (i.e. attempt to share out noise more equally across surrounding populations)	-1
4	If airspace change results in measurably louder noise events, but these are unlikely to be perceived by the human ear (i.e. <3dB Lmax), then this can be considered as no effective change to noise exposure	0
8	If newly exposing people to aircraft noise results in small numbers of people overall being exposed to noise impact, then that is acceptable	0
7	It's ok if some people become newly exposed to aircraft noise if this helps alleviate noise exposure in existing areas of over flight.	0
14	The level of compensation for residents experiencing noise impact should be proportionate to the level of noise exposure	0
11	We need to define a noise limit beyond which we can agree noise impacts do not occur	1
6	Airspace modernisation should seek to avoid noise exposure in areas which previously had no noise impact	1
13	All residents experiencing significant noise exposure should be compensated	1
15	Levels of compensation associated with airspace change should be greatest in the areas experiencing the biggest increase in noise exposure	2
10	Airports should commit to a growth cap as part of the negotiation over airspace modernisation	2
1	In airspace modernisation, every effort should be made to limit changes in noise exposure	3

Factor 2

Statement Number	Statement	Sort Values
5	It is ok to expose people to marginal increases in noise further away from the airport (where noise levels are lower) if there are benefits to communities closer to the airport that are currently exposed to higher noise levels	-3
1	In airspace modernisation, every effort should be made to limit changes in noise exposure	-2
7	It's ok if some people become newly exposed to aircraft noise if this helps alleviate noise exposure in existing areas of over flight.	-2
10	Airports should commit to a growth cap as part of the negotiation over airspace modernisation	-1
9	It is acceptable to increase the number of flights overall, if this does not increase overall noise exposure	-1
4	If airspace change results in measurably louder noise events, but these are unlikely to be perceived by the human ear (i.e. <3dB Lmax), then this can be considered as no effective change to noise exposure	-1
8	If newly exposing people to aircraft noise results in small numbers of people overall being exposed to noise impact, then that is acceptable	0
16	Aircraft noise exposure is more noticeable in quiet/tranquil areas and any compensation provision should reflect this	0
3	It is ok to increase the number of noise events in an area if these are deemed to be at a level that is not intrusive above existing noise sources	0
2	We should use airspace change as an opportunity to address current inequities in noise exposure (i.e. attempt to share out noise more equally across surrounding populations)	0
15	Levels of compensation associated with airspace change should be greatest in the areas experiencing the biggest increase in noise exposure	1
13	All residents experiencing significant noise exposure should be compensated	1
14	The level of compensation for residents experiencing noise impact should be proportionate to the level of noise exposure	1
6	Airspace modernisation should seek to avoid noise exposure in areas which previously had no noise impact	2
12	There is no need to limit air traffic growth, if this is possible with no overall increase in noise exposure	2
11	We need to define a noise limit beyond which we can agree noise impacts do not occur	3

Factor 3

Statement Number	Statement	Sort Values
1	In airspace modernisation, every effort should be made to limit changes in noise exposure	-3
9	It is acceptable to increase the number of flights overall, if this does not increase overall noise exposure	-2
12	There is no need to limit air traffic growth, if this is possible with no overall increase in noise exposure	-2
10	Airports should commit to a growth cap as part of the negotiation over airspace modernisation	-1
6	Airspace modernisation should seek to avoid noise exposure in areas which previously had no noise impact	-1
7	It's ok if some people become newly exposed to aircraft noise if this helps alleviate noise exposure in existing areas of over flight.	-1
4	If airspace change results in measurably louder noise events, but these are unlikely to be perceived by the human ear (i.e. <3dB Lmax), then this can be considered as no effective change to noise exposure	0
8	If newly exposing people to aircraft noise results in small numbers of people overall being exposed to noise impact, then that is acceptable	0
2	We should use airspace change as an opportunity to address current inequities in noise exposure (i.e. attempt to share out noise more equally across surrounding populations)	0
14	The level of compensation for residents experiencing noise impact should be proportionate to the level of noise exposure	1
3	It is ok to increase the number of noise events in an area if these are deemed to be at a level that is not intrusive above existing noise sources	0
11	We need to define a noise limit beyond which we can agree noise impacts do not occur	1
13	All residents experiencing significant noise exposure should be compensated	1
5	It is ok to expose people to marginal increases in noise further away from the airport (where noise levels are lower) if there are benefits to communities closer to the airport that are currently exposed to higher noise levels	2
16	Aircraft noise exposure is more noticeable in quiet/tranquil areas and any compensation provision should reflect this	2
15	Levels of compensation associated with airspace change should be greatest in the areas experiencing the biggest increase in noise exposure	3

Factor 4

Statement Number	Statement	Sort Values
9	It is acceptable to increase the number of flights overall, if this does not increase overall noise exposure	-3
8	If newly exposing people to aircraft noise results in small numbers of people overall being exposed to noise impact, then that is acceptable	-2
5	It is ok to expose people to marginal increases in noise further away from the airport (where noise levels are lower) if there are benefits to communities closer to the airport that are currently exposed to higher noise levels	-2
4	If airspace change results in measurably louder noise events, but these are unlikely to be perceived by the human ear (i.e. <3dB Lmax), then this can be considered as no effective change to noise exposure	-1
3	It is ok to increase the number of noise events in an area if these are deemed to be at a level that is not intrusive above existing noise sources	-1
11	We need to define a noise limit beyond which we can agree noise impacts do not occur	-1
15	Levels of compensation associated with airspace change should be greatest in the areas experiencing the biggest increase in noise exposure	0
6	Airspace modernisation should seek to avoid noise exposure in areas which previously had no noise impact	0
12	There is no need to limit air traffic growth, if this is possible with no overall increase in noise exposure	0
13	All residents experiencing significant noise exposure should be compensated	0
1	In airspace modernisation, every effort should be made to limit changes in noise exposure	1
14	The level of compensation for residents experiencing noise impact should be proportionate to the level of noise exposure	1
7	It's ok if some people become newly exposed to aircraft noise if this helps alleviate noise exposure in existing areas of over flight.	1
2	We should use airspace change as an opportunity to address current inequities in noise exposure (i.e. attempt to share out noise more equally across surrounding populations)	2
10	Airports should commit to a growth cap as part of the negotiation over airspace modernisation	2
16	Aircraft noise exposure is more noticeable in quiet/tranquil areas and any compensation provision should reflect this	3

Factor 5

Statement Number	Statement	Sort Values
14	The level of compensation for residents experiencing noise impact should be proportionate to the level of noise exposure	-3
8	If newly exposing people to aircraft noise results in small numbers of people overall being exposed to noise impact, then that is acceptable	-2
3	It is ok to increase the number of noise events in an area if these are deemed to be at a level that is not intrusive above existing noise sources	-2
9	It is acceptable to increase the number of flights overall, if this does not increase overall noise exposure	-1
10	Airports should commit to a growth cap as part of the negotiation over airspace modernisation	-1
16	Aircraft noise exposure is more noticeable in quiet/tranquil areas and any compensation provision should reflect this	-1
13	All residents experiencing significant noise exposure should be compensated	0
7	It's ok if some people become newly exposed to aircraft noise if this helps alleviate noise exposure in existing areas of over flight.	0
6	Airspace modernisation should seek to avoid noise exposure in areas which previously had no noise impact	0
12	There is no need to limit air traffic growth, if this is possible with no overall increase in noise exposure	0
4	If airspace change results in measurably louder noise events, but these are unlikely to be perceived by the human ear (i.e. <3dB Lmax), then this can be considered as no effective change to noise exposure	1
1	In airspace modernisation, every effort should be made to limit changes in noise exposure	1
2	We should use airspace change as an opportunity to address current inequities in noise exposure (i.e. attempt to share out noise more equally across surrounding populations)	1
11	We need to define a noise limit beyond which we can agree noise impacts do not occur	2
5	It is ok to expose people to marginal increases in noise further away from the airport (where noise levels are lower) if there are benefits to communities closer to the airport that are currently exposed to higher noise levels	2
15	Levels of compensation associated with airspace change should be greatest in the areas experiencing the biggest increase in noise exposure	3