

Response to Airports Commission Call for Evidence on Aviation Noise

September 2013

Introduction

Sustainable Aviation welcomes this opportunity to respond to the Airports Commission's call for evidence concerning aviation noise, and is pleased to offer the comments below which are intended to address and/or provide additional context to some of the questions posed in chapter 6 of the Commission's Document "[Discussion Paper 05: Aviation Noise](#)".

About Sustainable Aviation

Sustainable Aviation (SA) is a unique alliance of the UK's airlines, airports, aerospace manufacturers and air navigation service providers. Together, we drive a long term strategy to deliver cleaner, quieter, smarter flying. SA is the first alliance of its type in the world, and reports regularly on progress in reducing aviation's environmental impact. See www.sustainableaviation.co.uk for more details.

Sustainable Aviation is governed by a Council comprising a leading panel of aviation environment experts. External advice and guidance to the work of SA is provided by a Stakeholder Panel including representatives from Government, the CAA, NGO's and academics. This structure ensures SA's work remains relevant and robust. Our signatories cover a wide range of UK and global companies.

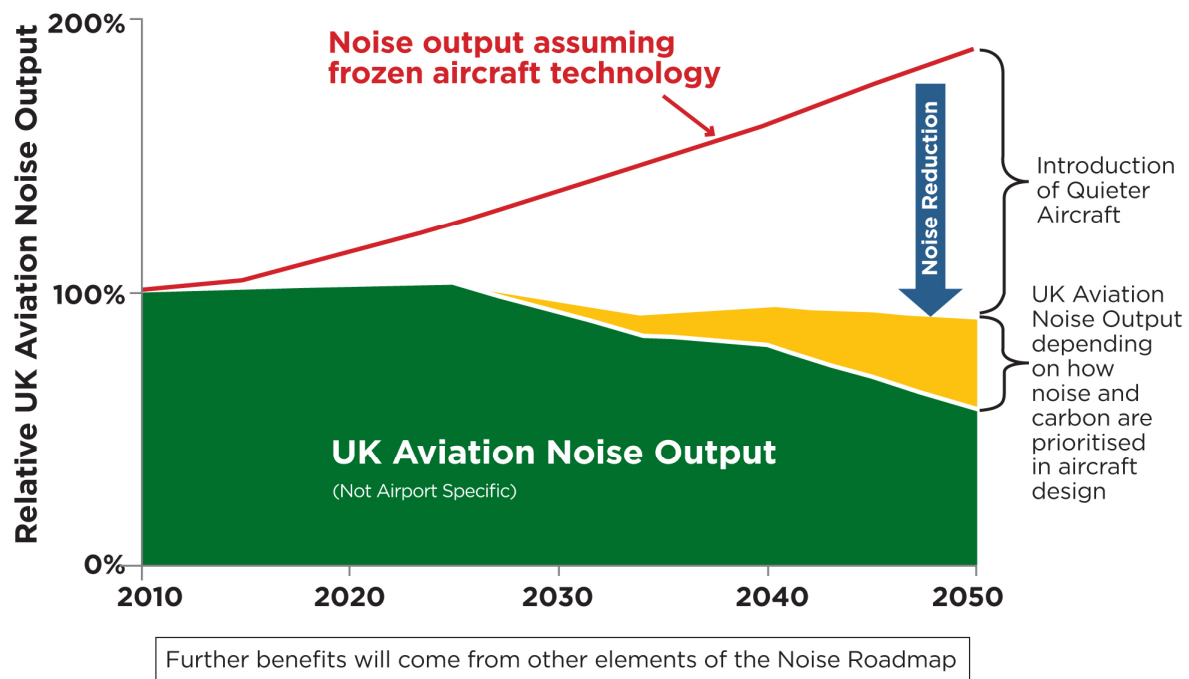
The SA strategy has established seven goals which cover the range of sustainability issues from social and economic aspects through to climate change and noise.

Tackling Aircraft Noise

In April 2013 SA, launched the industry's first Noise Road-Map¹, demonstrating that noise from UK aviation will not increase with greater flights over the next 40 years. This can be achieved through the development and introduction of quieter aircraft alongside the implementation of better operating procedures and improved land-use planning. The document was welcomed by Simon Burns MP, Minister for Aviation in his address to the launch event of the document in April². SA also welcomes the Airports Commission consideration of this document in chapter 5 of your discussion paper on aircraft noise.

¹ See <http://www.sustainableaviation.co.uk/>

² See http://www.simonburnsmp.com/index.php?option=com_content&view=article&id=520:launch-of-the-sustainable-aviation-noise-roadmap-23-april-2013&catid=35:latest-speeches&Itemid=55



In the last two years alone Sustainable Aviation and our signatory members have delivered a diverse range of work to define and address concerns about the impacts of aircraft noise.

- SA members have made very significant investments in new technology to tackle aviation noise through driving innovations in aircraft airframe and engine noise reductions and delivering airline fleet replacement programmes to introduce the quieter aircraft
- Conducting a range of operational flight trials to highlight the potential to reduce noise through removing inefficiencies in infrastructure capacity at airports and airspace. These include both vertical and lateral noise trials exploring options for concentrating or dispersing noise and opportunities to offer predictable noise respite.
- Developing best practice guides to the industry. In June 2012 the industry launched 'Reducing the Environmental Impacts of Ground Operations and Departing Aircraft - An Industry Code of Practice'. This champions a series of operational techniques to reduce noise and emissions from departing aircraft. SA is now overseeing implementation and will report on progress.
- SA members continue to work internationally through the ICAO CAEP working groups and the EU ACARE Flightpath 2050 initiative to find ways to achieve a 65% reduction in perceived noise from aircraft by 2050 compared to 2000 through technology and operational improvements.

Following the publication of the Noise Road-Map, SA is now focussing on delivery. In 2013 we will be publishing our Progress Report covering full details of our work against our strategic goals in the last few years. Beyond this our working groups on noise, operational improvements and communications will continue to focus on delivering the Noise Road-Map. Additionally we will seek to improve understanding of the non-technical noise issues such as individual's perception and reaction to

aircraft noise events. To start this SA will be facilitating a research symposium to understand what research is currently being studied and where gaps exist, how they could be resolved.

Noise Emissions from UK Aviation

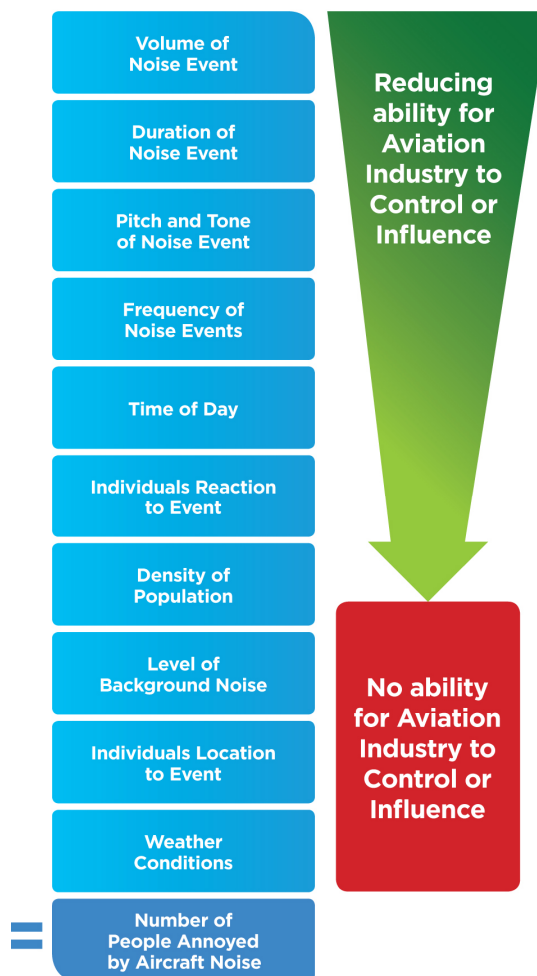
The Sustainable Aviation Noise Road-Map, published in 2013, resulted from several months of consultation and analysis involving all four corners of the UK aviation industry. It sets out SA's expectation of noise output emissions from UK aviation between 2010 and 2050, taking account of the latest evidence available at the time of publication.

The Road-Map combines an assessment of growth in demand - derived from UK government forecasts - with our own analysis and judgement concerning the available mitigation opportunities, and the extent to which they will deliver improvements in reducing noise. Our Road-Map shows that UK aviation can accommodate significant growth to 2050 whilst achieving a potential reduction in UK aviation's total noise output compared to 2010.

The opportunities assessed by the Road-Map cover five key areas:

1. Reduction of noise at source (new airframe and engine technology)
2. Noise abatement operational procedures
3. Land use planning and management
4. Noise communication and community engagement
5. Operating restrictions

In addition to this approach SA also explored the issue of individual's reaction to aircraft noise events. The noise output of current aircraft has reduced by 97% on departure and 94% on arrival compared with the first jet aircraft. Putting this in context a 97% reduction in noise energy means 33 modern aircraft departing simultaneously from an airport produce together the noise of one jet aircraft of the same size departing in the 1960's. Despite this step change in performance the issue of aircraft noise annoyance has not gone away.



The Noise Challenge in reducing the number of people affected by aircraft noise

The Noise Challenge in reducing the number of people affected by aircraft noise, however, is more complicated involving many other variables. For example, a loud aircraft event on a windy morning generally results in fewer people annoyed than the same aircraft event on a still, foggy morning.

While the aviation industry can take direct control of some of the variables, it has only indirect influence over others and no control at all over the remainder. Research is required to understand in more detail the specific weighting and inter-relationships each of the variables has on the final result. Perception of noise is a significant issue which requires further research and a shared commitment from the industry, Government, local authorities and communities to resolve.

SA members are committed to supporting research into understanding how people become annoyed by aircraft noise and how this relates to actual aircraft noise levels.

Improving Aircraft Technology

Aircraft and engine manufacturers have been aggressively researching low-noise technology for the past 50 years, resulting in aircraft with dramatically reduced noise levels now entering service. 33 modern aircraft departing simultaneously from an airport would produce together the noise of one jet aircraft of the same size departing in the 1960s. These noise improvements have been achieved while simultaneously reducing fuel burn and consequent CO2 emissions.

Sustainable Aviation has estimated how the overall noise exposure at UK airports will depend on:

- (i) the growth in operations,
- (ii) the noise levels of 'Imminent' aircraft (i.e. the latest generation of aircraft like the A380, B787 or A350 that have recently entered service or are planned to enter service shortly) and 'Future' aircraft (i.e. aircraft yet to be designed and launched that will enter service sometime after 2025), and
- (iii) the rate of penetration into the fleet of these 'Imminent' and 'Future' aircraft designs.

Sustainable Aviation has used forecasts of growth provided by the UK's Department for Transport to estimate the growth in aviation³. Over the 40 year period from 2010 to 2050, Air Traffic Movements are forecasted to grow by a factor of 2.1. Without the introduction of 'Imminent' and 'Future' aircraft into airline fleets, the overall UK noise output would therefore be expected to more than double over this period.

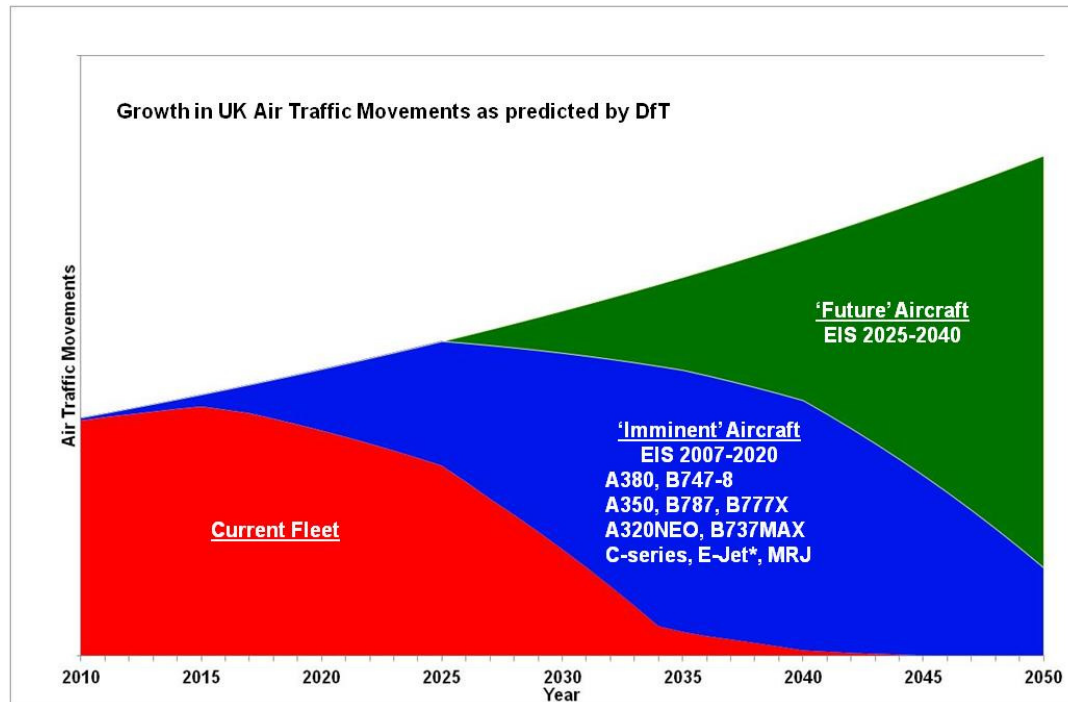
'Imminent' aircraft offer significant fuel burn and noise benefits compared with the aircraft they are replacing. These are aircraft that are already entering service or are currently offered for sale to the market (including all-new aircraft as well as re-engined aircraft); their noise characteristics are well-defined with two 'Imminent' aircraft typically making less noise than one of the aircraft they are replacing; their impact on noise emissions from UK aviation over the next two to three decades will be substantial.

'Future' aircraft are not so well defined. Within Sustainable Aviation our aerospace manufacturing partners are committed to working with other organisations to achieve long-term goals to reduce noise and CO2 emissions from aircraft operations. The technology and knowledge in both airframe and engine design to achieve these goals is yet to be acquired, so manufacturers are engaged in extensive research programmes with financial support from government. Addressing often-competing environmental requirements is a constant challenge, since achieving an improvement in noise may come at the expense of CO2 emissions. Also, noise solutions must be compatible with all the other design requirements of both engine and aircraft, for example the aircraft performance, the aircraft operating costs, the business needs of the manufacturer and operator, and the safe operation of the aircraft. Sustainable Aviation has therefore evaluated the impact on the overall UK noise output of alternative scenarios depending on the success of future research programmes and how noise and CO2 are prioritised in future aircraft designs.

Sustainable Aviation has predicted the rate at which new aircraft types replace older aircraft, based on proprietary information available to manufacturers and airlines. The transition from the current to 'Imminent' and finally 'Future' aircraft is illustrated below for a typical airport fleet mix, assuming Air

³ <https://www.gov.uk/government/publications/uk-aviation-forecasts-2013>

Traffic Movements grow by a factor of 2.1 over the period 2010 to 2050 in line with Department for Transport predictions.



Aircraft now entering service have demonstrated noise levels typically half that of the aircraft they are replacing, so air traffic movements can double without increasing the total noise output as shown in the initial Aviation Noise Output chart on page 2.

The actual noise output will vary by airport, depending on the fleet mix, route structure, number of runways, operating restrictions and the scope for adopting new noise mitigation measures. Therefore it is not possible to draw direct comparisons between the indicative trends illustrated here and the future noise footprints of any specific airport.

SA calls on the Airports Commission to ensure that the noise reductions through introduction of new aircraft is properly accounted for in any assumptions and decisions it reaches on future airport infrastructure provision.

Improving Operational Procedures

There is scope to increase the use of noise sharing techniques which may reduce community annoyance with noise. Operational improvements can be expected to offer noise reductions of between 1 and 5 decibels (SEL) by 2030 against a 2010 baseline. The exact noise improvement will vary for different communities depending on the current noise exposure and local scope for adopting new techniques.

Operational improvements fall into 3 main categories:

- **Vertical noise management** – These seek to keep aircraft as high as possible on arrival or enable them to climb as quickly as possible on departure to minimise noise. The focus for SA members is on continuous descent approaches, options for steeper approaches and ability to

achieve a continuous climb on departure. Further noise benefits from displaced thresholds could also be achieved by effectively increasing the altitude of aircraft over-flying the population.

- **Horizontal noise management** – These focus on moving aircraft along different tracks over the ground to minimise the number of people impacted by noise. There are a number of current trials looking to use aircraft satellite navigation to improve the accuracy of aircraft tracks over the ground. Use of satellite navigation also enables different departure tracks to be developed within existing noise preferential routes at airports. Extending this to arrivals there are opportunities to provide more predictability of aircraft arrival tracks or offer periods of noise respite over certain locations. HACAN, Heathrow Airport, NATS and British Airways tested this technique between November 2012 and March 2013⁴. In their final report it was found that whilst the trial successfully demonstrated the concept of providing predictable respite, some communities experienced a significant dis-benefit. As a result it was agreed the trial should not be taken forward in its current form. Heathrow will continue to work with HACAN and local communities to define predictable respite and apply this to future trials as well as undertake pre-trial assessments to predict the likely outcomes (both inside & outside the trial zones) and consider communication channels to convey information and solicit feedback.
- **Aircraft operational practice** – Aircraft operators are continuously seeking ways to reduce noise through improving how they operate the aircraft. Examples include optimising the lowering of wing flaps and the landing gear on arrival and avoiding the use of reverse engine thrust on landing. In all cases these procedures are only used where it is safe and feasible to do so.

Beyond these concepts further opportunities exist through the re-design of airspace to enable more direct flights and reductions in delays. SA members support this work through the Future Airspace Strategy working groups⁵.

SA calls on the Airports Commission to ensure that the opportunities to reduce noise impacts from aircraft through use of improved operational techniques is properly accounted for in any assumptions and decisions it reaches on future airport infrastructure provision.

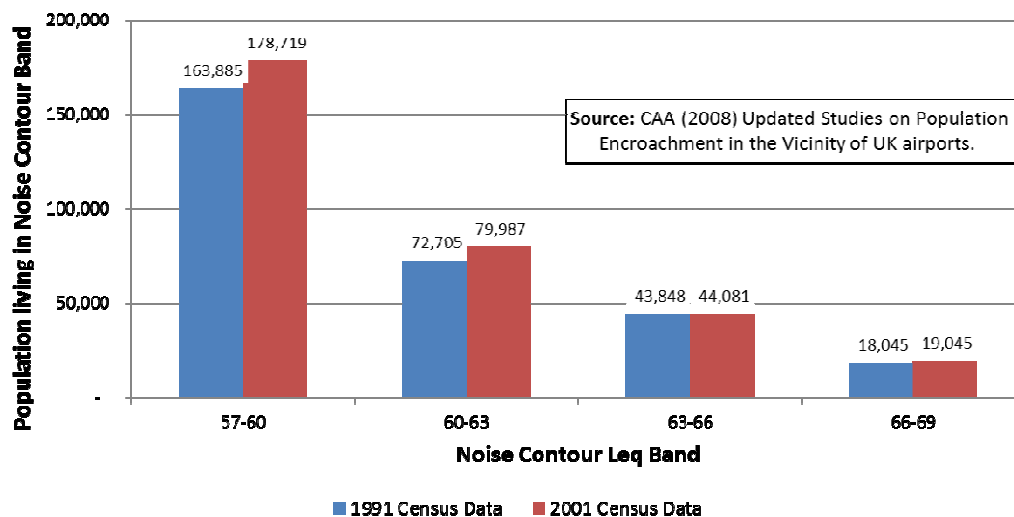
Improving Land Use Planning Controls

Significant progress has been made in recent years in reducing noise levels around the UK's major airports. This has been achieved due to technological improvements and despite an increase in air transport movements. At most airports, the noise contour areas and the population within them are considerably smaller than they were ten years ago. For example the 57 dBL_{Aeq} (16hr) contour at Heathrow was 1637 sq km in 1998 compared to 107.1 sq km in 2011. Also over the same period, the population within the contour reduced from 341,000 to 237,800. Whilst these contour area reductions have been secured mainly due to improvements in engine technology and the phase out of (Chapter 2 aircraft), there is a need for the planning system to protect previously noisy areas from encroachment by noise sensitive development.

⁴ <http://www.heathrowairport.com/noise/noise-in-your-area/early-morning-trial>

⁵ <http://www.caa.co.uk/default.aspx?catid=2408&pagetype=90>

**Population living within 2001 Noise Contour Bands
(combined result for Heathrow, Gatwick, Manchester and Luton
Airports)**



Where noise contours have shrunk land has become available for development. This brings a risk of population encroachment into areas around airports potentially diluting the noise improvements that have recently been secured.

It is therefore important, that as part of a balanced approach to the mitigation of aircraft noise, the UK planning system acts to minimise the encroachment of noise sensitive developments around airports, and that these areas are carefully managed in respect of future air traffic growth and airport development.

The aviation industry and airports in particular, can play an active role in contributing to and shaping land use planning policy. However a consistent national approach to planning and noise is essential in making policy and taking development decisions. SA recommends that given the historic weakness on land-use planning the Airports Commission should make a strong recommendation that a strategic, long term approach be taken to land-use planning around airports and that clear national guidance should be issued. Indeed, if such an approach had been adopted in the 1960s / 1970s SA believes we would not face the same degree of noise challenges in the capacity debate we currently do.

Improving Noise Communication and Community Engagement

SA sees this as a key area for improvement moving forwards and is committed to improving how the industry shares, communicates and listens to concerns about aircraft noise. Four key recommendations are:

- airport operators commit to review their current engagement strategies based on the best practices presented in this Roadmap;

- regular stakeholder sessions are required to ensure that the appropriate representatives are at the table, with clear terms of reference
- airlines, Air Navigation Service Providers (ANSPs) and manufacturers should seek to explore how engagement can be improved, and how best practice can be shared between stakeholders in the future;
- the aviation industry commits to work with Government and other stakeholders to identify and resolve research gaps in:
 - how the variables in the 'Noise Challenge' diagram are weighted; and consult on whether a more accurate model can be developed to predict the number of people annoyed by aircraft noise under various 'what if' scenarios,
 - our understanding of individual reactions to aircraft noise,
 - noise acceptability vs. noise annoyance and
 - a basis for agreeable noise metrics.

SA calls on the Airports Commission to support us in this area and also factoring in the benefits this work can achieve when making any assumptions and decisions on future airport infrastructure provision.

Operational Restrictions

- In line with the ICAO balanced approach, SA considers operational restrictions to be a measure of last resort
- The aviation industry supports the ICAO view that any proposed operating restrictions should not be applicable to aircraft that meet at least the requirements of ICAO Annex 16, vol 1, Chapter 4.
- The aviation industry believes that collaborative working and voluntary agreements are a more effective and responsive approach than operating restrictions but is nevertheless committed to meeting these wherever they apply.
- The industry wants to work with Government to develop policies and procedures that drive a move to more proactive ways of managing the impact of aircraft noise

Summary

SA believes that future growth in UK aviation can be achieved without increasing UK noise output. Achieving this will require substantial commitment from the aviation industry, Government, local authorities and communities. Given the subjective nature of annoyance to noise SA would caution the Airports Commission from believing they can quantify annoyance in a single metric.

From the experience of managing concerns about aircraft noise over time, SA members offer the Airports Commission the following advice in making future decisions on infrastructure provision.

- Introducing noise to new areas or populations should be minimised as far as possible.
- The aviation industry seeks to work with others to understand and address aircraft noise concerns but would like to see efforts to maintain a proactive rather than reactive and restrictive approach.
- Adequate Government support into research to understanding individuals annoyance and reaction to aircraft noise needs to be implemented and protected.

Answers to Specific Questions

The Airports Commission in their discussion paper ask the following questions on aviation noise.

1. What is the most appropriate methodology to assess and compare different airport noise footprints? For example:

- a. What metrics or assessment methods would an appropriate 'scorecard' be based on?

SA attaches high importance to having a clear and stable international framework for aviation noise standards, which is needed to plan and execute upstream technology acquisition programmes and to enable informed design trades to be performed during product development. Such clarity and stability is also necessary to achieve an optimised product for environmental and other factors. ICAO CAEP has provided such a clear and stable framework that has allowed manufacturers to reduce the noise output of current aircraft by 97% on departure and 94% on arrival compared with the first jet aircraft.

SA members have substantial experience of working with current noise metrics. It is clear that the current and alternative noise metrics have both strengths and weaknesses which we have summarised in the appendix to this response.

Based on this table SA would caution the Airports Commission from seeking to use multiple metrics in all cases. Experience has shown that any metric can be faulted by those impacted and should the Commission choose to make decisions based on new or novel metrics the risk of legal challenge is significantly increased. The priority as SA sees it is to take action to reduce noise from aircraft and to use a noise metric to show relative changes in performance over time. For this purpose SA supports the continued use of the 57dB 16hr LAeq as an historic noise comparison metric and principle metric for airport planning processes. This position accords with the policy of the Government, as set out in the recently published Aviation Policy Framework. In addition to this SA also support the use of a range of additional noise information tools to ensure any changes in noise patterns around an airport are properly understood by all those who may be affected.

- b. To what extent is it appropriate to use multiple metrics, and would there be any issues of contradiction if this were to occur?

SA members advise the Airports Commission to use a single noise metric for planning purposes but strongly encourages the use of other noise metrics to aid communication of potential noise impacts to those who may be affected. These other noise metrics are best defined locally to meet best fit local circumstances.

- c. Are there additional relevant metrics to those discussed in Chapter 3 which the Commission should be aware of?

SA is aware of additional potential noise metrics such as the number of noise complaints or complainants at airports, aircraft departure track keeping performance within noise preferential routes, aircraft continuous descent approach performance, maps of arrival and departure tracks and others. SA again would encourage the Airports Commission to ask itself 'what are metrics seeking to show?'. As SA has shown in its Noise Road-Map, an individual's reaction to an aircraft noise event is made up of a range of factors. It is

the view of SA that no single noise metric accurately addresses this. Consequently SA recommend that the Airports Commission use a single metric to determine its conclusions but ask supporters of proposals to prepare, as appropriate to local circumstances, alternative noise metrics to show additional information for those who may be affected in order to create a more rounded explanation.

- d. What baseline should any noise assessment be based on? Should an assessment be based on absolute noise levels, or on changes relative to the existing noise environment?

SA would encourage the Airports Commission to use a noise metric that can show both historic and potential future impacts. SA believe a single noise metric, the 57dB 16hr LAeq should be used for planning purposes although supplementary noise metrics should also be developed to help explain the outcome of any decisions.

- e. How should we characterise a noise environment currently unaffected by aircraft noise?

Experience from SA members shows that to indicate that outside of a noise metric individuals are not significantly affected by aircraft noise is dangerous. Beyond this however it is not clear how the areas should or could be classified. To some historic or areas of protected countryside are more important to protect from aircraft noise, whilst to others aircraft should be directed to the countryside and avoid flying over built up areas.

SA would encourage the Airports Commission to support further research into this topic before reaching any specific conclusions.

2. How could the assessment methods described in Chapter 4 be improved to better reflect noise impacts and effects?

In answering this SA would make the following points:

- SA does not believe any single noise assessment model will fully reflect the complexity of individuals reaction to aircraft noise events
- Concerns about night time aircraft noise do seem to be a higher priority than day time noise
- Attempts to monetise the impacts of noise disturbance do have merits but require detailed research and review to ensure that all stakeholders can support it.
- SA members are happy to support further research into this topic which we believe should be delivered through the DfT to avoid any issues of perceived bias by any party. .

3. Is monetising noise impacts and effects a sensible approach? If so, which monetisation methods described here hold the most credibility, or are most pertinent to noise and its various effects?

SA supports the principle of monetising noise impacts but would like to see both the impacts and benefits of aircraft noise to be assessed. The methodology to achieve this does require further development which SA is happy to support. Some attempts to do this have for instance already been tried at ICAO. SA encourages the Airports Commission to investigate this further before reaching any final conclusions.

4. Are there any specific thresholds that significantly alter the nature of any noise assessment, e.g. a level or intermittency of noise beyond which the impact or effect significantly changes in nature?

Experience from SA members you suggest that an individual's threshold to noise annoyance is highly variable due to the reasons outlined in the SA noise challenge diagram. SA calls on the Airports Commission to support SA and others in encouraging further research on this topic before reaching any conclusions. In the interim SA recommends that the Commission gives weight to the 57 dB Leq contour as representing the likely onset of significant community annoyance.

5. To what extent does introducing noise at a previously unaffected area represent more or less of an impact than increasing noise in already affected areas?

SA members have through experience sought to avoid introducing noise to previously unaffected areas wherever possible. The community reaction to the arrival respite trial at Heathrow airport is an example of the risks of exposing new individuals to aircraft noise. Trying to predict an individual's or community reaction to new areas of aircraft noise is very hard to do for the reasons SA explain in the noise challenge diagram. SA would encourage the Airports Commission to support us and others in developing further research into this which we believe should be delivered through the DfT to avoid any issues of perceived bias by any party.

6. To what extent is the use of a noise envelope approach appropriate, and which metrics could be used effectively in this regard?

SA members support the principles of a noise envelope but suggest the Airports Commission need to be careful in assuming a fixed envelope will address the concerns of communities exposed to aircraft noise.

We recommend that the Airports Commission carries out further research into the communication of noise impacts and metrics, similar to that published by Airservices Australia for major Australian airports⁶. It is also important to note that any restriction should fully take into account the UK's international obligations under the ICAO "Balanced Approach"⁷, and (relevant) EU noise directives.

7. To what extent should noise concentration and noise dispersal be used in the UK? Where and how could these techniques be deployed most effectively?

SA would strongly recommend that the Airports Commission enable this decision to be made on an airport by airport basis. Decisions on where to concentrate or disperse flights will be very dependent on the geographic and demographic make-up of the areas around an airport and the views of the communities that live there.

8. What constitutes best practice for noise compensation schemes abroad and how do these compare to current UK practice? What noise assessments could be effectively utilised when constructing compensation arrangements?

⁶ Airservices Australia "Airport information packs", Airservices Australia, <http://www.airservicesaustralia.com/aircraftnoise/airport-information/>, last accessed 25/10/2012.

⁷ ICAO "Guidance on the Balanced Approach to Aircraft Noise Management", ICAO Doc. 9829, AN/451, ICAO 2008.

SA does not have a view on this topic.

References

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Sustainable Aviation, 2013

<http://www.sustainableaviation.co.uk/wp-content/uploads/SA-Noise-Roadmap-Publication-version1.pdf>

Inter-dependencies between emissions of CO₂, NO_x & Noise from aviation

Sustainable Aviation, 2010

<http://www.sustainableaviation.co.uk/wp-content/uploads/sa-inter-dependencies-sep-2010.pdf>

Reducing the Environmental Impacts of Ground Operations and Departing Aircraft - An Industry Code of Practice

Departures and Ground Operations Code of Practice Working Group, 2012

<http://www.sustainableaviation.co.uk/wp-content/uploads/DCOPractice2012approvedhi-res.pdf>

Appendix 1: Sustainable Aviation review of noise metrics

Noise Metric	Indicator	Strengths	Weaknesses
Equivalent Continuous Sound Level	57 L_{Aeq16h}	Provides consistency with current enabling historical comparisons to be made showing relative changes in noise exposure over time Government preferred metric to mark the onset of significant community annoyance	Difficult to understand by communities Weaker in reflecting actual aircraft noise experienced by individuals Does not capture night noise Community groups argue significant community annoyance occurs at lower levels of noise Assumes all those individuals captured by the contour are annoyed by noise
	54 L_{Aeq16h}	Measures to a lower noise level than 57 L_{Aeq16h} to reflect community concerns	Assumes all those individuals captured by the contour are annoyed by noise Lower level still unlikely to meet concerns of those living in rural or tranquil areas
	55 L_{den}	Consistent with EU approach and the Environmental Noise Directive Seeks to account for noise made in the evening and night periods Enables comparisons to be made between UK and European airports	Does not properly reflect the lower number of flights at night Lack of scientific evidence to support evening and night noise weightings Assumes all those individuals captured by the contour are annoyed by noise
Number Above (N) or frequency contours	N70 Contour	Seen as easier to understand by communities Greater link to frequency of events over communities rather than just noise levels	Does not provide information on size of noise events above 70dB Does not depict duration of noise events
Person Events Index	PEI	Links noise impact to population based on N contours	Does not provide information on size of noise events above 70dB Does not depict duration of noise events Assumes all those individuals captured by the contour are annoyed by noise
Average Exposure Indicator	AIE	Gives a measure of the average number of noise events per person within a defined area.	Does not provide information on size of noise events above 70dB Does not depict duration of noise events Assumes all those individuals captured by the contour are annoyed by noise
Noise efficiency metrics	Population in 57 L_{Aeq16h} contour per annual ATM's	Relates people affected to size of airport operation Makes comparisons between airports possible	Averaging population affected per ATM is likely to be misleading Does not link impact of noise to size of aircraft Does not take account of night flights Assumes all those individuals captured by the contour are annoyed by noise
	Population in 57 L_{Aeq16h} contour per annual airport passengers	Relates people affected to size of airport operation Makes comparisons between airports possible	Averaging population affected per airport passenger is likely to be misleading Does not link impact of noise to size of aircraft Does not take account of night flights Assumes all those individuals captured by the contour are annoyed by noise