An AEF Report for HACAN on:

Approach Noise at Heathrow: Concentrating the Problem

Photo: Phil Weedon

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Executive Summary

Aircraft noise has always been, and will always be, the primary environmental concern for those living around airports and under flightpaths. But while local and national organisations continue to press for strict controls on the operating hours and numbers of flights, far less attention is given to how air traffic is distributed. This stems in part from the fact that historically Government and airport operators have maintained the mantra that air traffic procedures are already optimised to minimise disturbance. At Heathrow, however, recent changes to the way in which flights are directed on the approach to the airport have begun to generate a new set of concerns for local people.

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One of the ways in which Heathrow Airport has attempted to respond to community noise concern has been to make a commitment that the size of the 57 Decibel noise contour around the airport – representing the onset of significant annoyance according to a 1985 Government study –will not increase. But as the recent noise 'mapping' exercise required under the European Environment noise Directive has illustrated, many people beyond this contour are affected by significant noise levels. Over the past couple of decades, some within both industry and Government have begun to accept that attention needs to be given to addressing noise impacts in these areas too.

And the solution that has been championed concerns air traffic management, specifically the more widespread use of Continuous Descent Approaches (CDAs). Traditional approach paths involved aircraft descending through different blocks of airspace in a series of steps, using flaps and power changes to manage speed. In CDAs, in contrast, aircraft descend into the airport at a steady 3 degrees; while there will still be some noise from the engine, additional noise from the aircraft itself is reduced. This procedure, combined with the use of P-RNAV and changes to the joining point for final approach, have increased the concentration of aircraft along corridors. For pilots, this reduces the number of factors having to be taken into account when landing. For Government, it helps to satisfy the environmental objective of minimising the *number* of people affected by aircraft noise when determining arrival and departure paths and airspace revisions.

Changes in the joining point to optimise Continuous Descent Approaches have produced as many losers as winners: it has resulted in more concentration of flight paths many miles from the airport

It has therefore been assumed that the introduction of more CDAs will produce a noise benefit. In fact, however, at Heathrow as at other airports up and down the country, the approach has created winners and losers, as a reduction in the number of people affected may come at the cost of concentrating even more flights over particular communities.

Although these arguments have been made to Government and airports, there has been no indication that they are willing to listen to new ideas about using approach procedures more sensitively. The introduction of Noise Action Plans could have been an opportunity for BAA to take a fresh approach, identify where the significant problems were arising and work with communities to identify any operational improvements. Instead, Heathrow's Noise Action Plan, like that of most other airports, just repackages a set of existing measures and monitoring arrangements making

little, if any, additional effort. But alternative approaches do exist and, with airports keen to increase traffic volumes, interest in new ways to mitigate noise has led to a number of schemes being trialled at airports around the world or at least being assessed.

Some of the options involve a fresh look at some old ideas such as the possibility of steeper approaches, allowing reductions in the number of people overflown at low altitude. The UN's International Civil Aviation Organisation (ICAO) is currently evaluating steeper approaches, in terms of feasibility and environmental issues. While some airports, such as London City, have approaches set at 5.5 degrees, they are limited by the range of aircraft that can use the runway. Equally many of today's aircraft are capable of flying above the 3 degrees typical of most instrument landing glideslopes. So where does the balance lie? Preliminary analysis by ICAO suggests that up to 4 degrees is feasible and avoids most of the environmental trade-offs with emissions that are associated with approaches of 5 or more degrees. It may not sound much, but increasing the approach by just 1 degree will mean that aircraft can be over 30% higher when they fly over a given locality, and future generation aircraft may be able to achieve greater improvements.

But alternative approaches do exist…..a number of schemes are being trialled at airports around the world or at least being assessed.

To deal with the issue of concentration of traffic, some airports have been trialling curved CDA approaches. This gives the benefit of a continuous descent but allows air traffic controllers to have several CDA approaches – more akin to the fanning effect of traditional approach paths – reducing the number of overflights in any given place. Other airports have also looked at using curved CDA to join the final straight approach at different points, effectively a herring bone pattern. Some argue that parallel runways reduce the benefit of deploying this option because you can join from only one side, but that needn't be a constraint at Heathrow because of runway alternation.

The Government's noise objective, which focuses on only the number of people affected, is simplistic and out-of-date, and may even act as a constraint on improving the noise situation around many airports. It may not be feasible, or necessary, to introduce all the possible changes overnight, but it is certain that unless we begin a discussion now to assess their potential, change may never happen. The problem with concentrated noise corridors is therefore an issue for Government as well as for the airport operator. Revision of the Government's noise policy should be a high priority for 2010, especially with the current review of the CAA's environmental function: the Department for Transport consultation acknowledges the need for new guidance on environmental matters, which will include the use of airspace.

Government should also send a strong message to manufacturers that new designs must make the full potential for steeper approaches a reality. These issues are not a substitute for keeping those restrictions on noisier aircraft and on operational hours that currently give communities some noise protection, but they are an additional element of noise management that is currently being ignored at most UK airports.

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Chapter 1 – Introduction

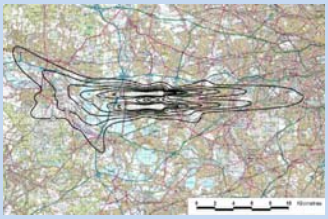
The management of noise further out from airports

When considering aircraft noise, airports and governments usually focus on the areas exposed to high levels of aircraft noise, as defined by contours that are constructed using average noise levels. Community groups have long voiced their concerns that problems exist outside these areas as well, but this has rarely led to any significant action. While there are some signs that community noise concerns outside the contours used for land use planning purposes are now being recognised and better understood, little attention is yet being given to how to deal with them.

How noise is measured

In the UK, the official daytime noise index is Leq 16 hour, measured in Decibels (dBA). Leq, or the Equivalent Continuous Sound Pressure Level, "flattens" the peaks and troughs of measured sound energy over a period of time (16 hours in this case) as if it were experienced continually. This averaging of the noisy and quiet intervals means the numerical value of an Leq reading will always be lower than the numerical value of the peak noise of an individual event. Leq metrics, some using weightings to account for sensitive times of day, others using different time periods, are used throughout the world to measure aircraft noise. For example, the new European noise maps are produced using Lden (Level Day Evening Night). Lden measures noise over 24 hours and applies a weighting of 5 to events in the evening and 10 at night.

Research in the 1980s showed that annoyance started at 50Leq and showed a significant upturn at 57 Leq. For this reason, Government takes 57 Leq as the threshold for reporting and considering noise. **The illustration shows a series of noise contours illustrating the areas around an airport affected by high noise levels. The innermost contour shows the area affected by an Leq of 72, while the outermost contour is for an Leq of 57** The recent ANASE study showed that a greater percentage of people are highly annoyed today: whereas the Department for Transport currently takes noise into account above 57 Leq, this threshold would fall to 50 Leq based on an equivalent percentage of the population being highly annoyed today. This represents an increase of hundreds of thousands of people exposed around the UK's airports. Other findings in the ANASE study confirm longstanding community concerns, for example that annoyance is strongly influenced by the number of noise events. This is important because the Leq metric is not sensitive to changes in the number of aircraft movements. A doubling of movements produces an increase of only 3 dBA Leq. The results make a compelling case for updating and supplementing the way the Government currently takes account of aircraft noise.



The issue has recently been taken up by a working group of the environment committee established by the UN's International Civil Aviation Organisation. The group recognised that concerns about noise beyond traditional contours relate not so much to the level of noise generated by individual aircraft as to the cumulative impact of a large number of overflights. Furthermore, it noted that the periods of respite from this noise are rapidly disappearing at many airports and that noise events are becoming more frequent in the sensitive times periods such as evenings and weekends. It concluded that "This change in the nature of the noise would appear to be a significant factor in the widening geographic range of adverse community reaction to aircraft noise".

While there are signs that community noise concerns outside the official contours are now being recognised, little attention is being given to how to deal with them.

These comments will appear very familiar, and of little surprise, to many communities living around airports in the UK today. Those who experience regular overflying have always suffered from noise impacts, although the limitations of traditional noise indices which show noise levels averaged over a wide area may have diverted attention away from those living directly under flightpaths. In fact, the focus on measures to relieve aircraft noise within the noise contours has had some unintended consequences for those living further out. New operational practices to improve the efficiency of air traffic management often require revised approach and departure paths. These rarely change flight tracks significantly within the contour areas, but away from the aerodrome the impact can be marked. This has given many communities more overflights with little consideration of the outcome.

Over the last couple of years the debate surrounding a third runway and the end to alternation has drawn some attention away from the fact that there are already longstanding and significant aircraft noise issues affecting Londoners.

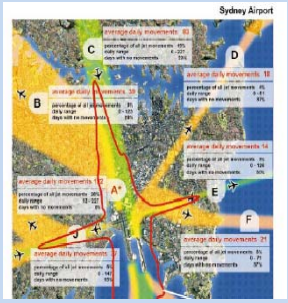
Beyond encouraging quieter aircraft and implementing operational procedures such as Continuous Descent Approach, the only real mitigation possibilities lie in addressing the flightpaths themselves. To deal with these effects, some airports have successfully experimented with the use of spatial or temporal spreading of the flightpaths, using concentration only where there is non-residential land.

The Sydney Airport story

Australia has become a world leader in experimenting with new noise metrics to communicate and engage with local communities, leading to several operational changes and ongoing trials. It started with a debate about a third runway, and rapidly became a contentious political issue which saw the election of several mayors who had based their manifesto around mitigating the aircraft noise. Conventional noise metrics were poorly understood by citizens, leading the Australian Government to publish single event noise metrics alongside the contours. These single event metrics showing the number of flights above a given noise threshold, when coupled with flight maps, helped the communities to understand how fight paths were changing, and how the traffic was distributed.

Recognising that traffic being concentrated over a few communities, many argued that it would be more equitable to spread the nuisance over a wider area, providing periods of despite in the process. This approach continues to form the basis of the Australian Government's policy for noise today.

The map opposite shows the conventional noise contour in red. The yellow and green swathes show the actual flightpaths and the boxes show the number of flights and other information at given locations.



This experience suggests that noise should be dealt with in a holistic manner, considering both "close in" and "further out" noise together. This report looks at these issues, and some potential solutions, in the context of London Heathrow Airport.

Away from the UK, other governments and airports have started to experiment with different approaches and including the possibility of sharing noise more equitably. From a political standpoint, these changes have gained a generally positive response from the community.

Chapter 2 – The policy context

Successive Governments have adopted policies to limit the number of flightpaths

Successive Governments have adopted policies to limit the number of flightpaths in use. This was backed up by advice from the Noise Advisory Council in the 1970s which concluded that dispersal would lead to greater levels of disturbance. Although this probably still holds true in many situations, it lacks the flexibility to deal with emerging issues such as concentration of flights and the noise over tranquil areas. Today this advice is repeated in the guidance given to the Civil Aviation Authority and in other policy documents, based on an overarching objective to limit and, where possible, reduce the number of people in the UK significantly affected by aircraft noise. The 2003 Air Transport White Paper sets out a plan to achieve this aim through:

(i) promoting research and development into new low noise engine and airframe technologies;

(ii) implementing the regulatory framework agreed by the International Civil Aviation Organisation (ICAO) using the balanced approach to noise management;

(iii) implementing EU Directive 2002/49/EC, which requires periodic noise mapping at many airports from 2007 to identify day and night noise problems and, from 2008, action plans to deal with them;

(iv) retaining and, where necessary, strengthening the current regulation by central Government of noise at Heathrow, Gatwick and Stansted airports, and;

(v) widening the use of economic instruments, including the use of differential landing charges according to noise levels at all airports where a significant local noise problem exists (funds from a noise-related charge could be used to finance local mitigation and compensation schemes).

The "Balanced Approach" to Noise Management

The International Civil Aviation Organisation identifies four key areas for reducing noise: (a) reduction at source, (b) land use planning measures, (c) operational procedures, and (d) operational restrictions at airports. It encourages all governments to take action only where it is justified. In reaching this conclusion, state authorities must assess the situation and the contribution that each of the above elements can make to reducing noise, with an inference that operational restrictions should be a last resort. Although this may appear to be a commonsense approach, it has made it difficult for the EU to introduce European-wide restrictions (for example on night flights).

All of the above policies, which centre on ICAO's balanced approach, have some limitations. Furthermore, while ICAO's balanced approach has four elements, both reduction at source and land use planning focus on providing long-term benefits. This means that in the absence of operational restrictions, operational procedures become the focus of noise mitigation to tackle today's problems.

While quieter aircraft are a high priority for everyone, there is little prospect that they will influence noise exposure levels in the next few years. In fact, both the UK and the European Commission recognise that noise exposure levels will increase at many airports over the next decade as technology improvements fail to keep pace with growth in the volume of air traffic. Industry has ambitious goals for a 50% improvement in the noise (represented by a 10 decibel change) of new aircraft by 2020, though many industry analysts consider the target unreachable in this time frame.

At the eighth meeting of ICAO's Committee on Aviation Environmental Protection (CAEP) in February 2010, the EU pushed hard to get agreement on starting work on a Chapter 5 noise standard. But even if this work proceeds as planned, a recommendation will not be forthcoming until 2013 at the earliest, and industry has usually been permitted at least 4 years preparation before the entry into force of a new standard. A chapter 5 standard is therefore unlikely before 2017 and it will be many years after that before these aircraft form a significant proportion of the fleet operating at any airport. It is in any case uncertain whether CAEP can even agree on the need to increase stringency. The US has already indicated that it has other priorities for new aircraft standards focussing on emissions (notably PM and CO2), while Europe and others fear a new noise standard may have negative consequences for the development of open rotor technology[1] and its associated efficiency and emissions savings. For these reasons, ICAO has suggested that any stringency debate should be bounded by an upper limit of 10-12dB summed across the three measurement points on take-off, approach and sideline.

Aircraft noise certification – the "chapters"

Aircraft are often referred to as being Chapter 3 or Chapter 4 compliant. These are references to noise certification limits agreed by the International Civil Aviation Organisation and published in Annex 16 of the Chicago Convention. The current standard (known as Chapter 4) for all new subsonic jet aircraft entering service from 1 January 2006 was agreed by ICAO in 2001. This improved upon the previous Chapter 3 standards by a cumulative margin of 10 dBA. At face value, this may appear a significant step forward. Yet closer examination reveals a different picture. Noise certification of aircraft requires three measurements: one taken on approach, one on take-off, and a third at a sideline measurement point. The Chapter 4 standard is based on the sum of the improvements at these three measurement points. In other words, the average reduction at each of the three measurement points is a little over 3 dBA. Against average background noise levels, changes of this magnitude can be very difficult for the human ear to perceive. Furthermore, by the time the standard came into effect in 2006, it had been nearly 30 years since the introduction of the Chapter 3 standard in 1977. Many aircraft in service by 2006 had already improved upon Chapter 3 standards by cumulative margins in excess of 20 dBA, while over 95% of the in-production aircraft were already capable of meeting the new standard by the time it was introduced. Older aircraft, certified to the pre-1977 Chapter 2 standard have, with a few exceptions, been banned from operating at EU airports since 2002.

[1] Open rotor technology was first discussed in the 1970s in response to the oil crisis. Concern over fuel prices today and the desire to improve efficiency to address greenhouse gas emissions have caused the idea to re-emerged and it is now being actively developed by manufacturers. Open rotor technology removes the casing that encloses modern turbofan engines. It is claimed that this can increase the efficiency by as much as 50%, but there is a noise trade-off as engine casing helps to shroud fan noise. Most manufacturers recognise that it will be politically unacceptable to design an open rotor engine that does not meet the noise standard in force today: Chapter 4. However, they are less optimistic about achieving any further increase in stringency, and have told policymakers that a new standard may limit potential efficiency improvements.

In the absence of new standards, regulators need to keep pressure on the existing fleet by looking at ways to accelerate the removal of the noisiest aircraft. Without doubt, one of the most significant impacts on noise exposure levels at airports came from the phase-out of Chapter 2 aircraft, but there has been little international appetite to extend this to Chapter 3 aircraft, and the agreement of a Chapter 4 standard for new aircraft in 2001 came with explicit recognition that it would not be used as the basis of operating restrictions.

EU Directive 2002/30/EC gave airports new powers to impose noise-based operating restrictions. However, since it came into force in 2002, few airports in competitive situations have, voluntarily, imposed operating restrictions and only one airport has applied the phase-out of marginally compliant aircraft. This highlights a serious deficiency in policy, namely the tendency for successive governments to place a lot of responsibility in the hands of airport operators to regulate themselves (an approach presented as a preference for local solutions to local problems). Airport operators have no shortage of tools to manage noise, including powers to levy financial penalties and charges as well as operational restrictions where justified. While it may appear coherent to take action on an airport-by-airport basis by limiting action to airports with, or anticipating, a noise problem, the Directive gives no guidance on what constitutes a 'problem' and sets no thresholds above which airports must take action. Without thresholds, the Directive succeeds only in harmonising a process without requiring common and equivalent action for all airports. The response by airports to a European Commission survey reviewing the effectiveness of the policy provides evidence of this, with both a low level of implementation and with some airports specifically citing competition as a reason for not proceeding.

Neither quieter aircraft nor operational restrictions are delivering satisfactorily

Directive 2002/49/EC on noise mapping and action plans has similar shortfalls. Without specifying common thresholds for action, and making the airports the competent authorities for fulfilling the Directive's requirements, it is unlikely that any airport will produce a Noise Action Plan that goes beyond existing noise arrangements. The Noise Action Plan for Heathrow is addressed in the next chapter but fits this description.

Noise Action Plans (NAPs) for Airports –

A report by AEF for AirportWatch (New style, old story - A review of UK Airport Noise Action Plans, January 2010) reviewed the 22 draft UK airport noise action plans to establish how these plans contribute to the aims and requirements of the Environmental Noise Directive (END). It found:

- None of the 19 airports in England and Northern Ireland based their NAPs on the 2006 baseline or the Lden noise contours in the associated noise maps.
- Only five airports offer forecasts or limits expressed using any form of noise contours and these all exceed the 2006 baseline noise levels. These use the 57 Leq(16hr) contour but this is not comparable with the Lden and Lnight contours specified by the Directive for noise mapping.
- All 19 airport NAPs produced in England and Northern Ireland allow, or actively plan, increases in aircraft noise (unlike Scotland where the three Scottish airports each make a commitment that, in the five years of the noise action plan (2008-13), the 57dBLAeq(16hr) contour area will not exceed the 2006 area).
- There is evidence that even the minimum requirements of the Environmental Noise Directive are not fully met by the airport noise action plans, and while Scottish airports have taken steps towards meeting the END objectives, the English and Northern Ireland airports have collectively failed to accept the spirit of the Directive, and have in fact subverted its aims and objectives.

The NAPs, in draft form, have been submitted to Defra and DfT for approval. The report concludes that these drafts should be rejected until the above issues can be remedied.

The role of operational procedures and CDA

Neither reduction at source (quieter aircraft) nor operational restrictions (through the introduction of noise action plans, direct Government regulation or voluntary airport initiatives) are delivering satisfactory mitigation. The land use planning element of ICAO's balanced approach is difficult to implement: land use planning in London may help to prevent some new development that may otherwise increase the number of people living under a flightpath, but it can do little for existing residents.

This leaves operational procedures, typically characterised by Noise Preferential Routes (NPRs), the use of Continuous Descent Approach (CDA) and P-RNAV[2].

Following the Government's policy of minimising the number of people affected by aircraft noise, NPRs generally fly over less populated areas. But with the need to perform a straight final approach, this reduces the opportunity to avoid densely populated areas, added to which the lack of variability requires aircraft to be concentrated on these routes. The following two chapters look in more detail at the impact of approach noise at one airport: Heathrow.

[2] P(recision)-RNAV aids track keeping. In Europe it is defined as operations which satisfy a required track-keeping accuracy of ±1 NM for at least 95% of the flight time.

Chapter 3 – Approach noise at Heathrow today

Heathrow's noise impact .... each year, the Department for Transport publishes annual noise contours for Heathrow, Gatwick and Stansted airports. Using the 57 Leq contour as a threshold, these official figures show 258,000 people exposed in 2006, covering a geographical area of 117.4 sq km (Dept for Transport, 2007). The DEFRA noise maps and action plans for airports, to comply with Directive 2002/49/EC, use a different metric and threshold. As described in the previous chapter, these maps and action plans use the 55 L_{DEN} contour. BAA's noise action plans show that 720,000 live with the 55 L_{DEN} contour at Heathrow. However, local communities believe even this underestimates the scale of the problem, and the true figure is probably closer to 1 million (see HACAN www.hacan.org.uk).

BAA Heathrow's long-term objective for the management of aircraft noise is:

"To limit aircraft noise impacts and gain the trust of our stakeholders that we are using best practicable means to achieve this goal, and to continue this approach into the future, within the framework established by government." (BAA Heathrow *Our Noise Strategy*[3])

To achieve this, the priority areas for action are:

"1. Reducing noise impacts wherever practicable. This includes:

1.1. Quietest fleet practicable

1.2. Quietest practicable aircraft operations, balanced against NO_x and CO_2 emissions

1.3. Effective and credible noise mitigation schemes.

2. Engaging with communities affected by noise impacts to better understand their concerns and priorities, reflecting them as far as possible in airport noise strategies and communication plans.

3. Influencing planning policy to minimise the number of noise-sensitive properties around our airports.

4. Organising ourselves to continue to manage noise efficiently and effectively.

5. Continuing to build on our understanding of aircraft noise to further inform our priorities, strategies and targets."

Although BAA recognises that noise is also an issue outside of the 57Leq contour, its only measure to benefit those overflown is an arrivals procedure that instructs pilots to use CDA wherever possible. "The CDA compliance levels are regularly reported back to our Noise and Track Keeping Working Group and the Heathrow Airport Consultative Committee as well as the Flight Operations Performance Committee (FLOPC), which includes airline and ATC representatives", states the strategy.

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3 http://www.heathrowairport.com/portal/page/Heathrow+noise%5EGeneral%5EWhat+we+do+about+it%5EOur+noise+strategy/0af8255eefa53210VgnVCM10000036821c0a____/448c6a4c7f1b0010VgnVCM200000357e120a____/

Public perception of the problem – residents' view

The AEF receives many complaints from the public concerning aircraft noise. Records of these complaints show an increase in comments received from residents in areas such as Southwark, Blackheath and Greenwich, places which have seen a marked increase in the number of over-flights since the promotion of CDA at Heathrow and more traffic coming from the Biggin Hill stack. Although records of flight path usage are rarely put into the public domain, most residents living in these areas perceive a significant increase in the number of arrival over-flights they experience over the past ten years.

BAA's draft Noise Action Plan for Heathrow is a repackaging of existing noise measures at the airport, bringing together operational practices, Government imposed limits and regimes, planning controls and locally agreed measures. It is not a fundamental rethink of noise as a whole and where it may cause specific problems for those regularly over-flown. Despite references to listening to those outside its noise contours, there is little understanding of the problems and how they may be remedied.

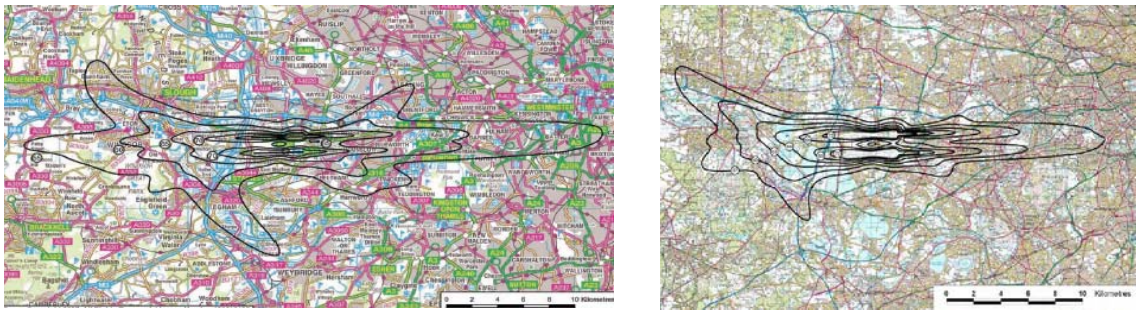


Figure 1: traditional Leq contours do not show any noise problems east of Putney, or east of Battersea when mapped using Lden (source: DfT 2009; and DEFRA 2009)

Figure 2: Noise complaints are not a reliable indicator of noise issues, but nevertheless these demonstrate that a large number originate from outside the contours (Source: BAA, 2009).

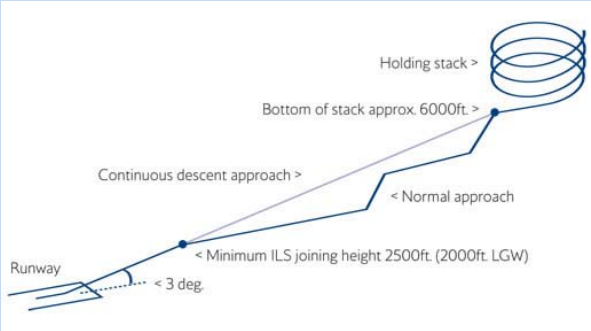
Chapter 4 – Approach noise: issues and alternatives

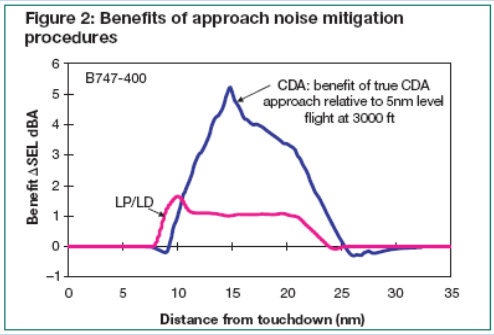
The biggest change to arrival at airports has been the increased use of Continuous Descent Approach (CDA). CDA is "*a noise abatement technique for arriving aircraft in which the pilot, when given descent clearance below Transition Altitude by ATC, will descend at the rate best suited to the achievement of continuous descent, whilst meeting the ATC speed control requirements, the objective being to join the glide-path at the appropriate height for the distance without recourse to level flight.*" (Noise from Arriving Aircraft – an Industry Code of Conduct, DfT et al, 2006)

In other words, rather than deploying flaps and descending through a series of flight levels, the aircraft makes a continuous steady descent at a fixed angle. Because most Instrument Landing Systems at airports are set at a glideslope of 3 degrees, this usually determines the angle of approach for CDA. The absence of gear and flap changes, and the fact that aircraft are higher at certain places along the approach, gives rise to a noise benefit as shown in the diagram below.

Continuous Descent Approaches

As shown in the first diagram below, the main benefit of CDA is that it avoids the deployment of flaps and thrust changes normally associated with a stepped approach. The aircraft may also be higher at points along the approach path. These combine to demonstrate a noise benefit as shown in the second diagram.





Source: (Diagram 1) British Airways (Diagram 2) Noise from Arriving Aircraft – An industry Code of Practice. Department for Transport et al, 2nd edition, November 2006

The use of CDA as a noise management tool is advocated by regulators worldwide, from the International Civil Aviation Organisation (ICAO) to national governments. It also helps to reduce fuel burn, giving it an added attraction for airlines. In the UK, the promotion of CDA is incorporated into a voluntary Code of Practice[4] compiled by a group representing airlines, air traffic control, airports, the Civil Aviation Authority (CAA) and the Department for Transport (DfT). The code is primarily concerned with Heathrow, Gatwick and Stansted airports, although much of the content is equally applicable to other airports. The code is intended to emphasise measures that can increase the number of flights using CDA.

[4] http://www.dft.gov.uk/pgr/aviation/environmentalissues/arrivalscodeofpractice/

CDA is pushed strongly by the Department for Transport

DfT is a strong promoter of CDA and uses its involvement in international arenas and meetings with manufacturers and airports to stress the importance and benefits whenever possible. Not all approaches use CDA, but DfT believes that the few that don't are the most disturbing for local residents and it therefore encourages all parties to continue to work together to strive towards maximum CDA achievement. However, in the second edition of the code, published in 2006, the DfT recognises that while "CDA has been clearly identified as the best arrivals noise abatement measure for current aircraft types, this could change in the future when quieter engines may make aerodynamic noise dominant for much of the approach, especially when speedbrakes and other drag-producing devices are deployed. The ultimate aim is to minimise noise levels in noise-sensitive areas under the arrival routes; if measures other than CDA were to prove more beneficial for some aircraft types in the future, ways of permitting such new procedures should be explored".

ICAO has also recently completed a review of the benefits of CDA operations. Based on trials in US and Europe, ICAO estimated that the average benefit is a 3-5 dB reduction in noise impact on the ground 10-25 miles from the runway (and although not the subject of this report, a fuel saving of 50-150kg for wide bodied aircraft and a reduction in both CO2 emissions and NOx). But the work does note that the noise benefits arise "typically outside of the critical (decision making) noise contours for most airports".

CDA in practice

While CDA (and P-RNAV) are presented as an overwhelming benefit, this ignores the increased frequency of flights for those living under the approach path. Instead of spreading noise over several routes, it is concentrated on a few.

At Heathrow, Gatwick and Stansted, the theoretical "ideal" CDA profile is a descent at 3° from 6000ft. This equates to a distance of approximately 19 nautical miles from touchdown. A nautical mile is equivalent to 1852m, so at Heathrow this means that aircraft must commence the CDA approximately 35 km before touchdown.

On westerly approaches, aircraft can join the CDA as far out as Greenwich on the northern runway and Blackheath on the southern runway. Both approaches go over large areas of Southwark, Lambeth and Battersea. For easterly operations, this will be equivalent to joining the CDA approach over the north of Reading.

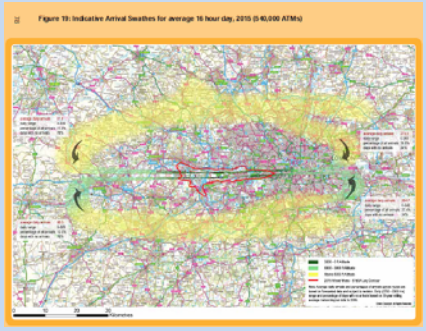
A change in approach?

This flight-path map from BAA's Heathrow environmental report in 1998/9 clearly shows large numbers of approaches coming across south west and north west London before turning onto the final approach over Westminster. Today, with extra stacks and joining points, more flights are joining the final approach much further east.

Coupled with the growth in traffic, this has led to a greater concentration of arrivals over Southwark, Wandsworth, Lambeth and Greenwich boroughs. All of these areas lie outside the 57 Leq contour for Heathrow for 2008.

However we are aware from residents' concerns that these areas generate significant community annoyance. As noted in the introduction, there is recognition that "further out noise" is generating a large number of complaints, and that either changes to flightpaths or an intensification of use are the primary triggers.

Although complaints are logged, both industry and government have been reluctant to consider noise outside of the 57 Leq contour. So while CDA (and P-RNAV) are presented as an overwhelming benefit, this ignores the increased frequency of events for those living under the approach path. Instead of spreading noise over several routes, it is concentrated on a few. For many people, the increased frequency outweighs any benefit from the reduction in individual noise events as a result of CDA.



And more to come?

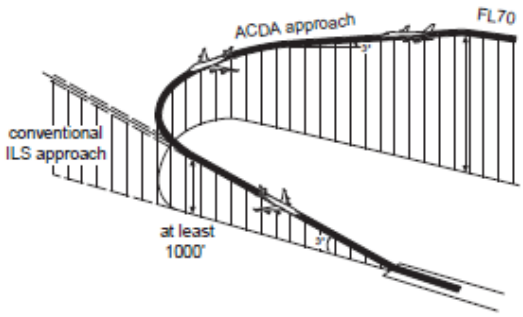
This map from the Department of Transport's consultation on the future of Heathrow shows indicative arrival paths for a 2-runway airport in 2015. It clearly shows the northerly and southerly approaches converging on the extended centreline far to the east and west of Heathrow.

Curved approaches

In addition to the many airports that have implemented continuous descent approach (CDA), there have been several trials with curved CDAs. Careful assessment needs to be made of whether alternative procedures could deliver environmental benefits on approach, but the main benefit of a curved CDA approach (known as Advanced CDA, or A-CDA) is that it allows aircraft to turn later onto a runway path. Although no formal regulation or certification of A-CDA currently exists, it has been successfully trialled.

A European Commission research project, OPTIMAL (Optimised Procedures and Techniques for Improvement of Approach and Landing) is looking at curved approaches, while in 2009 Novair became the first carrier in Europe to conduct a "curved green approach", with an Airbus aircraft using GPS navigation technology. At Stockholm Arlanda, a curve was flown around the provincial town of Uplands Vasby to avoid noise-sensitive regions. By 2012 at the earliest, a majority of the aircraft that serve Stockholm-Arlanda are expected to be equipped for curved approaches.

In the Netherlands, the NLR (a government research agency) has also started a research project on A-CDA. The curved approach path consists of straight and circular segments. A constant glide path angle (normally 3°) is maintained along the entire path, including the turns.



A curved CDA approach, or ACDA. Source NLR

NLR believes that A-CDA has potential environmental and economical benefits compared to the present-day approach procedures including:

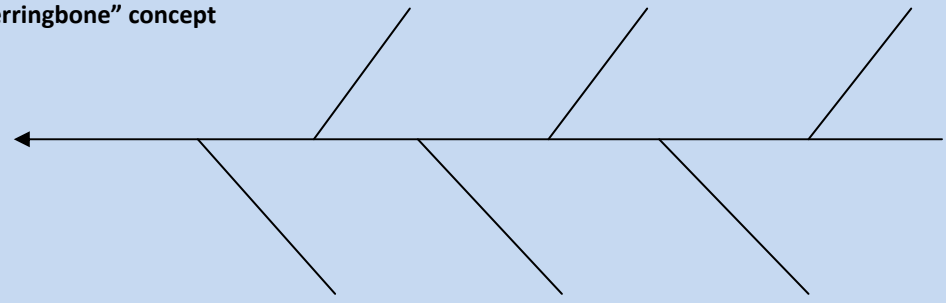
a) higher altitude during larger part of the approach;
b) lower power settings / clean aircraft configuration;
c) more flexibility in definition of approach path geometry, enabling the procedure designer to define approach paths away from residential area (with an additional advantage of reducing third party risk, a safety issue).

These studies demonstrate the feasibility of curved approaches. Providing the curve on the approach path is not severe the single event noise contour for a curved approach (showing the noise generated by one landing) will look very much the same as for a straight CDA.

But while curved CDAs offer greater flexibility in designing approach routes they still suffer from the issue of concentration. Some respite could be provided to residents if more than one CDA approach can be used for each runway. This is possible if aircraft can turn on to the final straight leg of a CDA at different intervals, creating a series of approach paths with different entry points. This would maintain many of the benefits of CDA while creating greater flexibility to reduce the number of overflights at any given location and to provide respite periods.

These entry points could be either side of the straight leg, creating a “herringbone” effect. This is already under discussion in Sydney where it is referred to as “Trident”. Required Navigation Performance routes (RNPs) used in Australia require an aircraft to stay within a specific ‘envelope’ of airspace and continuously monitor its performance. But the increased accuracy of the existing RNP on approach to Sydney has caused a 'natural' tightening of the flightpaths due to improved navigation performance and this has triggered a new wave of protests about noise concentration.

The “Herringbone” concept



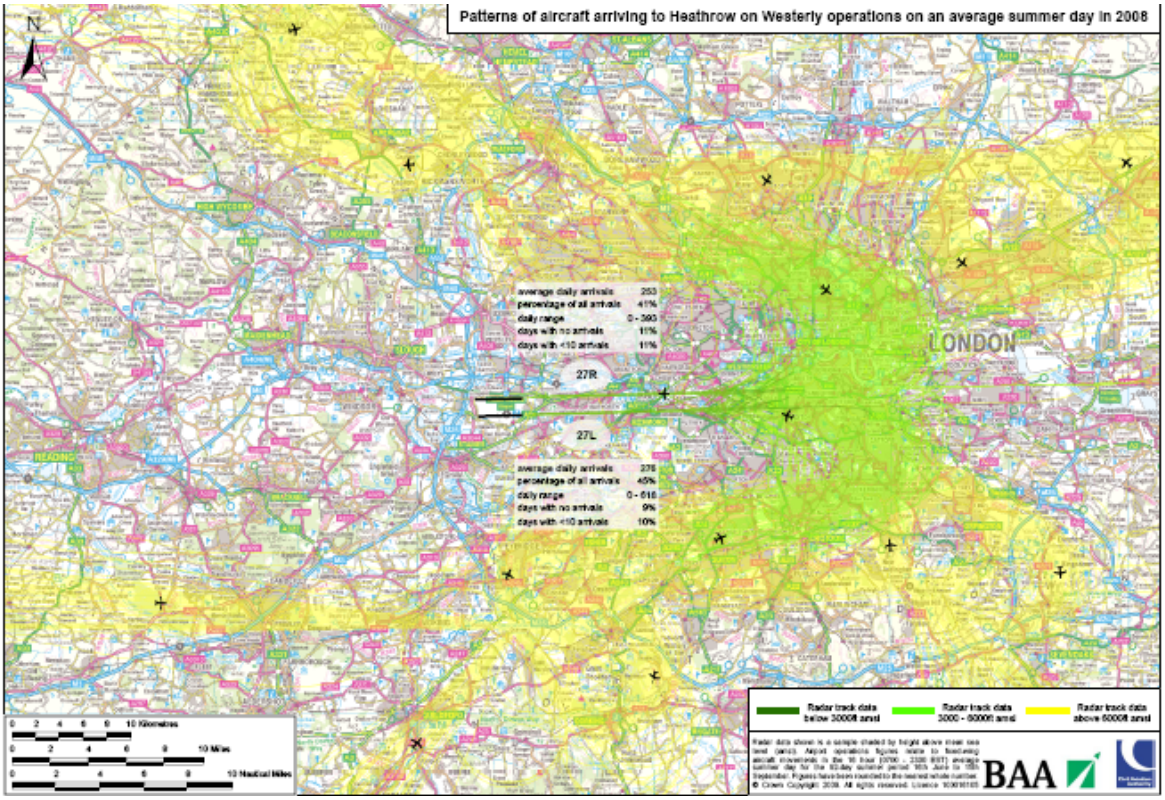
This approach allows arrivals to be dispersed to the north or south of the straight leg with different joining points. Aircraft arrive in a sequence to ensure that minimum separation distances are maintained.

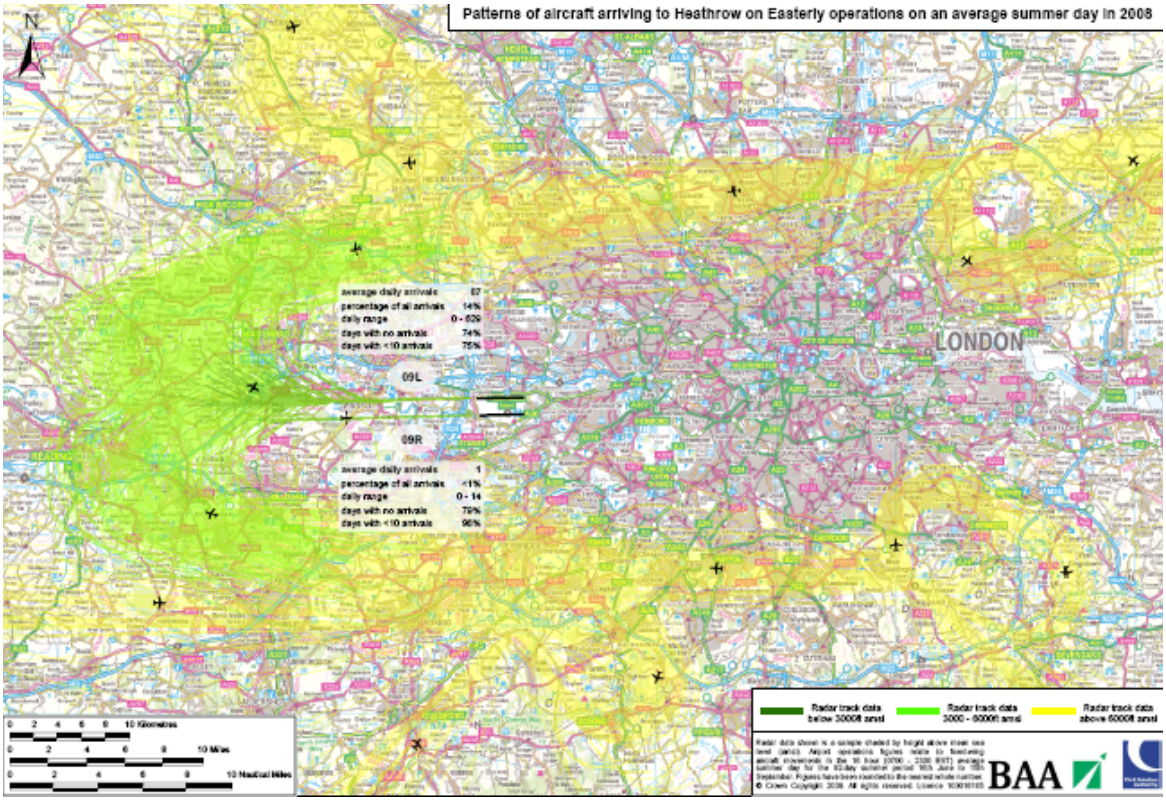
The Australian government is about to launch a study looking at the options for establishing multiple (RNP) routes to/from an individual runway in order to allow rotation. The Government hopes that the implementation of multiple RNPs in a Trident formation may offer beneficial respite for communities. To date, Airservices Australia, the body responsible for air traffic management at Sydney Airport, has taken a positive attitude to studying this approach further.

Although the feasibility of having multiple approaches has yet to be established, it should not preclude any discussion in the UK. Even with a 2 runway airport like Heathrow, the use of segregated mode would allow aircraft to join from either side of the extended centreline.

The extent of the problem

The maps below, taken from BAA's website, show the extent of the problem in 2008. They show only planes landing at the airport. The first one indicates what happens on a day the west wind is blowing (typically, 70-75% of the year); the second one paints the picture during an east wind.





Chapter 5 – Steeper Approaches: are they feasible?

The international standard approach at airports is an angle of 3 degrees. Aircraft manufacturers, when designing new aircraft types, ensure that aircraft are capable of flying such an approach at different landing speeds and weights. There is always, however, a margin of tolerance built in, and steeper approaches are possible. Some airports, because of their runway length or location, can only operate by deviating from this international practice.

The example that is closest to home is that of London City Airport where the approach is set at 5.5 degrees. When it first opened in the mid-1980s, London City found itself in the middle of a regeneration scheme including the development of Canary Wharf and a proposed East Thames river crossing. Both of these projects would have presented insurmountable problems to London City Airport if it operated with a 3 degree glideslope, as they would have infringed the required obstacle clearance slope (which ensures that no buildings or structure interfere with an approach to an airport). The fact that Canary Wharf was already built, coupled with its short runway (originally 899m and now 1199m), left London City Airport with little choice but to set an approach of 5.5 degrees. Despite this, a large number of regional jets were able to use the airport including the Fokker 50, Dash 8, BAe 146, and more recently an Airbus A319 operating at a reduced weight.

Airbus and the A318 experience

British Airways recently launched a service from London City Airport to New York via Shannon using an Airbus A319. Airbus had already been trialling steeper approaches using its A318 aircraft for many several years. Specially configured for the trialled operations, and with a few technical adjustments in the cockpit and onboard computers to select the required flap settings and speed, the aircraft was capable of performing approaches up to 5.5 degrees without any reduction in the required maximum landing weight (MLW).

These examples prove that aircraft are generally capable of operating at a steeper approach. While an angle of 5.5 degrees would require significantly different safety and airworthiness certification requirements, there is some potential for aircraft to operate up to 4.5 degrees without big changes in the way they are currently built and certificated. The theoretical benefit of a steeper approach, achieved by increasing the glide path angle of the Instrument Landing System (ILS), is that it keeps aircraft higher, reducing the noise for those communities under the approach path. Potential trade-offs with emissions, safety and operational performance have limited the assessment of steeper approaches to date, but the International Civil Aviation organisation (ICAO) has tasked a working group of its Committee on Aviation Environmental Protection (CAEP) with looking at the issue in more detail. Its emerging findings, reported to CAEP in February 2010, show that steeper approaches deserve further consideration while noting that the above trade-offs may present some limitations.

ICAO's justification for looking at steeper approaches is based on a realisation that there are few options to reduce noise close to an airport when technological improvements at source are increasingly hard to obtain (engine noise being exceeded by airframe noise in many cases). And there is a precedent. In 1978, ICAO increased the international standard for the ILS glide slope from

2.5 to the present 3 degrees, although subsequent studies evaluated beginning the descent at a steeper angle (up to 6 degrees) but still envisaged a final approach of 3 degrees.

CAEP's current assessment looked at the benefits of approaches between 3.25 and 4 degrees for both short and long-haul aircraft (the 737-800, the A340-600 and the 777-200). It became apparent that these aircraft were capable of landing above 3 degrees once they had decelerated to the right speed. However, it was not possible to decelerate at the same time as flying the steeper approach angle, requiring an aircraft to have achieved the right speed and deployed its flaps for landing beforehand. CAEP therefore suggested a two-tier approach where the initial descent is undertaken at 2 degrees and then the final descent at between 3-4 degrees. This is designed to both maximise the height above the ground and minimise the thrust, giving the greatest potential to reduce noise. It also appears to be operationally feasible. Preliminary findings suggest that noise can be reduced by approximately 1-4 dBA, or 0.5 dBA for every 0.25 degree increase in the glideslope. A glideslope of 4 degrees could therefore reduce noise by 2 dBA. More importantly it can reduce the area of the noise footprint for an individual aircraft by 21-35%.

Aircraft are generally capable of operating at a steeper approach than they do at present. Steeper approaches would mean aircraft remain higher longer and cut noise.

This is based on starting the final descent at a height of 2,500 feet, which keeps the largest benefits to a distance of 5 nautical miles from the airport. CAEP acknowledges that increasing this height before commencing the final approach could bring further benefits, albeit at the potential cost of greater fuel burn. But for the approaches measured, there appeared to be no change in fuel burn.

CAEP also identified some concerns with this approach, notably:

- A potential lack of standardisation if it is not replicated at every airport
- An increased work load for pilots
- A possible reduction in the ability to use low power and flap settings, and low drag techniques, originally introduced to minimise noise

CAEP has noted these and other concerns that may have safety, operational or capacity implications and has recommended that a full analysis would be required. Nevertheless, there seems sufficient potential to continue to study this option.

Chapter 6 – Conclusions and policy recommendations

- Current noise policies and measures, coupled with increases in traffic, have contributed to communities being overflown more regularly. Simply limiting the number of people affected by aircraft noise overlooks the quality of life for those likely to suffer from more concentrated flightpaths.

- In particular, it ignores the number of noise events they experience despite the findings of the ANASE study that annoyance is strongly influenced by the number of aircraft passing overhead.

- Both this, and the reliance on local action by airport operators, makes the existing noise policy out of date. The noise problem has evolved over the years with longstanding concerns about intrusive aircraft noise and night flying being supplemented by wider community concerns that extend well beyond the 57 dBA noise contours.

- The location of flightpaths and protecting tranquil areas have all added to the complexity of the noise problem. Government policy needs to reflect all these issues, and a revision should be a high priority for the new Government following the election.

- This year presents an ideal opportunity. Late in 2009, Government consulted on the reform of the Civil Aviation Authority following a review by Sir Joseph Pilling. The Pilling Review had recommended that the CAA be required to have a general environmental duty in performing its duties. The Department for Transport (DfT) agreed, and the consultation proposes giving the CAA a mandatory duty "to have regard for environmental factors alongside the proposed safety and consumer objectives and seek environment improvements". The AEF is supportive of this approach but believes it can only be effective if clear guidance is given by the DfT on environmental objectives. Failure to do so will leave the CAA to interpret what is reasonable when taking decisions on matters such as airspace changes. This point has been acknowledged by the DfT who state in the consultation that:

  > "...guidance from Government, including a clear articulation of the policy framework in which the CAA is operating, will be needed to help the CAA decide how best to achieve its environment objective. This was recommended by the Pilling Review and the Government proposes to follow such an approach. ....
  >
  > In addition to new environmental guidance, we anticipate that we will continue to need to provide specific guidance relevant to air navigation functions. We recognise the need to update the existing guidance in this area which was issued in 2002".

- This opportunity to update Government guidance on the environment could and should extend to a revision of existing noise policy.

- There is sufficient evidence in this report to support the further assessment of curved CDA and steeper approaches. They may not be right for every airport, but at some they could provide flexibility where problems of concentration exist, and should be examined further, as is already happening in other parts of the world.

- The Government should actively engage with airports, airlines, air traffic controllers and manufacturers to initiate trials to assess the potential benefits. Furthermore, the Government should use its membership of ICAO's environmental committee to support and encourage the global work on steeper approaches.

- In the run up to last year's climate negotiations in Copenhagen, both governments and industry prioritised actions to address greenhouse gas emissions from aircraft rather than focussing on noise issues, while airport operators, prompted by the requirement to produce Noise Action Plans, have been more concerned with regulatory compliance than finding fresh approaches to tackling the issues. This mindset can be construed as a wasted opportunity to assess, discuss and find emerging ideas.

Check out the video: what it is like to live in Vauxhall, over 17 miles from Heathrow and a stone's throw from Central London. Residents explain how aircraft noise has only become a problem in recent years. Click on image or visit the HACAN website – www.hacan.org.uk

HACAN commissioned this report from the Aviation Environment Federation (AEF). It was written by AEF Director Tim Johnson.

AEF is a not-for-profit organisation which specialises in aviation and the environment. It can be contacted at Broken Wharf House, 2 Broken Wharf House, London EC4V 3DT, tel 020 7248 2223; email info@aef.org.uk; website: www.aef.org.uk

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