Opportunities to improve noise management and communications at Heathrow

Summary of a dialogue between Aviation Environment Federation, British Airways, HACAN, Heathrow Airport and NATS

19th October 2011

1. Introduction

The Government is consulting on a sustainable framework for UK aviation. Many stakeholders in the debate on aviation and sustainability recognise the value of identifying areas of common ground where possible.

During the consultation period, Aviation Environment Federation, British Airways, HACAN, Heathrow Airport and NATS held a dialogue to share views on opportunities to improve the management and communication of aircraft noise. This 'noise dialogue group' focussed on two issues, selected as ones which are important in the debate over aircraft noise and also offer the greatest opportunity to identify areas of common ground. These were:

1. Noise communication.
2. Predictability of noise from departing and arriving aircraft

For each of these topics, the group's discussion followed a similar structure:

- Each organisation shared its perspective on the 'as is' situation, with supporting evidence and information.
- The group discussed areas of common ground in relation to the evidence base.
- The group discussed areas of common ground in relation to findings and recommendations.

This paper summarises the outcome of the dialogue for each of the topics above. It identifies a number of areas of common ground, practical steps and opportunities for further joint work. The dialogue focused on Heathrow as the UK's busiest airport and one where aircraft noise is a significant concern for local communities. It is envisaged that the conclusions of the dialogue will be applicable to other airports, although one of the group's findings is that the development of local solutions to tackle local issues is an important part of managing the impacts of noise.

2. Noise communications

2.1. Context

For communities living around airports noise remains one of the biggest areas of concern. Noise is complex to measure and to describe to communities in ways that are easily understood.

Noise has traditionally been represented through ‘noise contours’ which describe the average continuous level of noise experienced over a particular time period. These contours are used to inform Government policy and airport development planning decisions in the UK and many other parts of the world.

For example, an important basis for noise policy in the UK is a measurement of the population and area which is exposed to average noise levels from aircraft above 57 decibels through from 7am to 11pm during a typical summer day (known as the ’57 dbA Leq’ contour). The Government recognises this as the level at which communities start to be significantly annoyed by aircraft noise. Planning permissions for major airport developments, such as Terminal 5 at Heathrow, have required that the area exposed to this level of noise should not exceed a given area. Average noise contours have also been used as the basis for the noise insulation schemes that airports offer.

The European Union also uses an average noise contour as the basis for its noise legislation (‘Annual Lden’) although this is different from the official UK noise index as it measures noise over a 24-hour period, adding weightings for noise events in the evening and at night.

The way that average noise contours are calculated can be difficult to explain, and local communities around Heathrow and under the airport’s flight paths regularly feed back that the contours do not adequately describe their concerns about noise. As part of its ongoing programme of noise management, Heathrow Airport provides a range of information to local communities on noise issues. This has evolved over a number years as the airport has looked to respond to stakeholder views. In 2010, Heathrow launched a project as part of its Noise Action Plan to review which ‘supplementary noise metrics’ would better describe noise impacts to local communities. Heathrow commissioned the Centre for Air Transport and the Environment at Manchester Metropolitan University and Ian Flindell Associates to run this project, which has involved extensive stakeholder dialogue with groups interested in aircraft noise. The noise dialogue group drew extensively on this work.

2.2. Findings and recommendations

In summary, the group recognises that average noise contours are an important tool in noise measurement and management, but equally that average noise contours do not reflect the totality of community concerns around noise and should be supplemented by other metrics.

Noise contours:

- Provide an accurate calculation of average noise levels.
- Record how these levels have changed over time. Data for the 57 decibel Leq contour at Heathrow exists from the early 1980s onwards. Among other things this

allows the airport to measure the effectiveness of its measures to incentivise airlines to use quieter aircraft types and quieter operating practices at Heathrow.

- Can be forecast for future years to understand how average noise levels are likely to change as the number of flights and aircraft technology changes.

As a result, noise contours have been an important part of Government policy and have been used extensively by the planning system (Planning Policy Guidance Note 24, Planning and Noise). The Government has used them, for example, to recommend which properties around airports should be eligible for insulation. The planning system has regularly set 'contour limits' as a condition that new airport developments have to meet.

The group also recognises that, while local communities do not feel that contours represent the totality of their concerns around noise, they generally feel that the 'Lden' average noise contour represents more accurately the area impacted by aircraft noise. This contour includes an additional weighting for noise in the evening and at night and is used in European law as a basis for the Environmental Noise Directive that requires noise contour maps to be produced for road, rail and air noise sources. For each of these sources 'noise action plans' are also required.

While contours have played and will continue to play an important role in representing 'area-wide' changes in noise exposure, the group recognises that noise contours can be difficult to explain and that local communities do not feel that contours accurately describe their individual experiences of noise. Communities around Heathrow regularly feed back that rather than an average measure of noise, more meaningful information would include the total number of flights over a particular location, the time of day of those flights, and how loud the loudest flight will be.

Heathrow Airport commissioned the Centre of Air Transport and the Environment at Manchester Metropolitan University and Ian Flindell Associates to investigate supplementary metrics that could be used to complement or reinforce existing standard metrics when describing or communicating aircraft noise exposure to the general public and other stakeholders. The study built on previous OMEGA research which indicated that there is a general lack of understanding of existing standard aircraft noise metrics. The results of the study were informed by two phases of focus groups held with a range of stakeholders and local residents, all with an expressed interest in aviation issues. The focus groups were asked to consider and debate a range of different metrics ranging from standard Leq contours to site specific histograms.

From a public communication perspective, the primary conclusion of the study is that the basic building–blocks of aircraft noise communication initiatives aimed at the general public should be radar flight track charts overlaid with the capacity to generate noise event histograms for given locations for those wanting more detailed site specific information.

In addition to this the study also suggested the following extensions to these basic building blocks.

- An educational 'bolt-on' to illustrate how standard averaged aggregated noise metrics (e.g. LAeq and Lden) are calculated from the raw radar flight tracks. This would enable stakeholders to scrutinise the basis of planning and regulatory decisions and demonstrate that they are based on objective measures.

- A future scenarios capability to illustrate the potential impact of new developments as and when necessary. This capacity would illustrate the likely consequences of predicted changes in air traffic movements using radar flight track charts and event histograms.

Heathrow is planning to start including supplementary metrics as part of its communication on noise and will seek feedback from local communities on the information it provides. The noise dialogue group has agreed that there would be value in it continuing to meet periodically to review the development of supplementary metrics.

3. Predictability of noise

The predictability of noise from aircraft is highlighted regularly by communities around Heathrow and under the airport's flight paths as an important factor in determining the overall impact aircraft noise. For example providing predictable periods of respite from aircraft noise is seen as an important way of responding to community concerns over noise.

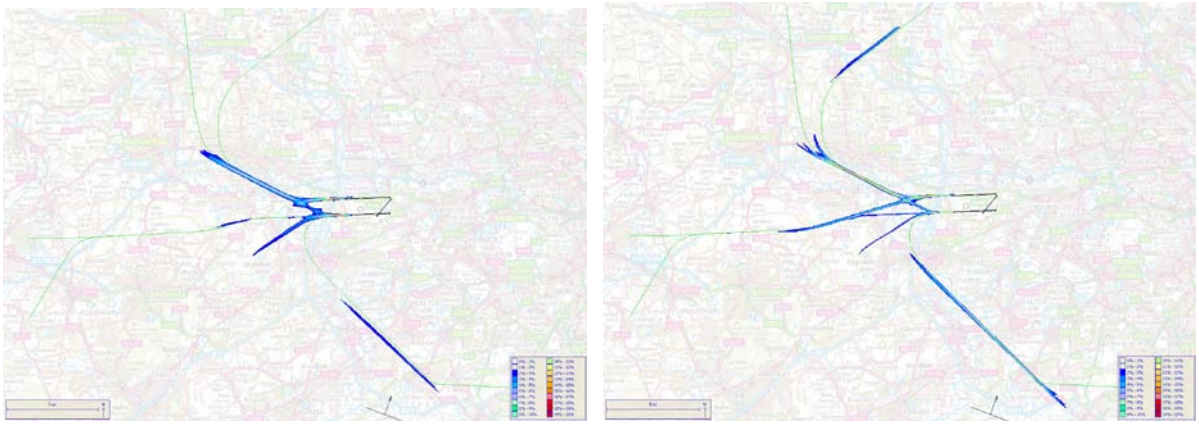
3.1. Departing aircraft

3.1.2. Context – the evidence base

Aircraft departing from Heathrow are required to follow a 'noise preferential route' (NPR) until they reach an altitude of at least 4000 feet. NPRs are identified by the Government to concentrate aircraft flight paths away from areas of dense population as far as possible. Aircraft are considered to be on track if they are within 1.5km either side of the NPR centre-line – a 3km band known as the NPR 'swathe'. The NPR that an aircraft follows when it departs from Heathrow will typically depend on its final destination.

Heathrow monitors and reports publicly on how well aircraft follow NPRs – this is known as 'track-keeping'. Data from the past 15 years shows that track-keeping at Heathrow has improved from consistently below 85% to consistently over 97 %. This is a result of improved technology and an ongoing programme by the airport to engage airlines and pilots in improving track-keeping. Such has been the improvement in technology that within the 3km NPR swathe there has been an increasing concentration on the centre-line of the NPR swathe. This is illustrated by Figure 1 which shows the difference in concentration through density maps for a sample period in 1997 and 2011.

Figure 1: Track density plots for a sample period in 1997 and 2011 showing a greater level of concentration in 2011(the single green lines indicate some of the departure SIDS).



1997 2011

While this improved track-keeping represents better compliance with the Government's policy of concentration, it also means that residents under or very close to the centre of an NPR swathe may experience more flights above them than they did historically.

3.1.3 Findings and recommendations

The group recognises the principle of maintaining noise preferential routes for departures, particularly given that these have been established for many years.

However the group also believes that there may be value in exploring opportunities to provide more predictable patterns of overflight within existing NPRs. While the group understands there may be significant operational hurdles to overcome in this sort of innovative approach to noise management, these should be explored further by a group of the operational stakeholders. Concepts to be explored might include (but not necessarily be limited to) the use of navigational technology now available to alternate use of different sections of the NPR swathe – for example, using one half of the NPR swathe on one day and the other half the next day.

Some high-level initial calculations based on aircraft being 750m from the NPR centreline suggest that if this were technically and operationally feasible there may be benefits in 'alternating' which half of the NPR is used. It is thought that the most notable differences are likely to occur when the aircraft are between 2000ft and 3000ft. This is because being able to achieve a separation below 1000ft is thought to be over ambitious and as the aircraft climb the level of change in sound levels perceived on the ground will become less noticeable. The group recognised that there would be periods when residents would experience an increase in noise levels but these would be balanced by periods of noise reductions and planned respite. For communities located at 750m from the centerline the estimated increase in noise ranges between 0.3dBA and 3.3dBA and the decreases between 1.5dBA and 8.4dBA depending on the altitude and type of aircraft. The group is keen to stress that these are very initial calculations based on a number of assumptions and further work would be needed to verify them.

The group also recognise that there is a number of notable technical issues which would need to be understood. These include, for example, the ability of aircraft flight management systems to cope with the additional data requirements, procedure design and safe integration into the current airspace management systems. The widespread application of this technique would also result in bigger noise contours.

Nevertheless the group believes that there would be value in exploring the operational feasibility of trialling use of technology to manage noise in innovative ways. Any such trial would need to be limited in scope in the first instance, the clear objective being to identify the operational feasibility of such procedures. To the group's knowledge, this sort of work has not been investigated anywhere else in the world. In addition to identifying the operational implications a trial, if feasible, should also be used to gauge local community feedback. Developing such a trial would rely on collaboration between Heathrow, an airline or airlines and the air navigation service provider, NATS. Any such a trial would need to be approved by the Civil Aviation Authority, the body that regulates airspace and sets safety standards. The industry partners in this dialogue have agreed to develop further the concept of a trial and will continue to meet with HACAN and AEF as part of this process to ensure that any trial addresses local community questions and concerns.

3.2. Arriving aircraft

3.2.1. Context – the evidence base

For aircraft landing at Heathrow, a level of predictability is provided for many communities by the way in which the airport's two runways operate.

The majority of the time aircraft land at Heathrow from the east over London - so-called 'westerly operations'. (This is because aircraft need to land into the wind, and the prevailing wind direction at the airport is from the west). Heathrow's runways are also operated in 'segregated mode' which means that one runway is used for take-offs and the other for landings. When Heathrow is operating 'westerly operations' the runway used for landings is switched half way through the day – known as 'runway alternation'.

During the day, all aircraft are required to join their 'final approach' to Heathrow by time they have reached an altitude of at least 2,500 feet (which equates to a distance of around 7.5 nautical miles from the airport). The final approach is where the aircraft are lined up with the runway that they will be landing on. This requirement is known as the 'minimum joining point'. At night the minimum joining point is 3000 feet and a distance of 10 nautical miles, a requirement formally introduced in the mid 1990s. Runway alternation means that communities between these joining points and the airport benefit most from a predictable period of time without flights over them.

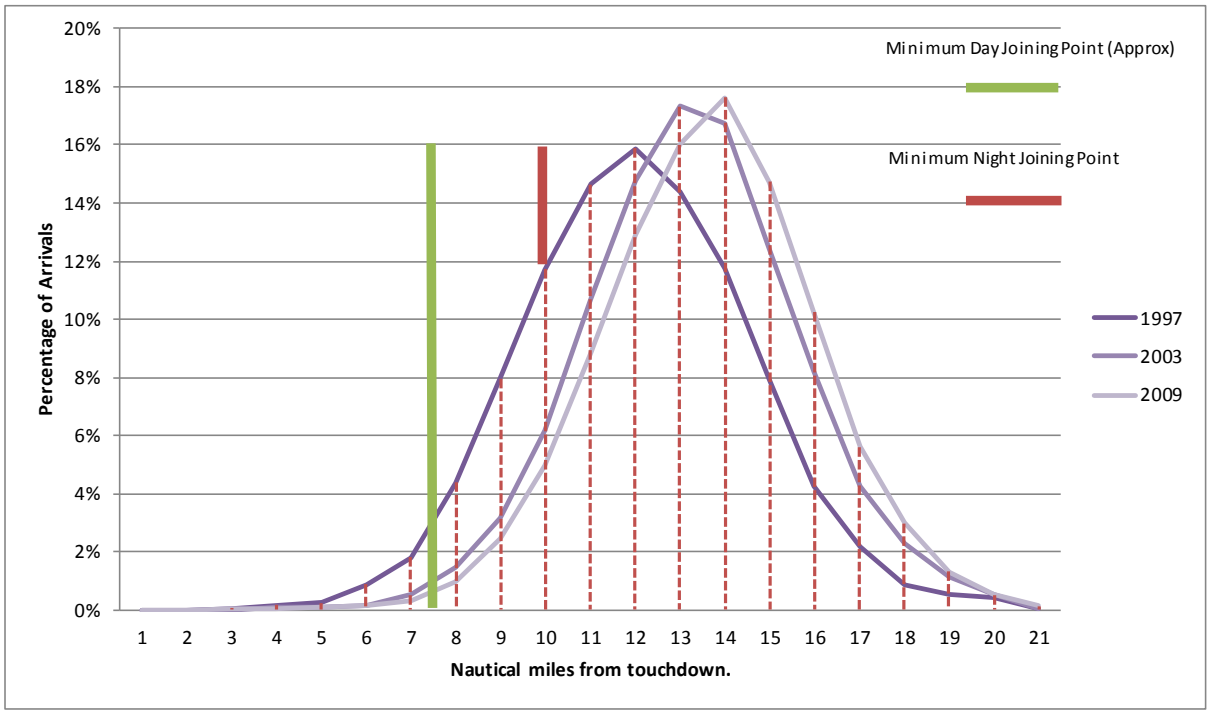
Figure 2 below show that most aircraft join their final approach before they reach the minimum joining point – in some cases as far as 20 nautical miles from the airport. This is because air traffic controllers are managing the airspace in a dynamic way to maintain a safe and efficient flow of aircraft and to minimise the distances that aircraft need to fly.

Statistical analysis of the point by which aircraft join their final approach has shown that the most frequent joining point on westerly operations has moved around 2 nautical miles away from the airport over the last 15 or so years, as shown blow. This point is now approximately 14 nautical miles from the airport. HACAN analysis has also shown that the last 10 years or so have seen an increased number of complaints about aircraft noise from this area. The increase in overflights in this area is a result of two main factors:

1. A gradual increase in total flights from around 420,000 cargo and passenger movements in 1995 to a peak of 476,000 in 2007. In 2010 there were around 450,000. (The annual cap on air traffic movements at Heathrow is 480,000).

2. An improvement in the adherence to minimum joining points.

Figure 2: Graph showing percentage of aircraft joining the final approach on westerly operations (over London) by nautical mile from touchdown for selected periods during 1997, 2003 and 2009.



The improved adherence by aircraft to these minimum joining points has coincided with an improvement in the percentage of aircraft that land using a Continuous Descent Approach (CDA). CDA means that an aircraft follows a smooth glide slope when it descends to land, avoiding prolonged periods of level flight and noisy changes in engine thrust settings. This brings benefits in terms of lower emissions and reduced noise levels as aircraft are flying over London.

However, an additional characteristic of the area in question - around 14 miles from the airport - is that it does not benefit from the predictability of runway alternation to the same extent as communities closer to the airport. This is because over the course of a whole day a number of planes will be crossing this area to line up on the runway they will be using, whichever runway is in use. The area is a densely populated part of central London.

While the most common point at which aircraft join the final approach is around 14 nautical miles from the airport, aircraft are also joining the final approach from between 7.5 and 20 nautical miles from Heathrow. Given this, the arrival routes that aircraft follow across London as a whole are relatively dispersed, as shown in Figure 3. This dispersal happens because air traffic controllers are managing the airspace in a dynamic way. They need to ensure that there is a safe distance between aircraft and that there is a steady and efficient flow of aircraft onto Heathrow's landing runway, which is at its capacity for significant parts of the day. This pattern means that many residents in London as a whole experience relatively few arriving aircraft flying directly over them. However this dispersal also means that there is difficult to predict when aircraft will be overhead. Figure 4 shows the area where aircraft most frequently join the final approach. It also illustrates how runway alternation will be less beneficial in these areas as aircraft fly north to south and vice versa to join the final approach.

Figure 4: typical westerly arrival tracks over London coloured by height.

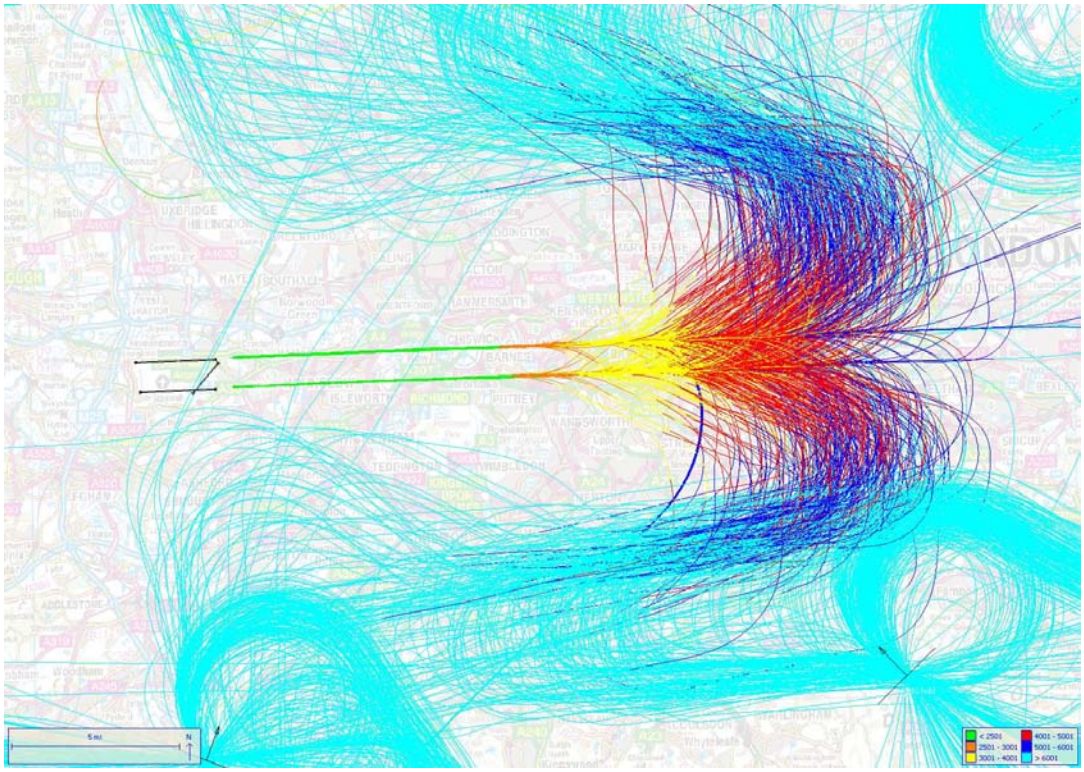
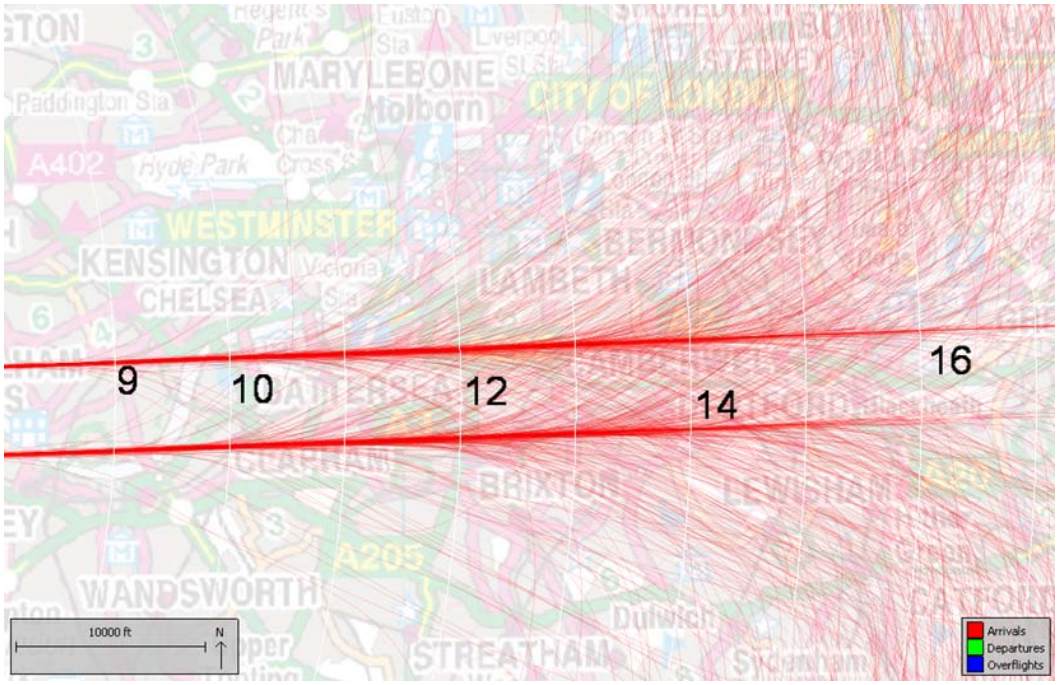


Figure 5: a zoomed in view of a typical day of westerly arrival tracks, highlighting the area where aircraft most frequently join the final approach



3.2.2. Findings and recommendations

Statistical analysis has shown that the most common point by which aircraft join their final approach to Heathrow has moved around 2 – 3 miles further from the airport in the last 15 or so years. Communities between the airport and the minimum joining points benefit most from predictable runway alternation. Over the same period, collaborative efforts between Heathrow Airport, NATS and the airlines have delivered improved levels of 'continuous descent approach' for aircraft en route to their final approach.

The group discussed opportunities to provide greater predictability of/relief from noise for communities under Heathrow's flight paths.

In the short-term, NATS felt that it would be difficult to alter significantly the current landing patterns. The option of moving the minimum joining points closer to or further away from Heathrow could have the effect of spreading the aircraft more widely, which could have benefits for some communities, but would also have disbenefits for others. There might also be operational and safety constraints to this. From a noise perspective this could also reduce the current high levels of adherence to CDA and would mean that more aircraft were joining the final approach closer to the airport, when they are at a lower altitude and therefore noisier.

The second option discussed was introducing fixed routes for arrivals over London as a whole which would allow different routes to be used at different times, thereby providing more predictable respite from noise. Given the need to manage Heathrow's arrival flows dynamically during the day, the opportunities to do this are severely limited at present without significantly affecting the safety, efficiency, capacity and environmental performance of the system. However, the group is committed to continue to explore options to manage the noise impact of aircraft arriving over London in the future.

A new approach technique known as 'point-merge' is starting to be used in some parts of Europe. This technique offers the potential for aircraft to be guided into land along more precise paths. NATS is currently beginning a process of evaluating the feasibility of point merge in future airspace designs. At this stage it is not clear exactly how point merge might perform in UK airspace in environmental terms, but NATS will continue to evaluate opportunities to manage noise in innovative ways using this and other tools.

For early morning arrivals (the c.16 flights which are scheduled to arrive each day between 4.30 am and 6.00 am) it may be more practical to trial fixed arrivals routes that could be alternated on different days to provide predictable relief from aircraft noise. The group believes that there would be value in exploring the operational feasibility of a trial of such an approach for early morning arrivals. Developing such a trial would rely on collaboration between Heathrow, an airline or airlines and the air navigation service provider, NATS. Such a trial would need to be approved by the Civil Aviation Authority, the body that regulates airspace and sets safety standards. The industry partners in this dialogue have agreed to further develop the concept of a trial and will continue to meet with HACAN and AEF as part of this process to ensure that any trial addresses local community questions and concerns.

The group recognises that for operational and safety reasons it is not realistic to plan to trial multiple innovative airspace management techniques concurrently. Given that, the timing of

future trials will need to be considered carefully once the operational feasibility has been investigated.

In summary, the group recognises:

1. The short-term options to manage arrival noise appear to be limited from operational, safety, capacity and overall environmental perspectives, with the possible exception of early morning arrivals given that the number of flights involved is lower.

2. In the longer-term new technology may have some potential to improve the noise climate relating to arriving aircraft.

3. When managing noise it is important to consider the possibility of unintended consequences - some attempts to improve the situation on noise could very easily impact on noise for others, other elements of environmental performance or factors such as safety

4. The group sees value in continuing the dialogue to identify opportunities to deploy innovative solutions to manage noise.

Consultation on flight path changes and operational matters will always be difficult as there are always likely to be winners and losers. Yet consultation, particularly of local residents, is important. Not only do local residents have the right to be consulted on changes which may affect them in fundamental ways but their perspective is helpful in helping the industry and policy-makers make the right decision. The group believes, therefore, that there is value in bringing in representative residents' organisations at the very early stage when consultation proposals are being formulated. Actual trials of proposed operational changes may make any consultation more meaningful to residents and more effective for the industry.