

# EMISSIONS: IMPOSSIBLE

An assessment of the noise and air pollution problems at Heathrow airport and the measures proposed to tackle them

Aviation Environment Federation  
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# SUMMARY

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Noise and air pollution pose severe environmental and public health problems at Heathrow and in the surrounding area. Nonetheless, the Government and the aviation industry wish to expand the airport, first by switching to 'mixed mode' operations (that is, ending the practice of runway alternation), and then by the addition of a third runway.

Annual Air Transport Movements (ATMs) are currently capped at 480,000 as a condition attached to planning permission for Terminal 5, due to open in 2008. The airport currently operates close to this limit. Ending runway alternation would mean overturning the planning condition and increasing capacity to 515,000 ATMs, while the addition of a third runway (and with it a sixth terminal) would bring capacity to 655,000 ATMs.

In the Future of Air Transport White Paper, the Government recognised the 'severe environmental disadvantages' of Heathrow and stated that it would only consider permitting expansion if it could be confident that specific targets would be met:

- the 57 dBA Leq contour must not exceed 127 km<sup>2</sup>
- annual mean concentrations of nitrogen dioxide must not exceed 40 µg/m<sup>3</sup>

The Government also re-iterated its guarantee on noise:

- to take all practicable steps to prevent any deterioration in the noise climate at Heathrow, and to continue to do everything practicable to improve it over time.

This report analyses the current levels and trends in noise and air pollution, and presents our assessment of whether the targets could be met in the event of expansion.

## Noise

It is inadequate to rely solely on averaged noise contours, since annoyance – the public's perception of noise – is related to the number of noise events. By this measure, the present steady growth in the number of flights is already causing the noise climate to deteriorate.

The airport might be able to operate in mixed mode without breaching the noise contour target, but this would deprive local residents of cherished quiet periods – undoubtedly a deterioration in the noise climate and therefore a failure to honour the noise guarantee.

Predictions for a third runway show the target being exceeded. BAA plc has said that meeting it 'will be challenging'. We believe it would be impossible in the period to 2030, the lifetime of the White Paper.

## Air Pollution

The airport is already breaching the EU and UK legal limit for nitrogen dioxide and therefore the present steady growth in the number of flights is probably unlawful. To comply with its statutory duties, the Government should restrict the number of flights each year to the level at which it can be confident that air pollution limits will not be breached.

Modelling carried out for the White Paper predicted that expansion without extreme mitigation would expose high numbers of people to illegal levels of nitrogen dioxide. The Government is determined to reassess this work to demonstrate, if at all possible, that expansion can proceed.

All predictions to date showing that air pollution at an expanded Heathrow airport could be successfully mitigated rely on assumptions ranging from the optimistic to the implausible. Any decision that granted permission to expand, based on 'confidence' in such assumptions, would unquestionably be subject to legal challenge.

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# 1. SETTING THE SCENE

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## The options

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Currently there are just over 470,000 Air Transport Movements (ATMs) a year at Heathrow. There are two ways in which the number of flights could be increased: so-called 'mixed-mode' operations, or a third runway.

Introducing mixed-mode operations means ending the current practice of runway alternation, whereby the two existing runways cannot be used for both take-offs and landings simultaneously. It would increase capacity to 515,000 ATMs, and utilising this capacity would mean overturning the 480,000 ATM limit imposed by the Secretary of State when granting planning permission for a fifth terminal.

Since mixed mode requires no additional infrastructure (once Terminal 5 is complete) this option could be realised quite quickly – certainly before 2015. The Government is due to consult on mixed mode shortly.

A short third runway<sup>1</sup> to the north of the existing two, together with a sixth terminal, would bring capacity at the airport to 655,000 ATMs. The Future of Air Transport White Paper stated that this would not be possible before 2015 at the earliest. The Government is due to consult on the third runway by the end of 2006.

## Pressure to expand

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The White Paper made it clear that on purely economic grounds, the expansion of Heathrow would be the Government's first choice for an extra runway in the South East:

Additional capacity at Heathrow would generate the largest direct net economic benefits of any new runway option. And although not easy to quantify with certainty, there is little dispute that the range and

frequency of Heathrow services bring wider benefits to the national economy.<sup>2</sup>

The expansion of Heathrow is also the preferred option of dominant players in the aviation industry. Their lobbying is channelled through the pressure group Future Heathrow, (headed by ex-west London MP Clive Soley, now Lord Soley of Hammersmith), which promotes 'sustainable' development of the airport – by which it means expanding in the ways outlined above. The group echoes the Government's assessment of the economic benefits of expansion but goes even further, presenting the issue as one of national pride:

Expansion of capacity at Heathrow is the only way to secure its internationally competitive future.

Heathrow brings economic benefits to the local area, London, the South-East region and the Nation.

Heathrow is essential for London's future as a world class city and the financial and business centre of Europe.<sup>3</sup>

## Barriers to expansion

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Heathrow is situated within the boundary of Greater London, with residential areas immediately to the north, east and south (and some less concentrated settlements to the west), and is already the busiest international airport in the world. As such, it has enormous adverse impacts on many thousands of people who suffer from noise and air pollution. Below, we outline the 'acceptable' limits for these impacts laid down by the UK Government and the European Commission. Keeping within these limits represents a major challenge for the airport if it is to increase capacity.

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<sup>1</sup> A full-length runway was ruled out before the White Paper on environmental grounds.

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<sup>2</sup> The Future of Air Transport White Paper (henceforth ATWP) 11.50

<sup>3</sup> [www.futureheathrow.org/purpose.htm](http://www.futureheathrow.org/purpose.htm)

Noise has historically been the most contentious issue in the Heathrow area. While the noisiness of individual planes has been substantially reduced since the 1960s, this gain has been offset by the relentless growth in numbers – a plane now lands or takes off every 55 seconds at busy periods.

The chief measure of noise that the Government uses is the Leq contour. Leq stands for 'Level equivalent' and delineates the area where noise, averaged over a 16-hour day, is above a given number of decibels. The crucial contour is the 57 dBA Leq – a threshold of annoyance developed from social surveys in the 1960s and also taken as equivalent to the World Health Organisation threshold for 'serious annoyance'.<sup>4</sup> That said, many complaints come from residents living beyond this contour and we have long argued that 54 dBA is a more appropriate threshold for annoyance.

In 2004 the 57 dBA contour enclosed an area of 117 km<sup>2</sup>, and a population of 240,000. At the inner core were 1,500 people who suffered 32 times as much noise as triggers 'serious annoyance'.<sup>5</sup>

The White Paper reiterated the Government's noise guarantee: to prevent the noise climate from deteriorating and to improve it where possible. A specific target was identified to ensure that this guarantee would be honoured: the size of the 57 dBA Leq contour should not exceed 127 km<sup>2</sup> (its size in 2002).

Chapter 2 assesses the chances of meeting this target with an expanded airport, and goes on to question whether the contour target is in fact adequate to meet the guarantee, given that averaged Leq alone does not provide a full description of the noise climate.

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<sup>4</sup> Guidelines for Community Noise, chapter 4. The WHO threshold is actually 55 dB, which relates to 'freefield' noise; the extra 2 dB is added to account ground reflection, although why reflected noise should be any less annoying is unclear.

<sup>5</sup> That is, within the 72 dB contour. Every 3 dB signifies a doubling of noise energy, although a 10 dB increase is typically stated to be perceived as a doubling of subjective loudness.

Air pollution poses an even more serious challenge to expansion than noise. The limit values laid down by EU Directive<sup>6</sup> are non-negotiable, and are already being exceeded around Heathrow. Values are set for a range of pollutants, measured over several different time spans, but it is the annual mean concentration of nitrogen dioxide (NO<sub>2</sub>) that is being exceeded at the airport and across sizeable areas of Hillingdon and Hounslow, with a high risk of exceedences in Spelthorne.

The UK regulations implementing the Air Quality Directive came into force in 2001 (and were updated in 2003). The limit of 40 microgrammes per cubic metre (µg/m<sup>3</sup>) took immediate effect, although 'margins of tolerance' were also specified. These reduce each year until 2010, when the limit of 40 µg/m<sup>3</sup> will be absolute. So in practice the limit was 54 µg/m<sup>3</sup> in 2003, 52 µg/m<sup>3</sup> in 2004, 50 µg/m<sup>3</sup> in 2005, and so on.

At monitoring sites close to the airport these limits were breached in 2003 and 2004, while the provisional mean concentration for 2005 is equal to the limit for that year. Chapter 5 assesses the implications of breaching the limits.

On the issue of further capacity, the Government's policy is clear:

...another runway at Heathrow could not be considered unless the Government could be confident that levels of all relevant pollutants could be consistently contained within EU limits.<sup>7</sup>

It has long been understood that air pollution would be the crucial barrier to the expansion of Heathrow, and the issue has received a great deal of Government attention.

### Air pollution work to date

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Before the White Paper consultation, the Government commissioned independent modelling of the likely impacts on air quality of a variety of expansion scenarios at Heathrow.

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<sup>6</sup> Directives 96/62/EC and 1999/30/EC  
<sup>7</sup> ATWP 11.54

This work, referred to as 'the SERAS work',<sup>8</sup> predicted that if expansion went ahead without significant mitigation efforts, large numbers of people would be exposed to illegal levels of NO<sub>2</sub> by 2015 – around 20,000 in mixed mode, and around 35,000 if a third runway were added. It was found that by modelling the effects of ever more 'determined action', using assumptions developed in consultation with key players from the aviation industry, this number could be reduced to 5,000.

These figures were put out to consultation and challenged by BAA plc, who carried out their own work, using bolder assumptions about operations and engine technology.

Taking all this into account, the Government produced its own modelling in support of the White Paper, seeking to

move away from the SERAS estimates, which tend to be conservative, toward the "best estimate" value. That implies choosing parameter values that are as likely to be underestimated as overestimated<sup>9</sup>

The work accepted some of BAA plc's assumptions and factored in progressively more vigorous measures to reduce air pollution. Even so, it was found that solving the problem required (amongst other improbable assumptions) an extortionate road access charge, the M4 placed in a tunnel and unrealistically rapid progress on emissions from both road vehicles and aircraft.

A detailed review of these assumptions in the light of progress since 2003 forms the basis of chapter 3.

### Current air pollution work

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The White Paper committed the Government to revisit the question of air quality at Heathrow. Accordingly, the Department for Transport is currently engaged on the Project for the

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<sup>8</sup> Modelling was carried out by AEA Technology with consultants Halcrow Ltd, who reported to South East and East of England Regional Air Services Study (SERAS).

<sup>9</sup> Air Quality Assessments Supporting the Government's White paper "The Future of Air Transport", 6.1.1

Sustainable Development of Heathrow, employing experts from around the country to develop a state-of-the-art model for predicting future levels of air pollution. The project is due to report on its methodology in early 2006, and the model will be used as the basis of revised forecasts to be published at the end of 2006.

### What can we expect?

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Shortly after publication of the White Paper, former Aviation Minister Chris Mullin reflected on his time in office:

I learnt two things. First, that the demands of the aviation industry are insatiable. Second, that successive governments have usually given way to them. Although nowadays the industry pays lip-service to the notion of sustainability, its demands are essentially unchanged. It wants more of everything—airports, runways, terminals.<sup>10</sup>

The amount of public money being spent, the Department's doggedness in seeking 'to enable the addition of a third runway as soon as practicable',<sup>11</sup> the huge industry pressure to expand, even the loaded name of the Project for the Sustainable Development of Heathrow – all go to reinforce the impression that the outcome will be made to fit the desired policy of expansion if at all possible.

### Reality check

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This report is offered as a 'reality check' on the situation at Heathrow. Legal limits of nitrogen dioxide are already being exceeded, and significant numbers of people are being exposed to pollution levels dangerous to their health. As we review the earlier modelling work, we find that all predictions that environmental targets would be met at an expanded airport rely on assumptions about the future ranging from the optimistic to the implausible. Whatever may be published this year to the contrary, we have found no evidence to counter the common-sense assumption that more planes will mean more pollution and more noise.

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<sup>10</sup> "What's on the Horizon?" New Statesman supplement, 15.12.2003

<sup>11</sup> ATWP 11.63

## 2. NOISE

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Although individual aircraft have become significantly quieter since the 1960s (particularly on take-off), these gains have been offset at Heathrow by the relentless growth in the number of flights. Though the contours representing average noise may have shrunk, many residents feel the noise climate has actually deteriorated, highlighting the inadequacy of relying on any single metric.

The Government recognised this fact in the first stage of its consultation for the White Paper in 2000<sup>12</sup>, and at the end of this chapter we argue that average noise contours should be supplemented by additional indicators. We go on to examine the anomalous effect of individual noisy events such as Concorde flights on the size of the average noise contour.

Nonetheless, the Government continues to rely on average noise contours, and the noise target set for Heathrow is measured in this way. Accordingly, we examine the possibility that the airport could be expanded while keeping within the contour limit, and consider the potential of radical new technology to deliver noise reductions of the magnitude required.

### The White Paper

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The White Paper the Government proposed that for Heathrow

any further development could only be considered on the basis that it resulted in no net increase in the total area of the 57dBA noise contour compared with summer 2002, a contour area of 127 sq km.<sup>13</sup>

The forecasts behind the White Paper suggest that by 2015, with a third runway, the area of the 57 Leq contour would be closer to 143 km<sup>2</sup> (see Table 1 below). This challenging discrepancy would have to be avoided by focusing on the promotion of R&D into new technology,

implementing the so-called ‘balanced approach’ to noise management promoted by ICAO<sup>14</sup>, using noise mapping and action plans anticipated under Directive 2002/49/EC, retaining and where necessary increasing central Government regulation, and using economic instruments to encourage quieter aircraft and fund local mitigation and compensation schemes.

We address the degree to which technology may play a role later in this chapter. The ‘balanced approach’, in the context of Heathrow, has its limitations: operational procedures (such as Continuous Descent Approach) have largely been exhausted given the restrictions during peak times, while land-use planning can make a significant difference only via drastic new approaches such as the widespread buying-up and demolition of affected properties.

This leaves operational restrictions. The balanced approach, and its subsequent inclusion in EU Directive 2002/30/EC, requires tailor-made solutions for each airport. We believe that it is unlikely to result in effective measures unless BAA plc or the Government could be assured that Heathrow’s competitors were prepared to introduce measures of a comparable stringency. This applies equally to the powers vested in the Secretary of State for Transport: economic instruments can play a role, but charges and penalties must be set high enough to change the way airlines operate.

On this basis, we believe it will be extremely difficult for the noise contour resulting from a third runway to remain within the contour target set out in the White Paper.

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<sup>12</sup> The Future of Aviation: the Government’s consultation on air transport policy (DETR 2000) para 142

<sup>13</sup> ATWP 11.53

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<sup>14</sup> The International Civil Aviation Organisation



## Underlying assumptions

In the noise modelling carried out for the Government's second stage consultation, the following assumptions were made:

- For future aircraft types, noise performance characteristics were defined using available manufacturers' data and assumptions based on current trends in technology and future international regulations
- Specifically, new aircraft would be designed to achieve a cumulative reduction of 14dB below Chapter 3 permitted noise levels
- For those aircraft types no longer in production in 2000, a retirement profile was produced based on the current age profile of the European fleet; and
- The future fleet profile was reviewed to ensure it included those types more likely to be in general use and more compatible with forecast air services (in practice, this meant assuming shorter-range rather than longer-range variants of some new aircraft types on short-haul routes).

These assumptions were considered reasonable and possibly conservative, although it was acknowledged that to deliver them would require determined action by both Government and the industry.

The assumptions were later revised to take account of the changing regulatory regime and updated fleet mix predictions.<sup>15</sup> The revisions showed that the size of the contour and the number of people affected actually went up (see Table 1).

<sup>15</sup> Updated Methodology and Supplementary Information Relating to Future Aircraft Noise Exposure Estimates at UK Airports, ERCD Report 0307, CAA, Dec. 2003

Table 1: Heathrow in 2015 (655,000 ATMs on 3 runways – original and revised forecasts)

Leq contour	Area sq km revised forecast	Area sq km original forecast	Pop (000s) revised forecast	Pop (000s) original forecast
>54	254.0	250.5	710.6	692.0
>57	143.3	141.3	304.9	295.1
>60	86.3	86.0	141.7	138.0
>63	52.6	51.2	66.9	64.4
>66	29.0	28.4	22.0	21.3
>69	15.2	15.1	5.7	5.5
>72	7.3	6.8	0.6	0.5

Source: CAA, ERCD Report 0308

The main features of the revised contours were:

- Existing noise characteristics and operating procedures based on 2002 measurement and observation data instead of 2000;
- Future aircraft noise performance data revised.

Rather surprisingly, the assumption that all aircraft using Heathrow by 2015 would be at least a cumulative margin of 14 dBA<sup>16</sup> below the ICAO Chapter 3 noise standard remained unchanged – despite the fact that by then ICAO had adopted a stringency of only 10dBA below Chapter 3 as the basis of the new Chapter 4 noise standard (for new aircraft from 2006). The accompanying analysis justified the assumption by arguing that many manufacturers bettered this already, and that airline purchasing requirements for routes to and from Heathrow usually relate to achieving a night rating of Quota Count 2 or below, effectively setting a higher standard than that required by ICAO. While this may have some validity, we believe that its application to all future movements at Heathrow is unrealistic,

<sup>16</sup> Reductions on Chapter standards are, somewhat misleadingly, described in terms of the arithmetical sum of reductions at three entirely separate points – takeoff, sideline, and landing. The reduction perceived by someone on the ground could thus be, say, 3 or 4 dB at one location.

not least because night movements are limited and by no means all airlines or routes require them.

Applying this level of improvement on the ICAO standard does generate some significant differences in the outer contours (Table 2).<sup>17</sup>

Table 2: Heathrow in 2015 (655,000 ATMs on 3 runways – revised central forecasts)

Leq contour	Area sq km assuming 14dB below Chapter 3	Area sq km assuming 10dB below Chapter 3	Pop (000s) assuming 14dB below Chapter 3	Pop (000s) assuming 10dB below Chapter 3
>54	254.0	261.1	710.6	735.0
>57	143.3	146.5	304.9	313.6
>60	86.3	89.7	141.7	146.8
>63	52.6	54.0	66.9	69.5
>66	29.0	29.7	22.0	23.2
>69	15.2	15.9	5.7	5.9
>72	7.3	7.7	0.6	0.7

Source: CAA, ERCD Report 0308

## Future Technology

The industry often points to radical new technology on the horizon that will deliver very substantial future noise reductions. The implication of projects with titles such as the Silent Aircraft Initiative is that at some point in the not-too-distant future aircraft noise will simply cease to be a problem. But if a three-runway airport in 2015 or 2020 is to remain within the Government's contour target for the 57 dBA Leq, substantially quieter aircraft will need to have been on the market for some years. Here we examine whether this is likely.

In 2000, the Advisory Council for Aeronautical Research in Europe (ACARE) published its 2020 vision for the air transport industry<sup>18</sup>. In

<sup>17</sup> Revised Future Aircraft Noise Exposure Estimates for UK Airports, ERCD Report 0308, CAA, Dec 2003

<sup>18</sup> ACARE's brief is to create and maintain a Strategic Research Agenda (SRA). The first SRA was published in October 2002 and included 'Environment' as a top level objective, with SRA2 appearing in October 2004.

relation to aircraft noise, it set itself ambitious goals to reduce perceived noise by 50% by 2020 relative to 2000, and to eliminate significant aircraft noise outside the airport boundary during the same period. In practical terms, this means reducing noise by 10 EPNdB<sup>19</sup> per take-off, and keeping the 65 LDEN<sup>20</sup> contour within the airport boundary.

As mentioned, these goals are aspirational and present significant challenges to manufacturers and the rest of the industry. The earliest implementation date for any of the technologies emerging from this work is likely to be 2010, by which time ACARE hopes to be able to demonstrate a reduction of 5 EPNdB for existing in-production aircraft as well as new designs.

To date, certainly, some progress is being made. Innovations in nacelle and nozzle liner concepts, inlet design and landing gear<sup>21</sup> are all currently being used in flight tests, with a full evaluation scheduled for July 2007. However, there is only limited scope for retro-fitting these technologies to the existing fleet (a new engine would probably be required, making it an expensive option), nor do we believe they will be in production by 2010, especially without any global or regional regulatory or economic drivers, an issue enlarged on below.

The vision for 2020 is less clear still. The interim target is based on making marginal improvements to existing technologies, but achieving the full 10 EPNdB reduction will clearly require a new generation of airframes and engines. Such designs might include over-fuselage wings and engines as well as 'blended-wing' aircraft, a concept not yet far advanced beyond the drawing board.

Few would disagree that ACARE's goals will be tough to meet. In fact they will require a faster rate of technological introduction than over the past 20 years, even though it is generally acknowledged that the current generation of technology now offers diminishing returns.

<sup>19</sup> Effective Perceived Noise (Level) in Decibels

<sup>20</sup> Level Day Evening and Night – a 24 hour Leq with weightings for evening and night periods.

<sup>21</sup> See eg [www.sourdine.org](http://www.sourdine.org)

But the crucial point is that ACARE focuses on what the best new technology can achieve, rather than on what the market is likely to demand. We remain of the view that without regulation or stringent standards, uptake is likely to be slow. Most airlines currently using Heathrow have young fleets and significant early fleet replacement is unlikely without substantial incentives or penalties.

### Mixed mode

Although the idea was not raised in the SERAS consultation, the White Paper opened the prospect of getting maximum capacity from existing infrastructure at Heathrow by allowing mixed-mode operations. A consultation is expected later this year, but noise contours for mixed-mode operations at Heathrow have already been published by the CAA<sup>22</sup>, based on 515,000 annual movements by 2010. Compared to existing operations (albeit for 2015) the number of people affected will increase dramatically.

Table 3: number of people affected by mixed-mode and segregated-mode operations at Heathrow.

Leq contour	>54	>57	>60	>63	>66	>69	>72
2 runways, 480,000 ATMs	436.9	195.5	88.2	41.0	15.4	3.3	0.2
2 runways mixed mode, 515,000 ATMs	590.9	226.0	107.0	54.3	20.3	7.0	1.8

SOURCE: ERCD, CAA

While the 57 Leq contour associated with mixed-mode might remain within the Government's White Paper target (preliminary estimates show it to be 111.7 km<sup>2</sup>, although there are 'a number of caveats'<sup>23</sup>), we believe this in itself demonstrates the limitations of averaged noise contours. Mixed mode would

<sup>22</sup> ERCD Report 0308, as in note above.

<sup>23</sup> As reported at [www.dft.gov.uk/stellent/groups/dft\\_aviation/documents/page/dft\\_aviation\\_610117.hcsp](http://www.dft.gov.uk/stellent/groups/dft_aviation/documents/page/dft_aviation_610117.hcsp)

subject communities to continuous aircraft operations throughout the day, which would undoubtedly increase their annoyance, whatever was indicated by the published contour. The importance attached by residents to the predictable half day's respite from aircraft noise provided by runway alternation cannot be stated strongly enough.

### An increase in noise events

The Government has acknowledged that 'no single metric can capture all the characteristics of noise, nor of the annoyance it causes'.<sup>24</sup> We agree and have long argued that while contours are a useful comparative tool, the reaction to aircraft noise is highly influenced by the number of noise events and other factors. The case touched on above of mixed mode at Heathrow is a good example: despite the slight decrease in averaged noise, huge public opposition would arise because of the more frequent noise events and the loss of cherished quiet periods.

Self-evidently, with 655,000 movements opposition would be even greater. And here we come to the crux: even if the specific target relating to the 57 dB Leq contour were achieved, it can be argued that the noise guarantee it is supposed to deliver would not have been honoured, namely

to take all practicable steps to prevent any deterioration in the noise climate around the airport after the phase out of Chapter 2 aircraft is completed (as it was from 1 April 2002), and to continue efforts to do everything practicable to improve the noise climate over time.<sup>25</sup>

If public annoyance increases, as it undoubtedly would if residents were subjected to mixed mode, then by definition the noise climate has deteriorated, and the Government has failed to honour its guarantee on noise.

<sup>24</sup> Future of Aviation (DETR, 2000) para 142

<sup>25</sup> The Future Development of Air Transport in the UK: South East (DfT 2003) 16.32

## Deterioration

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We now consider the question of whether the noise climate is already deteriorating at Heathrow, as the number of flights continues to increase up to the limit of 480,000 ATMs.

A particular weakness of the Leq system is that it is liable to be distorted by individual noisy events such as Concorde flights, and it should be noted that the contour target stipulated in the White Paper is set with reference to a year when Concorde was still flying. By 2004 Concorde had been retired, with the result that some additional 'head room' became available in the contour target.

The difference Concorde makes can readily be quantified from DfT data:<sup>26</sup> an extra two flights per day extend the area of the 57 dBA Leq by almost 20 km<sup>2</sup>.

Since DfT provide a figure for hypothetical extra Concorde flights, it is equally possible to subtract the effect of these flights and estimate the size of the contour had Concorde not been flying at all. This provides a measure of the performance of the conventional fleet, and a truer indicator of the noise climate.

Table 4: an estimate of noise contours at Heathrow without Concorde

Year	'98	'99	'00	'01	'02	'03	'04
57 dB Leq (km <sup>2</sup> )	125	120	112	115	107	110	116

DERIVED FROM: DfT noise contours

These figures are approximate, but they are sufficient to illustrate a trend: while the impact of growing numbers of aircraft movements was successfully offset by a hard-and-fast operational restriction (the phase-out of chapter 2 aircraft by 2002), once this was complete the contour began to expand again in line with ATMs – in other words the on-going

replacement of aircraft at the margins of the fleet is not enough to offset the effects of growth. What is more, no further phase-out is in prospect: ICAO failed in 2001 to agree on a phase-out of the noisiest Chapter 3 aircraft, and the issue has not been raised since.

So once the anomalous effect of Concorde has been set aside, it can be seen that the noise climate, even as measured by the Government's preferred metric of averaged noise contours, is deteriorating, and the Government has failed to honour its guarantee on noise.

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<sup>26</sup> All Concorde were grounded following a crash in Paris in July 2000. Only test flights occurred in 2001; there were limited commercial flights in 2002 and 2003 but by 2004 the aircraft had been retired. For each of these years a hypothetical contour with 1999 levels of Concorde flights was also published.

### 3. AIR POLLUTION

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The modelling carried out at the Department for Transport and published in support of The Future of Aviation White Paper was aimed at assessing how or whether the air quality problem could be 'solved' at Heathrow.

'Solving' the air quality problem means complying with EU Framework and Daughter Directives on Air Quality<sup>27</sup>, transposed into UK legislation as the Air Quality Regulations 2003. These lay down hard-and-fast limits for concentrations of given pollutants, which are enforceable immediately – although a decreasing amount of leeway is permitted each year until 2010, after which point there are no further margins of tolerance. The implications of breaching these regulations are explored further in chapter 5.

The problem at Heathrow is that the annual mean concentration of nitrogen dioxide has remained substantially and stubbornly above the level that will be permitted by 2010.

To approve expansion of the airport, it would be necessary to show that concentrations of NO<sub>2</sub> will not only fall below the legal limit of 40 µg/m<sup>3</sup> but remain below that level despite the addition of more planes and the associated road traffic.

This was the possibility explored in the air quality assessment supporting the White paper. Firstly, a number of basic assumptions from the earlier SERAS modelling that were considered conservative were revised to what were described as 'best estimates'. Secondly, a number of putative and increasingly aggressive mitigation measures were modelled, to assess what level of intervention might be required to achieve the desired level of air pollution.

In this chapter we examine some of the assumptions to see whether they do indeed represent 'best estimates', and investigate

whether the mitigation measures are plausible in the light of developments since 2003. In advance of the work currently in train at the DfT, this chapter aims to provide a 'reality check' on the air quality situation at Heathrow.

Note: in the following discussion numbers in square brackets refer to sections of the document 'Air Quality Assessments supporting the White Paper The Future of Air Transport' (DfT 2003).

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#### Basic assumptions

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Fleet performance: Best estimate case taking the Heathrow fleet expected at 2015 and yielding a fleet mean NO<sub>x</sub> performance equivalent to CAEP/4-28%. [4.2.4]

CAEP/4<sup>28</sup> was the current ICAO NO<sub>x</sub> standard for new planes in 2003, and the assumption here is that by 2015 the Heathrow fleet would be outperforming this standard by 28%, although some model runs go even further and examine the effect of a fleet achieving CAEP/4 -31, -34 or even -40%. Shortly afterwards at CAEP/6, the next standard was agreed: a disappointing 12% reduction on CAEP/4. Negotiations on a new stringency will not start until CAEP/8 in 2010 at the earliest and there is little chance that any new standard will come into force before 2015 at the earliest.

Since regulation alone cannot drive the assumed improvement, it will have to be encouraged by other means such as economic instruments. These can have an impact, but will need to give a clearer signal than the current revenue-neutral NO<sub>x</sub>-related landing

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<sup>27</sup> Directives 96/62/EC and 1999/30/EC

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<sup>28</sup> The Committee on Aviation Environmental Protection is an arm ICAO. Its work includes setting standards for emissions and noise that are binding on the global aircraft fleet.

charge at Heathrow. Although only recently introduced, there is no indication that this is exerting significant leverage over the Heathrow fleet.

It is important to remember that a CAEP NOx standard is not a single figure, but a continuous range of values that covers engines operating at all possible pressure ratios. Newer engines tend to operate at higher by-pass ratios than earlier-generation engines of comparable size, since this offers greater fuel efficiency, but it also generates higher NOx emissions per unit of fuel. The financial incentives to improve fuel burn are many times greater than those to improve NOx performance, a theme discussed in more detail in chapter 4.

Furthermore, BAA plc's published strategy for continuing to increase passenger numbers within the current limit of 480,000 ATMs relies heavily on ever-larger planes, which have larger, higher-pressure engines. To cap it all, it is the higher-pressure engines which according to QinetiQ forecasts have the least potential for improvement against their CAEP benchmark [8.1.2]

All in all, the picture for the immediate future at Heathrow is one of a stable number of larger, newer planes emitting far more NOx than before.

As a postscript, we note that DfT appear to have been using ICAO's 'average' values for engine emissions rather than the 'characteristic' values. The latter are adjusted for the likelihood that the certified emissions factors will be achieved in practice. Accordingly, it was admitted that the figures used 'may represent an underestimate of actual NOx emissions of up to 13%' [4.2.5]. We hope that this substantial discrepancy will be addressed by the Project for the Sustainable Development of Heathrow.

**New road emission factors:** These factors account for Euro IV standards for all vehicle types that will take effect in 2005/6 and for Euro V standards for heavy-duty engines that will take effect in 2008. [4.3.2]

Recent research has shown that manufacturers of diesel cars have responded to the Euro exhaust standards by optimising engines' NOx performance for the particular test cycle stipulated by the regulations. When emissions are measured for a typical real-world driving cycle, however, NOx emissions are far greater than for the rated performance, which is the level assumed by the modelling: 50% more for Euro 2 (new cars from 1996), 100% more for Euro 3 (new cars since 2000), and 150% more for the current generation of Euro 4 cars.<sup>29</sup>

Moreover, sales of diesel cars are booming in the UK, helped by high fuel prices and a new 3% tax incentive for company cars, which represent the biggest growth area (and are not inconceivably being bought and driven to the airport by the executive business travellers who account for 40% of Heathrow's passengers).

Pre-Conditioned Air (PCA) on all stands; 30% reduction in aircraft average holding time

These assumptions were made by BAA plc in their submission to the White Paper consultation and accepted uncritically by DfT.

No data were available to quantify progress on holding times (which anyway account for at most 3% of aircraft NOx), but progress with PCA<sup>30</sup> has not been smooth, as reported on BAA's website:

The PCA trial was completed this year [2005], despite a number of set-backs, which resulted in a change of supplier. This highlighted the need to have a robust maintenance and fault support process in place. A trial report has been produced, highlighting the operational challenges that face the airport and agreement has been reached through the Heathrow

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<sup>29</sup> 'Emissions levels of diesel cars, Euro1-4' Institut für Verbrennungskraftmaschinen und Thermodynamik, Austria 2006

<sup>30</sup> Between flights aircraft need to maintain a temperature in the cabin that will be comfortable to boarding passengers. By default they run auxiliary units to power their own air conditioning; PCA is an alternative offered by the airport operator.

sustainability board to fit PCA to all stands for new generation large aircraft, up to 2007.<sup>31</sup>

Thus there are plans only to fit PCA to new A380 stands, and it seems it will be far harder to make the economic case for retro-fitting old stands. If this policy is maintained to 2015, PCA will be available on less than a fifth of all stands at the airport. Getting airlines to use it is another problem again: evidence from other airports has shown that airlines are reluctant to switch to PCA unless specific regulation requires it (as at Copenhagen).

### 20% reduction in airport-related landside vehicle emissions

Again, this assumption was taken from work carried out by BAA plc, and for the first four sensitivity tests was applied unquestioningly (or, as the supporting documentation puts it, 'unallocated or justified by specific measures').

For test b5, the assumption was reviewed, in order to

- Identify specific measures which would in total provide/justify the 20% figure, and/or
- Indicate that it might be reasonable to increase the percentage reduction. [8.2.1.2]

(Note the pre-determination implicit in the phrase 'indicate that', rather than 'indicate whether'...)

A number of measures were duly examined, but by the time their effectiveness came to be weighed, the basic task of validating the 20% reduction had been lost in the drive to show that a greater reduction could be justified. When the measures turned out to provide less than the 20% reduction, the idea of improving upon it was shelved, but the 20% figure itself was retained – and presented as a conservative assumption:

The key question was whether the measures proposed would actually result in a greater improvement than the global reduction of 20% in airport-related

landside vehicle emissions already in completed sensitivity tests (b1 – b4). Incorporating both the 15-20% decrease in total airport-related road vehicle trips and a speed limit of 40mph (see 8.2.3 below), the net change in emissions on the M4 would be less than 15%. This is less than the global reduction of 20%. Away from the M4, the global reduction of 20% in emissions is clearly greater than a 20% reduction in trips. On this basis, the global reduction of 20% in airport-related landside vehicle emissions was retained in b5. [8.2.2.2]

Sensitivity tests carried out with the revised assumptions above, which we consider optimistic, still showed high numbers of people exposed to illegal and dangerous levels of nitrogen dioxide – in the order of 10,000 for a 3-runway airport. Even for an unexpanded airport, with ATMs capped at 480,000, there were still in the region of 5,000 people exposed.

### Further mitigation measures

50% reduction in airside emissions: This was assumed to arise from managed changes to the fleet of vehicles and plant operating airside (such as introduction of electric vehicles). There is some uncertainty in how or whether such a reduction could be achieved and it may be considered that this is an optimistic assumption. [8.3.2]

DfT was right to add these words of caution. There has been little progress as of 2005:

The number of alternatively fuelled vehicles in the BAA Heathrow fleet has increased from 24% to 28%, which falls short of the target of 40%. The prime reason for this has been difficulties experienced with the liquid petroleum gas (LPG) technology, resulting in vehicle breakdowns and reliability issues. In order to address this, we have set up a five-year programme to develop the appropriate infrastructure to support electric vehicles.<sup>32</sup>

The NOx performance of LPG vehicles generally lies somewhere between petrol and

<sup>31</sup> <http://tinyurl.com/gbvy5>

<sup>32</sup> <http://tinyurl.com/gbvy5>

diesel engines, so they are not a radically clean technology, and while electric vehicles, if introduced, would have lower emissions, it should be remembered that Heathrow generates much of its electricity onsite via gas-fired plant, itself a contributor to NOx emissions. Increased electricity consumption would inevitably increase the emissions from this source, particularly since BAA plc are naturally optimising their power generation for CO<sub>2</sub> emissions, not local air pollutants, an issue discussed further in chapter 4).

### 23% reduction in employee-related vehicle trips

This assumption is based on 70% of employees arriving at the airport by car with an average occupancy of 1.25 [8.4.2]. Single-occupancy vehicle trips must therefore drop to 56%.

Between 1999 and 2004 (when the 'Travel to Work' scheme was in operation, encouraging carsharing), single-occupancy staff trips actually rose slightly, from 71.5% to 72.1%. The target set out in BAA Travel Plan 2004-7 is to reduce them by 1% a year up to 2008. Even if the current trend can be bucked and the target met every year up to 2015, there would still be more than 60% of staff driving alone to the airport.

Alternatively – for 70% of staff to access the airport by car at an occupancy rate of 1.25, 14% of all staff must be passengers in a carshare scheme – a total of 8,400 if employment shrinks as predicted to 60,000 in 2015. Currently there are around 3000 active members, and again, BAA's target is to increase these by 1% a year to 2008. Even if this level of uptake is sustained to 2015, it will still leave fewer than 3,500 car-sharers – well under half of those assumed in the modelling.

Furthermore, an 'active' car-sharer is defined as one who shares 'at least 3 days a week'. To have the desired effect on overall staff trips, the numbers in the scheme would have to be even higher. In short, this assumption is implausible.

Airport-related traffic scaled down from a £20 airport access charge; no growth in non-airport related traffic on the M4 and M4 spur over current levels.

Originally, an access charge of £10 was identified as 'plausible' [8.4.3.3]. The increased access charge of £20 is a proxy for a road charging scheme, which is also assumed to freeze growth on the M4 [8.4.4.2] at 1997 levels (not 'current' levels as in the tabulated assumptions). It is hard to see how a measure likely to be introduced a decade into the 21<sup>st</sup> century could freeze growth at 1997 levels.

In 2004 the Government announced that a national road-charging scheme was 'at least ten years away'.<sup>33</sup> While local pilot schemes are envisaged sooner, these are mainly in the West Midlands, and there are no plans for an early west London scheme. Moreover, the main source of finance for road user charging, the Transport Innovation Fund, was in February 2006 split in two – with the bulk going to fund 'productivity' projects (infrastructure). These should include public transport projects such as Crossrail, but road-building equally falls within the definition of 'productivity', and as money is diverted from road charging it becomes less certain that it will play a large part in improving air quality at Heathrow. How mitigation measures might be funded is considered further in chapter 4.

Finally, it would be unwise to underestimate the pressure from the motoring lobby, who insist that any road charging scheme should be revenue-neutral. Such a system would be unlikely to have a dramatic effect on congestion or emissions.

Reallocate all westerly departures from northern runway to southern runway, all westerly arrivals on the northern runway

The Government is due to consult later this year on proposals to end runway alternation,

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<sup>33</sup> Feasibility Study of Road Pricing in the UK – Summary (DfT 2004) para 24.



which currently provides those under the flight path with some measure of relief. It seems likely that the enormous local opposition to any such change will be formally articulated in response.

In the simple reallocation considered at first, levels of exposure actually went up in the Hatton Cross area [8.4.6.1]. To compensate, a complex staggered take-off procedure was introduced, which increased the size of the 57 dBA Leq contour to the west. This illustrates the difficulty of simultaneously mitigating very different environmental impacts, an issue considered further in chapter 4. Since BAA plc has admitted it will be challenging to meet the noise contour target with an expanded airport, it is very unlikely that they would be able to implement this measure.

Sensitivity tests carried out with these additional mitigation measures, which we consider implausible, still showed significant numbers of people exposed to illegal and dangerous levels of nitrogen dioxide – in the order of 1,500 to 4000 for a 3-runway airport. Even for an unexpanded airport, with ATMs capped at 480,000, there were around 1,000 people exposed. Tellingly, a test was also carried out for 515,000 ATMs on the existing runways, with a more realistic improvement in NOx performance: CAEP/4 -15% by 2010. It showed almost 23,000 people exposed to unacceptable levels of pollution.

#### Last-ditch efforts

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Finally, two scenarios were considered for 550,000 ATMs on three runways, with different measures to mitigate NOx from road traffic.

The introduction of rigorous Euro V/VI exhaust emission standards for road traffic: the effective change in emission rates from the introduction of Euro V (and Euro VI for HDV) and the associated changes in fleet make up, result in a reduction in road traffic emissions of 41%. [7.6.4]

There has been a great deal of wrangling and political backsliding since 2003 over the agreement of Euro V and VI exhaust standards. By the end of 2005 there was a Euro V proposal for a 20% reduction from diesel cars and a draft proposal for a 25% reduction from petrol cars, with proposals for Euro VI standards for heavy vehicles yet further off). These standards will enter into force by mid-2008 at the earliest, and there is a further 3 years before all new cars must conform.<sup>34</sup>

Currently around 8% of the UK fleet is replaced each year. Even with the optimistic assumptions that all new cars sold from 2010 will conform to the Euro V standards, and traffic in the area will not grow, the total reduction in road NOx is still only around half of the 41% assumed here. The discrepancy between the rated and actual performance of diesel engines has been discussed above, and is likely to further reduce any improvement.

The sensitivity test carried out with this over-optimistic assumption still left 450 people exposed to dangerous levels of nitrogen dioxide.

#### Zero emissions for M4 between M25 and Cranford

Achieving this would mean placing the M4 and the spur in a tunnel with vent stacks which have scrubbers 100% effective at removing NOx. In the absence of clarification we take this option to be hypothetical and prohibitively expensive, particularly once the disruption to traffic is factored in. Furthermore, the technology to scrub 100% of NOx from vent stacks does not exist and would not come into existence unless custom-developed for this project.

This option, probably only hypothetical, was the only one that delivered the desired result – a negligible number of people (16) exposed to dangerous levels of nitrogen dioxide.

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<sup>34</sup> Although new-type approvals have a shorter implementation period of 18 months.

## 4. FURTHER UNCERTAINTY

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In this chapter we consider other factors that cast doubt on whether the measures required to solve the air quality problem at Heathrow could ever be delivered in practice. These factors are grouped under two headings: trade-offs, where we note how other environmental imperatives constrain the industry's ability to cut down on NO<sub>x</sub>, and other stakeholders, where we consider the wide range of actors who must deliver substantial reductions if the targets are to be met. All other actors naturally have their own constraints, financial and operational, as well as their own priorities, which do not necessarily match those of BAA plc. Finally we consider the difficulty of guaranteeing funding for the numerous necessary measures.

### Trade-offs

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A number of trade-offs have been identified in previous chapters. Here we discuss them in more depth.

Engine CO<sub>2</sub> vs NO<sub>x</sub>: jet engines operating at higher by-pass ratios burn less fuel and therefore emit less carbon, but they also produce more NO<sub>x</sub>. Financial imperatives to cut fuel burn are many times greater than those to cut NO<sub>x</sub>: fuel accounts for around 15% of global industry costs (and this figure is likely to rise if high oil prices are sustained), whereas NO<sub>x</sub> charges, and revenue-neutral ones at that, are in force at only a handful of European airports. Considering also the likelihood of an Emissions Trading Scheme in Europe that will penalise only carbon emissions, it is clear that the price signal that filters through to manufacturers is overwhelmingly in the direction of optimising engines for CO<sub>2</sub> performance.

The CAEP/6 standard for Landing and Take-Off NO<sub>x</sub> will work as a cap on the trend towards higher NO<sub>x</sub> emissions, but all compliant scenarios assume deep cuts beyond the standard, for which there is precious little fiscal incentive.

Power plant CO<sub>2</sub> vs NO<sub>x</sub>: Heathrow consumes a huge amount of power, largely provided by on-site gas-fired plants. Faced with carbon-penalising policies such as the Climate Change Levy, it has an incentive to reduce CO<sub>2</sub> from power generation, and has invested in Combined Heat and Power units which are better for the climate, but certainly not optimised for NO<sub>x</sub>. Even the claim that they are better than the inefficient old plant is not made convincingly:

It is often difficult to attain a win-win situation when trying to achieve a balance between different impacts, however we believe that an efficient CHP will also reduce our local emissions, by off-setting emissions from smaller less efficient boilers.<sup>35</sup>

Aircraft Noise vs NO<sub>x</sub>: it is well-documented that the Airbus A380, expected to play an increasingly important role at Heathrow, burns 2% more fuel, and therefore emits more NO<sub>x</sub> than it would need to, unless it had to achieve a given Quota Count rating to enable night operations at the airport.

This might appear to contradict the assertion above that a measure at a single airport cannot influence manufacturers' behaviour. But there is a difference between a financial incentive (provided, weakly in this case, by NO<sub>x</sub> charges) and an outright ban. It was the prospect of being prohibited from operating at the airport at night that led airlines to ask Airbus to alter the A380.<sup>36</sup> Certainly, if BAA plc were prepared to ban all aircraft from Heathrow that did not meet the required NO<sub>x</sub> stringency, it would create a powerful incentive. But it is hard to imagine them excluding half of their customers, and there may well be legal constraints on such a move.

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<sup>35</sup> BAA Heathrow, Air Quality Strategy and Action plan 2001-2006, 4.7.2

<sup>36</sup> Longer nacelles were introduced and the fan size was increased, reducing noise but creating more drag.

## Other stakeholders

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BAA plc has a huge vested interest in the expansion of Heathrow. It has spent, and continues to spend, a great deal of money designing and implementing schemes to reduce air pollution at and around the airport.

BAA plc are at the epicentre of the problem, but 'BAA Heathrow itself has direct control over only a limited number of airport emissions'.<sup>37</sup> Spiralling out from BAA are a host of other stakeholders – corporate, governmental and quasi-governmental – whose actions and policies affect local air quality but whose interest in the expansion of the airport becomes weaker as distance from BAA increases. Some are actively opposed to expansion, and yet have the task of implementing the policies necessary to facilitate it. Starting from the centre and working outwards, we examine some of these actors, and suggest that it is far from certain that they will all play their parts in the way that optimistic forecasts assume.

Even though other businesses based at Heathrow have a vested interest in expansion, they have been slower than BAA would have liked to implement measures such as Staff Travel Plans – for instance only 10 companies, representing just over half of all airport employees, were signed up to the scheme by 2005.<sup>38</sup> This lack of direct control is one reason why progress has been so slow in this area.

Aircraft operators obviously have an interest in expansion, but not at any price, and their highly-competitive business environment means that any mitigation measure that increases costs is an uncertain proposition. This is particularly significant with regard to purchasing the cleanest aircraft – both a major financial outlay and a major factor in the air quality equation.

The Local Authorities of Hounslow and Hillingdon are in a difficult position. They are

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<sup>37</sup> BAA PLC Heathrow, Air Quality Strategy and Action plan 2001-2006, 3.4.8

<sup>38</sup> <http://tinyurl.com/gme66>

strongly committed (not least for the sake of their residents' health) to bringing air pollution within the limits, but are concerned that any reduction they achieve will be used up by the Government in permitting expansion of the airport – an outcome they are united in opposing.

The problem is sharpened by difficulties over funding. As is clear from Hillingdon's first progress report on their Air Quality Action Plan, money is not automatically available:

Air quality problems in Hillingdon will not be solved without serious action to deal with emissions from traffic. The funding application [...] is thus extremely important. In the event that the application is not successful the action plan would need to be substantially revised. That said, the funding identified in the draft Local Implementation Plan is insufficient to fully implement the plan.<sup>39</sup>

There is uncertainty at every level: there can be no guarantee that the plan if fully implemented would bring air quality within the legal limits; funding for full implementation has not yet been identified; what funding has been identified cannot be guaranteed, and so on.

The Boroughs as well as the airport are of course reliant on actors with a wider remit. The policies of Transport for London have an impact on air quality, but these are determined ultimately from the Mayor's office and although the Mayor has proposed some bold mitigation measures<sup>40</sup> he has also publicly declared his opposition to the third runway<sup>41</sup>. Setting aside the question of political backing, TfL has its own commercial constraints which will not always tally with the needs of the airport. The following, frustrated comment from BAA provides an illustration:

The start times of public transport services are a key determinant for airport staff who work shift patterns outside of normal office hours. The recent TfL

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<sup>39</sup> [www.hillingdon-air.info/pdf/ProgressReport2005.pdf](http://www.hillingdon-air.info/pdf/ProgressReport2005.pdf), p.14

<sup>40</sup> For instance designating Greater London a Low Emission Zone – see [www.tfl.gov.uk/tfl/low-emission-zone/default.asp](http://www.tfl.gov.uk/tfl/low-emission-zone/default.asp)

<sup>41</sup> <http://mqt.london.gov.uk//public/question.do?id=13176>

proposal to begin London Underground operations an hour later in the morning and cancel early morning trains at the weekend will damage our efforts to encourage more staff to use public transport.<sup>42</sup>

Although this proposal may yet be shelved, it illustrates the difficulty inherent in relying on a third party to deliver reductions.

Further key stakeholders are the Highways Agency, a major public body with a remit to improve the strategic road network of England, and Network Rail, with an equivalent remit for the railways across the whole of Britain. As we saw in chapter 3, several of the mitigation options require quite dramatic intervention from these bodies. But they have no particular interest in facilitating the expansion, nor can they be expected to allocate a disproportionate amount of public money to such projects, given the breadth of their responsibilities.

Finally, it is worth touching on the possible attitude of the general public. While some sections of the population, away from the immediate impacts and forever reminded of the benefit to the Nation, may support expansion in a generalised way, they are unlikely to tolerate being asked to pay for it. This was evident from the reaction of the powerful motoring lobby to leaked proposals for an M4 congestion charge – they condemned any scheme that would hit non-airport motorists. All motorists in the area contribute to the problem irrespective of their purpose, but it will be politically difficult to charge them all in the interests of the airport.

## Funding

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No mechanism has yet been defined by the Department for Transport for delivering the numerous measures that would be necessary to bring air pollution within legal limits. The question of how they might be funded is of particular concern, not just to environmental groups but to the industry, who need to know well in advance what demands will be made on their finances.

The only answer that DfT can give as yet is that each measure will be subjected to a cost-benefit analysis. This of course necessitates an estimate of the benefit as well as the cost, but since, as the White Paper stated, the total benefit of expansion is ‘not easy to quantify with certainty’,<sup>43</sup> it is hard to see how these decisions could be taken on a robust basis.

We would be extremely concerned if the Government were to grant permission for the expansion of Heathrow before it had published full costing of each and every measure necessary to mitigate the air pollution problem, together with a guaranteed strategy for funding the package. Without this preliminary work, it would be meaningless for the Government to assert that it is ‘confident’ that air pollution targets would be met in the event of expansion.

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<sup>42</sup> Heathrow Draft Interim Master Plan 8.24

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<sup>43</sup> ATWP 11.50

## 5. LEGAL QUESTIONS

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The airport is already breaching the EU and UK legal limit for nitrogen dioxide; we argue here that this makes the present steady growth of the airport unlawful, even before further expansion is considered. To comply with its statutory duties, the Government should restrict the number of flights each year to the level at which it can be confident that air pollution limits will not be breached.

In addition, there is significant uncertainty surrounding almost every factor involved in predicting future air quality at Heathrow. Relying on any such predictions to sanction any expansion of the airport would be an irresponsible use of the science. If the predictions turned out to be wrong, it would also be unlawful.

### Uncertainty in assumptions

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Everyone agrees that a wide range of stakeholders will have to make deep cuts in emissions if air quality targets are to be met at an expanded Heathrow:

The solution is not something that can be delivered by the aviation sector alone and is likely to necessitate other stakeholders playing their part in delivering air quality improvements. Some of the measures that may be necessary may be radical and have a long lead time before the benefit can be realised.<sup>44</sup>

This report has shown that meeting the targets relies on highly uncertain assumptions about:

- factors under the industry's control (such as aircraft emissions)
- factors partially within their remit (such as public transport)
- factors beyond their control (such as road vehicle emissions)

We believe that for the greater part of these assumptions, not only is delivery uncertain, but

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<sup>44</sup> Heathrow Draft Interim Master Plan 9.29

is more likely to fail than to succeed. The chance of all assumptions being turned into realities – as would be required for airport expansion to be legal – is close to zero.

### Uncertainty in modelling

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In addition to the uncertainty surrounding the assumptions made about future levels of NO<sub>x</sub> emissions, there is uncertainty in modelling how these emissions will be converted to concentrations of NO<sub>2</sub>. This is not controversial:

In order to predict future impacts, assessments must utilise modelling or forecasting techniques [...] Such methods are far from precise<sup>45</sup>

The Project for the Sustainable Development of Heathrow is currently developing a state-of-the-art model for predicting air quality. There is no reason to question the quality or integrity of this work, but uncertainty is inherent in all predictive tools and is compounded as the number of variables increases. We assume that uncertainty ranges will be included in the documentation of the modelling methodology, although the Department for Transport have recently indicated that the level of uncertainty is in itself uncertain.

### The legal situation

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By way of conclusion, we examine the legal implications in the case that air quality limit values are breached.

Today: limit values for nitrogen dioxide came into force in the UK in 2001 and were updated in 2003.<sup>46</sup> The value for 2003 was 54 microgrammes per cubic metre (µg/m<sup>3</sup>), reducing by 2 microgrammes each subsequent year until in 2010 it reaches the permanent

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<sup>45</sup> Heathrow Draft Interim Master Plan 9.25

<sup>46</sup> The Air Quality Limit Values Regulations, Defra 2001, Part II, Section 2.1

limit of 40 µg/m<sup>3</sup> – the level determined by the European Commission as minimising the risk to human health.

The limit has been widely misrepresented as ‘coming into force in 2010’, when in fact the Air Quality Regulations are unambiguous – there has been a binding limit since 2001; it is simply one that reduces annually until 2010.

The annual means measured at Heathrow in 2003 and 2004 were 59µg and 55µg respectively, according to BAA plc’s own measurements<sup>47</sup> (or 58µg and 55µg according to the independent London Air Quality Network). It is incontrovertible, therefore, that there was a breach of the limit values in those years.<sup>48</sup> The Regulations go on to state that where there are exceedences,

the Secretary of State shall draw up for each zone [...] a plan or programme for attaining the limit values for the pollutants in question within the time limits specified [...] and shall ensure that the plan or programme is implemented.<sup>49</sup>

While plans have been drawn up by local authorities to mitigate the problem, the airport, which is beyond their control, has been allowed to continue growing – so for instance in 2004 there were 13,000 more flights than in 2003. This hardly seems consistent with the statutory duty to

take the measures necessary to ensure that [...] concentrations of relevant pollutants[...] do not exceed the limit values.<sup>50</sup>

The difficulty is obviously that the consolidated annual mean cannot be known until some time into the following year, by which time any mitigating action will be impossible. This does not mean, however, that the limit values should be ignored until 2010.

The EU limit values are non-negotiable; unlike much environmental legislation they are not

open to counter arguments about economic interest, since these factors were accounted for in the original legislation.

This being the case, the only lawful policy would be for the Government each year to restrict the number of movements at the airport to the level at which it can be certain that the limit value for the year will not be exceeded.

To 2010... As discussed above, limit values are currently being exceeded at the airport. Several of the scenarios modelled using ‘pessimistic’ (realistic?) assumptions suggest that by 2010, when the final limit value comes into force, the airport will be in breach even if still operating under its current cap of 480,000 ATMs. This is supported by recent measured trends: concentrations of NO<sub>2</sub> were 55µg/m<sup>3</sup> in 2000, and they were 55µg/m<sup>3</sup> in 2004, after four years of mitigating effort.

Again, we question whether allowing the airport to expand up to the 480,000 cap, and to grow its passenger numbers within that cap by using larger aircraft which emit more NO<sub>x</sub> – as envisaged in the Draft Interim Master Plan for Heathrow – is consistent with the duty to ensure that concentrations do not exceed the limit values. Again, we recommend a precautionary approach which would involve restricting movements to ensure compliance.

... and beyond: as an action likely to lead to a breach of air pollution levels, allowing the airport to grow within its existing limits pales in comparison to permitting expansion, either by allowing mixed-mode operations or sanctioning a third runway.

The Government of course recognises this, as was stated in both the consultation and final text of the White Paper:

another runway at Heathrow could not be considered unless the Government could be confident that levels

<sup>47</sup> As reported at <http://tinyurl.com/gbvy5>

<sup>48</sup> The provisional figure reported for 2005 was 50 µg/m<sup>3</sup>, which if confirmed would be equal to the limit value for that year.

<sup>49</sup> Air Quality Regulations 2003 11.3.3

<sup>50</sup> Air Quality Regulations 2003 4.1

of all relevant pollutants could be consistently contained within EU limits<sup>51</sup>

We hold it to be self-evident that the Government could never be confident of a future outcome that is dependent on such a wide range of uncertain variables.

Predicting air quality involves using an imprecise instrument, fed with data describing conditions five, ten and even fifteen years into the future – data which rely on huge but as yet nebulous changes of policy and technology to turn them into reality.

It is absurd to claim that anyone could be confident that the output of a complex model will describe the real situation in 2010, 2015 or 2020 to within a few microgrammes per cubic metre.

To use this false confidence to justify a substantial new source of emissions would be grossly irresponsible and, we believe, unlawful. The only lawful way to proceed with expansion would be first to bring pollution levels within legal limits, and then to consider the impacts of further capacity using reliable current data.

In support of our arguments, we commissioned a preliminary counsel from a barrister with long experience of environmental legislation. He advised us that:

it would be possible to bring action in the UK to secure compliance with the implementing regulations. That action is likely to be in the form of a judicial review challenge to (for example) a failure to put in place or implement a plan as required by the regulations; or – more sharply – a failure to take specific action to secure compliance with the hard pollution thresholds set in the regulations; or – possibly – a challenge to (for example) the granting of consent for a project which is predicted to lead to exceedences of thresholds.

The European Courts are becoming receptive to the argument that a precautionary approach should be applied to the evaluation of future environmental

effect [...] I can see arguments for taking a “precautionary approach” in the context of modelling and predictions. I do not consider that a development could be permitted where exceedences were predicted and there was reliance on the hope that (for example) unknown technological changes would remove the exceedences over time.

### The prospects for action

The UK Air Quality Regulations implement EU Directives,<sup>52</sup> so any breach of the limit values would be a breach of European as well as national law. Although responsibility for Air Quality Action Plans (the Government’s chief strategy for reducing pollutions where limits have already been exceeded) is devolved to local council level, any breach is ultimately the responsibility of the Secretary of State whose actions led to that breach. A third runway at Heathrow could only be built with permission from central Government, so it would be liable for any breaches that ensued.

The European Commission has recently shown that it is willing to take on the UK government over environmental issues, as demonstrated by the on-going legal wrangling over the UK’s revised National Allocation Plan.

It would also be open to private citizens or public interest groups to sue the Government. Feelings run high over Heathrow, and if the residents of West London felt that once again their concerns were being sidelined in the drive to expand the airport, there is little doubt that the Government would find its policy being tested in the courts.

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<sup>51</sup> ATWP 11.54; The Future Development of Air Transport in the United Kingdom: South East 16.30

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<sup>52</sup> Directives 96/62/EC and 1999/30/EC

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