

Airports Commission: Interim Report

December 2013



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Airports Commission
6th Floor Sanctuary Buildings
20 Great Smith Street
London SW1P 3BT

Web: www.gov.uk/government/organisations/airports-commission

Email: airports.enquiries@airports.gsi.gov.uk

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¹ The suite of supporting documentation underpinning Chapters is available on the website, <https://www.gov.uk/government/organisations/airports-commission>

Chair's foreword

When the Airports Commission membership was announced in November last year, my colleagues and I received more commiserations than congratulations. Few commentators failed to point out that ours was the latest in a long series of so far largely fruitless attempts to grapple with the problem of airport capacity in a densely populated island.

A few supportive voices noted that the problem nonetheless needed to be solved, more particularly at a time when, in the aftermath of the financial crisis, the country was thinking hard about its place in the world. While that process of rethinking has not concluded, there is a broad consensus that the UK must further develop its links with the fastest growing regions of the world. Whether that involves growth in exports of goods and services or of inbound tourists and students, aviation connectivity seems likely to be an important element in the mix. And around 60 million Britons travel abroad each year, the great majority by air.

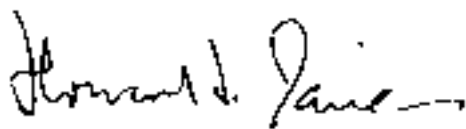
So the economic imperative to resolve the problem is strengthening by the year, but there is also a growing realisation that the expansion of aviation must be set in the context of a comprehensive approach to the challenge of climate change. As the other sectors of the economy decarbonise more rapidly, aviation emissions will become a larger proportion of the total. And local environmental impacts, notably the nuisance and health implications of noise, must be weighed in the balance.

My colleagues and I are not naïve enough to think that the analysis in this report will miraculously deliver a consensus on the way forward. But we hope that the many people who have responded to our consultations – and we are grateful to all of them – will accept that we have made an effort to grapple with the conflicting points of view and to produce reasonable responses to their points.

We hope we have clarified the arguments, updated earlier analysis, assessed the way the aviation world is changing and identified a realistic set of options for future expansion. We were conscious of the importance of avoiding unnecessary costs and anxiety for communities across the South East, unless we saw a credible case for a commercially viable and sustainable development at a proposed site.

Speaking personally I am very grateful to my Commission colleagues – John Armitt, Ricky Burdett, Vivienne Cox and Julia King (and Geoff Muirhead who stood down in September) – for their thoughtful and committed work so far. We are also grateful to our hard-working team of officials and others, ably led by Phil Graham.

In sporting terms, this is a game of two halves. The Interim Report, published here, is the end of the beginning. In 2014 we will move on to the next phase of our work. We remain confident that a solution can be found, which allows the UK to maintain its strong position in world aviation, while respecting the inhabitants of those communities which most feel the side effects.

A handwritten signature in black ink, appearing to read 'Howard Davies', with a stylized flourish at the end.

Sir Howard Davies
Chair, Airports Commission

Executive summary

- 1 Decisions on airport location and capacity are among the most important strategic choices a country or city can make, influencing the economic, environmental and social development of cities and regions more than almost any other single planning decision. They are also among the most contentious.
- 2 Alongside economic benefits, airports bring noise, air pollution and carbon emissions, all of which can have significant impacts on the environment and on the quality of life for people who live or work nearby. The planning process must therefore ensure that decisions on airport capacity balance local considerations with the national interest.
- 3 In addition, most major UK airports are – unusually in international terms – in private ownership. This means that airport planning must also take proper account of commercial considerations. Airports will not choose to finance and build additional capacity unless they are confident it will be heavily utilised.
- 4 The question of UK airport capacity has been considered a number of times over past decades. The Roskill Commission in 1968 recommended a new airport at Cublington, with a minority report favouring Maplin Sands. Neither airport was built. More recently, the 2003 White Paper *The Future of Air Transport* concluded that a second runway should be built at Stansted, followed by a third at Heathrow, if certain environmental standards could be met. That conclusion was rejected by the incoming coalition Government after the 2010 General Election.
- 5 The Airports Commission (the Commission) was set up in 2012 to take a fresh and independent look at the UK's future airport capacity needs. It has been tasked with producing:
 - An *Interim Report* (this document) by the end of 2013, setting out the nature, scale, and timing of steps needed to maintain the UK's status as an international hub for aviation, alongside recommendations for making better use of the UK's existing runway capacity over the next five years; and,
 - A final report by summer 2015, setting out recommendations on how to meet any need for additional airport capacity in the longer-term.

- 6** To facilitate the process of reaching final recommendations, and reduce uncertainty, it has also sought to identify a list of the most credible options for new runway capacity, which will be further developed and appraised before the final report.
- 7** The Commission has aimed to generate a greater consensus on airport policy by following an approach that is:
- **Integrated:** The Commission has considered a range of economic, social and environmental factors that affect how much – and what sort of – airport capacity is needed in the UK. It has not followed a mechanistic ‘predict and provide’ model, based on forecasting future demand for aviation and then meeting that demand no matter the cost. It has commissioned new research and analysis and sought to consider impacts across the whole of the system, including on air traffic and air space, surface access to airports, cost and deliverability.
 - **Collaborative:** The Commission has engaged extensively with a broad range of interested parties, through public evidence sessions, a programme of meetings and visits, and a series of discussion papers on key topics. As the number of responses to the discussion papers indicates, the papers were important for advancing debate on key topics such as connectivity, climate change, aviation noise, and airport operational models. The Commission also invited submissions on how to make best use of existing runway capacity, and proposals for adding new airport capacity in the longer-term. It also appointed a panel of leading experts to advise it on key issues.

The world has changed since previous reviews of UK airport capacity

- 8** While the UK has debated airport policy the world has changed. Globalisation and technological innovation are driving an increase in cross-border flows of goods, services and people. The global economy’s centre of gravity is shifting from west to east. Lifestyles have also changed, with many people taking advantage of European integration to live and work outside their country of origin.
- 9** Aviation has had to adapt to these changes. Two parallel trends can be seen:
- **Consolidation and network integration focused on major aviation hubs.** In the most liberalised markets such as the United States and, increasingly, Europe, significant market share has been captured by very large carriers, often formed through mergers. Three major global ‘alliances’ between airlines have emerged – Star Alliance, SkyTeam, and oneworld. These alliances have developed global route networks focused on major aviation hubs in the United States, Europe and, more recently, the Middle East and Asia.

- **The emergence of new competitors and new business models, especially in the low-cost and point-to-point markets.** The position of the major American and European carriers is being challenged by rapidly growing Middle Eastern and Asian airlines and by competition from low-cost carriers. The low-cost sector has grown rapidly since the early 1990s, and is continuing to expand into new markets such as business travel and long-haul services.

- 10 These trends are not mutually exclusive. For example, some low-cost airlines are entering alliances and some network airlines have set up low-cost subsidiaries. New aircraft, such as the Airbus 350 and Boeing 787, could further blur the boundaries as they make new types of routes and services viable. The Middle Eastern carriers are establishing significant new hubs in the Gulf.
- 11 As well as adapting to these new commercial realities, the industry also has to address its environmental impacts. International negotiations on a framework to control aviation greenhouse gas emissions are ongoing, but significant challenges remain and the ultimate form of such a scheme remains unclear.
- 12 In this context, the future of the industry remains difficult to predict. Some argue that airline alliances, and the hub-and-spoke networks that they operate, will remain central to the way the industry works. Others maintain that a wider range of airports will start to operate some form of hub, even where they lack a major network carrier, by enabling passengers to ‘self-connect’ or by hosting new partnerships between low-cost carriers and other airlines. A third view is that new aircraft with longer ranges will make more long-haul destinations viable as point-to-point routes, resulting in a decline in the importance of hubs.
- 13 The balance between the integrated network model based around major hubs, and the growth of low-cost and other point-to-point models, may have profound effects on the future shape of the overall aviation industry, as well as affecting the nature and scale of any additional capacity which might be required in the UK.

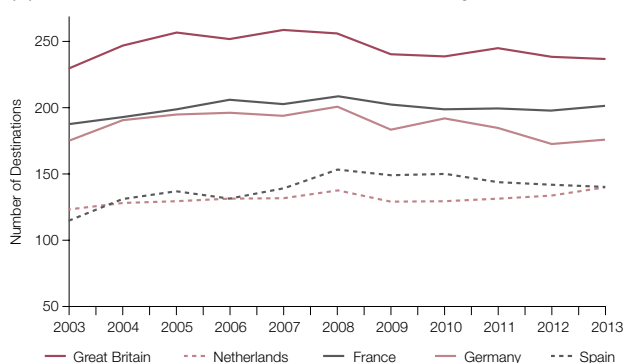
So far, UK airports have adapted fairly well

- 14 These changes have had important impacts on the UK aviation sector. The consolidation around major hubs has entrenched the dominance of the London aviation market and particularly the UK’s largest airport, Heathrow, which acts as a hub for British Airways, the country’s sole network carrier. Meanwhile, a variety of carriers operate successful and dynamic point-to-point networks at many of the UK’s other airports, including its second largest, Gatwick, which has also attracted new long-haul services.

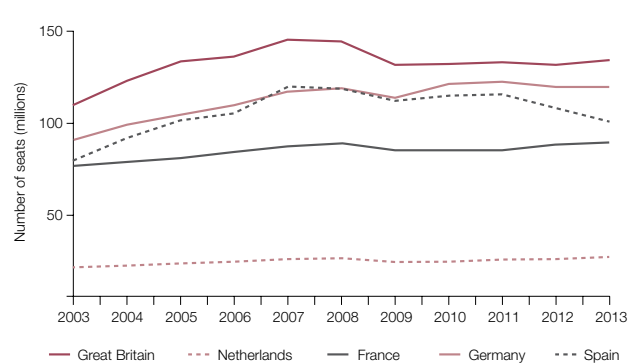
- 15** Alongside the impact of these global trends, developments at the national level are changing the UK aviation sector. These include the break up of BAA Ltd, the development of competition within the London airports system, and a new statutory framework for reducing carbon emissions. Growth in demand for aviation has been tempered by the economic downturn.
- 16** These developments were largely unforeseen by previous studies of airport capacity.
- 17** The one thing that has not changed significantly is the UK's physical airport infrastructure, and particularly runway capacity. The only new runways built in recent decades have been at London City and Manchester airports. The main London airports have benefited from new terminals, but are still reliant on runways which have been in place since the middle of the twentieth century.
- 18** The industry has responded well both to the constraints of the existing infrastructure and the new, more competitive environment. Competition between major airports may drive some further improvements over the coming years.
- 19** The UK remains one of the best connected countries in the world. Available seat capacity and the number of destinations served out of UK airports are higher than any comparable European country. Heathrow still serves the largest number of international passengers of any airport in the world.

Figure 1: UK has more seats available and serves more destinations on a daily basis than any other European country

(a) Number of destinations served daily 2003–2013



(b) Seat capacity available daily, 2003–13



Source: CAA analysis based on OAG data

But problems are starting to emerge and are likely to get worse

- 20** Heathrow is now effectively full. Gatwick is operating at more than 85% of its maximum capacity and is completely full at peak times. It is becoming more and

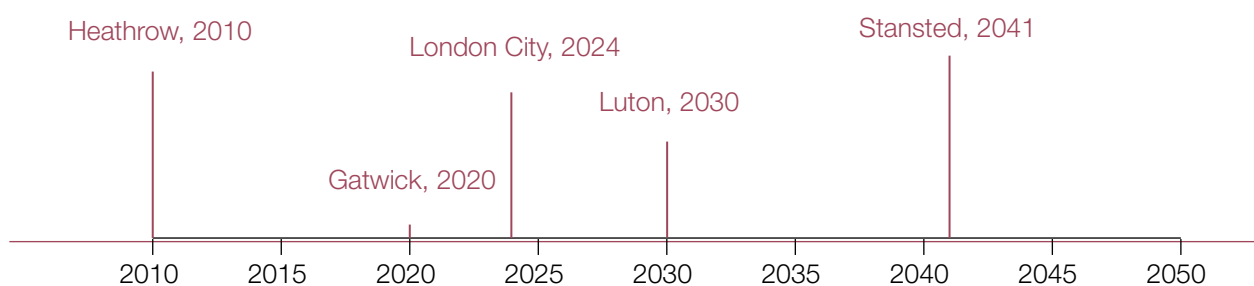
more difficult for airports and airlines to operate efficiently within the constraints of their existing infrastructure. Smaller airports have been successful at attracting some forms of traffic, but many services – particularly in long-haul markets – rely on the volumes of demand that only exist at the country's largest airports.

- 21** As a result, the UK appears to be reaching the limits of what can be achieved within its existing airport infrastructure.
- 22** Passengers at Heathrow suffer from a high level of delay and unreliability, as a result of capacity constraints limiting the airport's day-to-day efficiency and its ability to respond to one-off events. These issues do not only affect passengers; they also limit the airport's ability to offer predictable patterns of respite from noise for local communities. As other airports reach capacity, similar impacts can be foreseen.
- 23** In terms of connectivity, Heathrow continues to have a dominant position amongst European hubs on routes to North America and other established aviation markets. However, it has not been able to build on this and establish a similar position of strength in routes to emerging economies. And the number of domestic routes to the airport is declining, restricting access from other UK regions to Heathrow's network of international services.
- 24** The current approach of forcing ever greater volumes of traffic through the existing infrastructure, if continued, would therefore have increasingly detrimental effects on the national economy, businesses, and air passengers.
- 25** The Commission's analysis suggests that the costs of failing to address these issues could amount, over a sixty-year time period, to:
- £18-20 billion of costs to users and providers of airport infrastructure.
 - £30-45 billion of costs to the wider economy.
- 26** It is not possible to predict exactly when these problems will come to a head. There are major uncertainties involved in forecasting aviation demand, and any forecasts are sensitive to assumptions around how the economy and society will develop in future.
- 27** Governments, however, have a responsibility to plan ahead for the future, particularly in the case of long-lived infrastructure like runways, which take many years to plan and build. To do so, policymakers need to consider a range of future scenarios and their implications for the amount and type of infrastructure that may be needed.

- 28** The Commission has developed a new set of forecasts which address many of the key concerns about the way the Department for Transport has previously forecast aviation demand. It has used these forecasts to test a range of scenarios for the future of the aviation sector.
- 29** Across all scenarios considered, including where the UK is meeting its climate change targets, there is significant growth in demand for aviation between now and 2050, placing additional pressure on already stressed airport infrastructure in London and the South East. The London airport system is forecast to be under very substantial pressure in 2030, and by 2050 sees demand significantly in excess of the total available capacity, even when aviation emissions are constrained to 2005 levels.

Figure 2: By 2030, Heathrow, Gatwick, London City and Luton are all predicted to be full

Projected years when London and South East airports become full, in the carbon capped, capacity constrained forecast



Addressing these problems will require new runway infrastructure in London and the South East

- 30** Intervening to redistribute this excess demand away from airports in London and the South East does not appear to be a credible option.
- 31** The Commission has looked at options for imposing a congestion charge on the UK's busiest airports to incentivise airlines and their passengers to use other airports, including regional airports that are not yet fully utilised. Most of the new services developed at less-congested airports under this policy would simply duplicate services already available at Heathrow, such as flights between London and New York.
- 32** In addition, there is little scope for Government intervention to force airlines and passengers to use less busy airports, and past measures of this kind have rarely, if ever, achieved their objectives.
- 33** The Commission has therefore concluded that there is a clear case for one net additional runway in London and the South East, to come into operation by 2030.

34 In terms of the nature of the capacity that is needed, the Commission does not believe there is a binary choice between providing additional hub capacity or additional point-to-point capacity. Instead, the optimal approach is to continue to invest in an airport system that caters for a range of airline business models. This is particularly important in a competitive airports system, like London, where airlines can choose how to use the available capacity, and the market can be expected to respond dynamically to the provision of new infrastructure.

35 The Commission's forecasts also indicate that there is likely to be a demand case for a second additional runway in operation by 2050 or, in some scenarios, earlier. The Commission will carry out further analysis on this issue in the second phase of its work programme, including looking at the implications for any future capacity expansion of each of the new runway options shortlisted for detailed consideration. This will enable it to make recommendations to Government in its final report as to when, how and by whom the case for a second new runway should be considered.

Before new capacity becomes operational, better use can be made of existing airport infrastructure

36 There are no easy ways of addressing the emerging problems for UK airports without developing new infrastructure, but there are some steps that can be taken to make better use of existing capacity in the short-term.

37 Following a call for evidence, the Commission is recommending a range of measures including the following:

- An 'Optimisation Strategy' to improve the operational efficiency of UK airports and airspace, including:
 - **airport collaborative decision making.** A system which provides access to accurate and timely flight information for all those involved in processing aircraft to increase the predictability and speed of the aircraft turnaround process;
 - **airspace changes supporting performance based navigation.** Matching airspace structures with modern aircraft's ability to follow more accurate tracks allowing the possibility of designing closer spaced departure routes or alternating multiple arrival and departure routes for respite;
 - **enhanced en-route traffic management.** Driving greater schedule adherence; and,

- **time based separation.** Enabling air traffic control to apply the same time spacing between aircraft irrespective of wind conditions, increasing the operational resilience of the airport in high wind conditions.
- Trials at Heathrow of measures to smooth the early morning arrival schedule to minimise delays and provide more predictable respite for local communities as part of a range of measures to increase the flexibility of runway use.
- The establishment of a Senior Delivery Group to drive forward the implementation of the Future Airspace Strategy and the delivery of the Commission's recommendations, showing strong leadership and accountability for delivery.
- The creation of an Independent Aviation Noise Authority to provide expert and impartial advice about the noise impacts of aviation and facilitate the delivery of future improvements to airspace operations.
- A package of surface transport improvements to make airports with spare capacity more attractive to airlines and passengers, including:
 - the enhancement of Gatwick Airport Station;
 - further work to develop a strategy for enhancing Gatwick's road and rail access;
 - work on developing proposals to improve the rail link between London and Stansted;
 - work to provide rail access into Heathrow from the South; and,
 - the provision of smart ticketing facilities at airport stations.

38 These measures are worthwhile on their own terms, but none of them can provide a long-term solution to the UK's airport capacity problem.

39 The Chair of the Commission wrote to the Chancellor of the Exchequer on 26 November about its recommendations on surface access to airports. HM Treasury's National Infrastructure Plan,² published on 4 December, began the process of implementing it. The Commission welcomes this, and encourages the Government to continue to work on the delivery of the surface transport improvements.

² HM Treasury (2013), *National Infrastructure Plan*
<https://www.gov.uk/government/publications/national-infrastructure-plan-2013>

The Commission has carried out an assessment of the options for adding extra capacity in the longer-term

- 40** The Commission received 52 proposals for addressing the UK's airport capacity shortfall, over 40 of which suggested building additional runway infrastructure. These proposals were based on very different visions for the future of the aviation sector.
- 41** The Commission's analysis looked at accommodating increasing demand through a variety of means. This included options requiring no new runway infrastructure, through purely operational measures or by using surface transport improvements to replace the need for short-haul flights. The analysis concluded that none of these options delivered the capacity needed.
- 42** The options for new runway infrastructure were assessed against the Commission's sift criteria and on this basis two potential sites were selected for further analysis and assessment:
- a. **Gatwick Airport:** At this site the Commission's analysis will be based on a new runway over 3,000m in length spaced sufficiently south of existing runway to permit fully independent operation.
 - b. **Heathrow Airport:** At this site the Commission's analysis will consider two potential runway options:
 - A new 3,500m runway constructed to the northwest of the existing airport, as proposed by Heathrow Airport Ltd, and spaced sufficiently to permit fully independent operation.
 - An extension of the existing northern runway to the west, as proposed by Heathrow Hub Ltd, lengthening it to at least 6,000m and enabling it to be operated as two separate runways: one for departures and one for arrivals.
- 43** The Thames Estuary airport options were not at this stage shortlisted. While the potential they offered to reduce aviation noise impacts in the South East of England and to support economic development on the eastern side of London was attractive, they presented many challenges and uncertainties.
- 44** They would be extremely expensive, with the cost of an Isle of Grain airport (the most viable of those presented) around five times that of the three short-listed options at up to £112 billion. They would present major environmental issues, especially around impacts on protected sites. The new surface access infrastructure required would be very substantial, with potential cost, deliverability and environmental challenges of its own. And the overall balance of economic impacts

would be uncertain – particularly as an Estuary airport would require the closure of Heathrow for commercial reasons and London City for airspace reasons.

- 45 The Commission intends to carry out additional analysis in respect of the Isle of Grain option in the first half of 2014. On this basis, it will reach a view before the end of the year as to whether such an option would offer a credible proposal for consideration alongside the short-listed options. If so, it will be subject to a similar appraisal and consultation process as for those options, although not necessarily to the same timetable.
- 46 Stansted airport options have not been short-listed. Its volumes have fallen in recent years, and there is considerable spare capacity, unlike at Gatwick. In addition, a large hub airport would be close to the cost of the Estuary, highly disruptive to airspace and would not present the same regeneration opportunities. Stansted may however be a plausible option for any second additional runway in the 2040s.
- 47 None of the other proposals was considered to be a credible option for further detailed development in the next phase of the Commission's work. The Commission's consideration of rejected proposals is set out in the supporting **Appendix 2**.

The Commission will now begin the next phase of its work to determine the most suitable location and design for new airport capacity

- 48 In the second phase of its work, from now until the publication of its final report in summer 2015, the designs of the short-listed proposals will be further developed and subjected to a more detailed assessment. There will be a consultation on the short-listed options and associated appraisal results in the autumn of 2014.
- 49 The Commission will publish a draft *Appraisal Framework* for consultation early in 2014. This will set out details of how scheme designs should be developed and how scheme impacts will be appraised.
- 50 The Commission will also set out early in 2014 more details of how it will take forward its further analysis of the option for a new hub airport in the Thames Estuary.
- 51 The Commission recognises that the publication of this *Interim Report* may cause uncertainty for communities close to the short-listed sites and may have some impact on local property markets. The Commission encourages the Government and those promoting schemes to consider what steps can appropriately be taken to limit these concerns, including for the limited number of people who may face an urgent need to sell their home before the Commission publishes its final report, but find themselves unable to do so.

Chapter 1:

Background and methodology

Background

1.1 On 7 September 2012, the Government announced the creation of an independent Airports Commission (the Commission) to identify and recommend to Government options for maintaining the UK's status as an international hub for aviation. The Commission's members are Howard Davies (Chair), Sir John Armitt, Professor Ricky Burdett, Vivienne Cox, and Professor Dame Julia King.³

1.2 The Commission has been tasked with producing an *Interim Report* (this document) by the end of 2013 and a final report by summer 2015. The Commission's terms of reference set out the following requirements for the *Interim Report*:

The Commission should report no later than the end of 2013 on:

- *its assessment of the evidence on the nature, scale and timing of the steps needed to maintain the UK's global hub status; and,*
- *its recommendation(s) for immediate actions to improve the use of existing runway capacity in the next five years – consistent with credible long-term options.*

1.3 The final report will set out the Commission's recommendations for meeting any need for additional capacity, based on a detailed assessment of the three short-listed long-term options, including their economic, social and environmental impacts. It will also make recommendations for ensuring that the need is met as expeditiously as practicable within the required timescale.

1.4 In order to meet the requirements set out in the terms of reference for the *Interim Report*, and to ensure that the Commission is well-placed to deliver a timely and robust final report, this document:

- sets out the Commission's views on the nature, scale and timing of the UK's future aviation capacity and connectivity needs;
- makes recommendations for immediate actions to improve the use of existing runway capacity in the next five years;

³ A sixth Commissioner, Geoff Muirhead, stepped down from the Commission in September 2013

- identifies additional measures for making the best use of existing capacity that might be further developed before the Commission's final report;
- presents a shortlist of the most credible options for new runway capacity, consistent with the Commission's conclusions on the UK's aviation capacity needs, to be further developed before the final report; and,
- sets out the process for the second phase of the Commission's work, from now until summer 2015, and explains how those with an interest in this work can engage with it.

How the Commission's work supports the Government's role in planning airport capacity

- 1.5** While the UK has a competitive and substantially privatised airport sector, the Government still has an important role in relation to planning future airport capacity. The Planning Act 2008, as modified by the Localism Act 2011, put in place a new system of development consent for Nationally Significant Infrastructure Projects (NSIPs), including certain types of energy, transport, water, and waste projects.
- 1.6** Under this system, planning applications for NSIPs are examined by the Planning Inspectorate, in the context of a National Policy Statement (NPS) produced by the Government. NPSs include the Government's objectives for the development of nationally significant infrastructure in a particular sector, such as aviation. They give reasons for the policy set out in the statement, and must include an explanation of how the policy takes account of Government policy relating to mitigation of, and adaptation to, climate change.
- 1.7** NPSs undergo a democratic process of public consultation and parliamentary scrutiny before being 'designated' (published). They provide the framework within which Planning Inspectors make their recommendations to the relevant Secretary of State, who ultimately takes the decision on whether to grant or refuse development consent. This system recognises the challenging and contentious nature of many major infrastructure schemes.
- 1.8** The need for close Government involvement, to ensure the process is fair to both communities and developers, and that it balances local considerations with the national interest, is evident from the contentious nature of the recent debate on airport expansion in the UK. When, in 2010, the incoming Coalition Government said that it did not support an existing plan to build a third runway at Heathrow (which, it should be emphasised, is different from the proposals that the

Commission has received for additional runways at that airport⁴), the airport quickly dropped its plan. Although it would have been open to Heathrow, as a private company, to have pressed ahead and submitted its application, it recognised that without support from Government it was highly unlikely to obtain consent.

- 1.9** To help avoid a similar situation arising in future, the Commission will publish as part of its final report its recommendations on the appropriate legal and planning processes that should be used to expedite the delivery of new airport infrastructure.

The Commission's methodology

- 1.10** Decisions on airport location and capacity are among the most important strategic choices a country or city can make. These choices influence the economic, environmental and social development of cities and regions more than many other planning choices. It is therefore right that these decisions are carefully made, and that an attempt is made to achieve as much consensus as possible. Those principles have guided the Commission's process and approach.

An integrated approach

- 1.11** Decisions on major infrastructure projects have often been based on a simplistic process of projecting future demand, and then providing the infrastructure to meet that demand no matter the cost – the so-called 'predict and provide' model.
- 1.12** Previous attempts at addressing the issue of the UK's airport capacity have conformed to this model. Work has been predicated on a straightforward projection of demand and has primarily focused on a comparison of the merits and drawbacks of various sites for expansion. Political consensus has proven difficult to achieve.
- 1.13** The Commission began its work with an understanding that aviation and airports have wide ranging impacts. The ability to move people and goods across the globe in a matter of hours is fundamental to the global economy, affecting everything from the performance of our financial services to the range of goods available on supermarket shelves. Airports themselves can also make an important contribution to their local economies, being major employers in their own right and having the potential to attract companies whose business depends on air travel into their immediate proximity.
- 1.14** The ability to travel abroad for leisure (which has become much more widely available in recent decades) makes an important contribution to quality of life, whether by providing opportunities for relaxation or by allowing people to broaden

⁴ Heathrow Airport Ltd. (17th July 2013), Submission to Airports Commission, http://www.heathrowairport.com/static/HeathrowAboutUs/Downloads/PDF/long-term-hub-capacity-options_LHR.pdf

their horizons. One fast-growing driver of demand for air travel is the need to visit friends and relatives – an inevitable consequence of an increasingly mobile global society in which families and communities are frequently spread around the world. Airports are also often the first point of contact for many visitors to the UK.

1.15 Some of the consequences of aviation are not so positive. Air travel already makes a significant contribution to global greenhouse gas emissions and this contribution is set to grow as other industries take steps to decarbonise. Other environmental impacts are more local in scope; aircraft noise causes considerable annoyance to the communities it affects and there is a growing body of evidence regarding its impacts on human health. New infrastructure developments can alter landscapes and affect natural habitats and cultural heritage. The challenge of getting passengers into and out of airports on the ground can also place stress on local transport networks, potentially leading to congestion and air quality issues.

1.16 The Commission has therefore adopted an integrated approach to analysis. It has considered a range of economic, social and environmental factors that affect how much – and what sort of – airport capacity is needed in the UK. These include:

- the Government's objective of maintaining the UK's status as Europe's most important aviation hub;
- the impacts of air connectivity on the economy;
- the interactions between aviation and other transport modes;
- the need for action on climate change and, in particular, to meet the UK's legislated climate change commitments;
- the impacts of airport development on the local environment, landscape and heritage;
- the impacts of airports on the quality of life for people living and working near airports, such as the impacts of aircraft noise;
- the impacts on employment, housing and broader social factors;
- the needs of air passengers, both business and leisure;
- the implications for the quality of experience for passengers; and,
- the prospects for financing and delivering new airport infrastructure.

1.17 The Commission's approach has been informed by the principles of the Strategic Environmental Assessment (SEA) Directive to support any subsequent decision by

Government on its long-term aviation policy. The Commission's methodology takes account of the social and environmental costs of policy options alongside their anticipated benefits, and has considered a range of alternative strategies for meeting the stated policy objectives.

An open and inclusive process

- 1.18** The Commission was determined to take a fresh and independent look at UK airport capacity. As a new body, comprising individuals with a variety of professional backgrounds and expertise, it has been able to engage widely, review the evidence objectively, and exercise its judgement at arm's length from the political process.
- 1.19** The Commission's work has been supported by an Expert Advisory Panel, whose terms of reference are available on the Commission's website.⁵ The views and opinions expressed in this report are those of the Commission and do not necessarily reflect the views or opinions of any other parties who assisted in the compilation of this *Interim Report*.
- 1.20** The Commission began its work by making a fresh assessment of the UK's future airport capacity requirements. It published a series of discussion papers, on aviation demand forecasting, the economic benefits of air connectivity, aviation and climate change, airport operating models, and aviation noise.⁶ It has sought to look afresh at how the industry operates and how it may develop in future, taking into account the latest evidence and forecasts.
- 1.21** In addition, the Commission held two public evidence sessions in Manchester and London on 9 and 10 July 2013 respectively. At these events the Commission took evidence from airport operators, airlines, environmental organisations, local campaign groups, business organisations, representatives of the tourism industry, and others.
- 1.22** The Commission has considered research and reports from a wide range of bodies including Committees, academic bodies and interest groups. It has also undertaken an extensive programme of meetings and visits. The Commission has been to several of the proposed sites for expansion and has visited or met representatives from a number of overseas airports. The Commission has also sought to understand the local impacts of potential airport development, for example by visiting west-London sites affected by noise from Heathrow, and touring a proposed site for a Thames Estuary airport on the Hoo Peninsula.

⁵ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/193932/eap-tor-membership.pdf

⁶ All discussion papers can be found on the Commission's website, <https://www.gov.uk/government/collections/airports-commission-discussion-papers--2>.

- 1.23** The Commission also invited submissions on how to make best use of the UK's existing airports and runways. Seventy-five responses were received to the consultation which ended on 17 May, covering issues such as airspace optimisation, airport operations, and surface access. Further detail of the assessment of these measures is included in **Appendix 1**. The conclusions are in **Chapter 5**.
- 1.24** Finally, to ensure that it would be able to move quickly to assess the options for meeting any long-term capacity gap it might identify, the Commission invited outline proposals for adding new airport capacity in the longer-term. Fifty-two proposals were received, of which 39 were from organisations and 13 from members of the public. Detail of the assessment of these proposals is included in **Appendix 2**. The conclusions are in **Chapter 6**.
- 1.25** To make the process as open, inclusive, and transparent as possible, the Commission has published the responses to its discussion papers on its website, alongside transcripts of public evidence sessions, a summary of options for making best use of existing capacity, and the full text of the proposals for new capacity (or links to them where they had previously been published by their authors). Interested parties were given an additional two months after the publication of proposals for new capacity to submit further comments on these, and 300 individual responses were received. In addition, two campaigns generated around 3,000 representations in relation to the proposed Thames Estuary airport.
- 1.26** Finally on 7 October the Commission Chair gave a speech outlining that there was a need for some additional capacity to service future demand in London and the South East. The speech invited comments on this emerging thinking by 31 October and just over one hundred responses were received.

Structure of the Interim Report

- 1.27** This *Interim Report* sets out the conclusions the Commission has now reached, and the evidence and judgements on which they are based. The document is structured as follows:
- **Chapter 2** provides an overview of recent developments in the global aviation sector, and how these relate to broader economic, social and environmental changes. It also proposes a set of scenarios for how the aviation sector might evolve in the future.

- **Chapter 3** assesses the structure of the UK airports sector and considers how well the UK's economy and society are being served by its current airport infrastructure.
 - **Chapter 4** sets out the Commission's view of the UK's longer-term airport capacity requirements, in the context of the Commission's forecasts of aviation demand and traffic to 2050, and the scenarios set out in **Chapter 2**.
 - **Chapter 5** sets out the Commission's recommendations for making best use of the UK's existing airport capacity, including airspace improvements, operational changes, and proposals for improving surface transport links to airports.
 - **Chapter 6** summarises the proposals for adding new airport infrastructure in the longer-term, and sets out the options that the Commission believes merit more detailed appraisal.
 - **Chapter 7** sets out the next phase of the Commission's work, including the publication of its draft *Appraisal Framework*, and information on how interested parties can engage with the Commission in the next phase of its work.
- 1.28** The series of supporting Appendices and Technical Reports⁷ provide more detail on the processes the Commission followed, the analytical approaches it has adopted, and the technical details of its recommendations.

⁷ These can be found on the Commission's website at <https://www.gov.uk/government/organisations/airports-commission>

Chapter 2

The global aviation sector

SUMMARY

The world has changed substantially since the last major review of UK airport policy, due to globalisation, technological innovation, the recent economic downturn, and international efforts to tackle climate change.

These changes have had a profound impact on the aviation industry. Two parallel trends can be observed – one of consolidation, partnership and network integration; the other of new entrants, enhanced competition and expanding point-to-point travel.

The first of these trends has seen:

- consolidation in liberalised aviation markets such as the US and, increasingly, Europe;
- the rapid growth of the three major airline alliances – Star Alliance, SkyTeam and oneworld;
- complex webs of code shares, equity stakes and joint ventures underneath and alongside these alliance structures, which are further strengthening links between airlines; and,
- the development of dense and integrated route networks focused around major aviation hubs, combining origin and destination (OD) and transfer traffic to enable high levels of connectivity.

This pattern of increasing integration has, however, been accompanied by a parallel trend which has seen new competitors and new business models emerging, particularly in the more liberalised markets, and point-to-point networks expanding. Key developments include:

- the growing importance of the low-cost sector, which is increasingly expanding into new markets – for example long-haul services and business travel;
- cost-efficiencies and new technologies, enabling new routes to be opened which were not previously considered viable;

- Middle Eastern and south east Asian carriers competing with long-haul legacy airlines, and new international links to second-tier airports; and,
- the emergence of self-connecting, supported by airports like Gatwick.

These trends are not mutually exclusive and they bring the low-cost and the full-service models closer together. For example, some low-cost airlines are entering alliances and some legacy carriers are establishing low-cost subsidiaries of their own.

There are also a number of wider factors to take into account. Increasing demand for aviation in new and emerging markets, driven by their expanding middle-class, will shape future industry investment decisions and strategies.

The introduction of new aircraft, for example the Airbus A350 and Boeing 787, will make new routes and service types possible. Future trends towards protectionism or liberalisation may have significant implications for the shape of the industry and the markets it serves. And moves towards a global scheme to tackle aviation greenhouse gas emissions could affect the way the industry is regulated in the future.

- 2.1** The aviation industry has evolved rapidly in the past few decades and often in unforeseen ways. One important development has been the evolution of airline alliances, operating global route networks from major aviation hubs in Europe, North America and, increasingly, the Middle East and south east Asia.
- 2.2** A second important innovation has been the rapid expansion of the low-cost airline business, which was pioneered in the US and subsequently spread to Europe during the 1990s. There are now a number of low-cost models with different strategies. Low-cost carriers represent the fastest growing sector of the aviation market, which has led to new routes and lower fares.
- 2.3** This chapter describes these recent industry developments in more detail, explores the factors that have driven them, and considers how they might evolve in the future. A key theme is the dynamism of the aviation industry: neither the emergence of the hub model, nor the expansion of the low-cost sector were widely predicted.
- 2.4** The Commission has engaged widely with stakeholders within and outside the aviation industry, and found little consensus about how the sector will develop in future. Some argue that airline alliances, and the hub-and-spoke networks that they operate, will remain central to the way the industry works. Others maintain that a wider range of airports will start to operate some form of hub, even where they lack a major hub carrier, by enabling passengers to ‘self-connect’. A third view is that

new aircraft with longer ranges will make more long-haul destinations viable as point-to-point routes, resulting in a decline in the importance of hubs. Each of these views has different implications for the type of airport capacity needed in the UK.

The aviation industry today

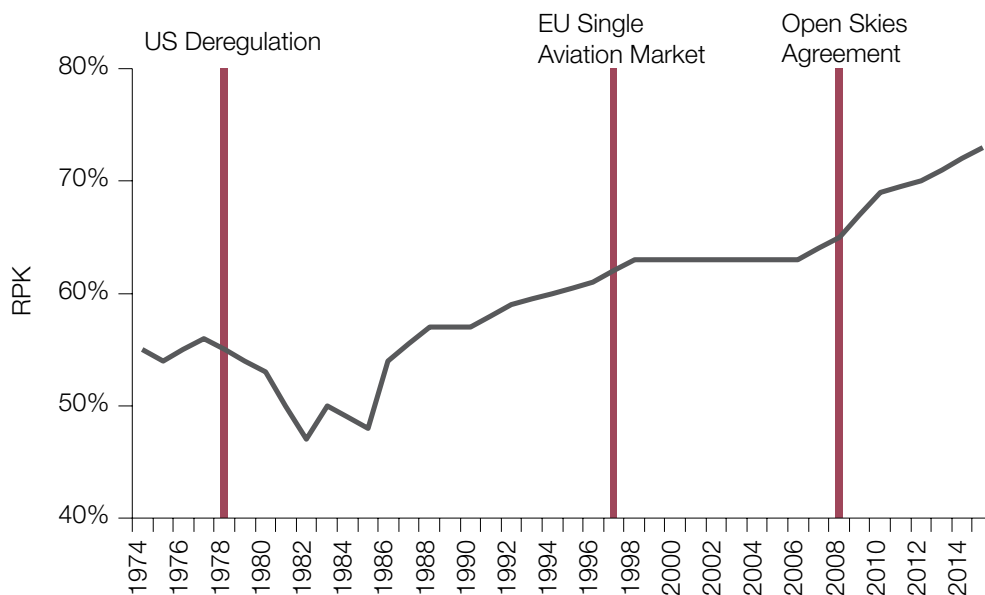
- 2.5** The current structure of the global aviation industry is the product of a number of recent economic, social and technological changes. Globalisation and technological innovation have resulted in an increase in cross-border flows of goods, services and people. This has created new opportunities for airlines, and there have been a number of cross-border mergers and partnerships, which were not previously possible.

Consolidation and alliances

- 2.6** For the airline industry, globalisation and changes to the way the industry is regulated have liberalised a market that was highly fragmented and protected. Until around thirty years ago, airlines were typically state-owned companies with monopoly rights in domestic markets, and almost all international traffic rights were negotiated bilaterally between individual states.
- 2.7** This situation began to change when the US became the first to deregulate its airline sector in 1978. Europe followed suit in the following decades, with a series of reforms between 1987 and 1997. Until this point liberalisation mostly took the form of internal deregulation within the US and EU, with some limited steps towards deregulation in other parts of the world. However, in 2008 the EU and US signed the Open Skies agreement, under which any carrier from either side can fly to and from any point in the EU and any point in the US.
- 2.8** Liberalisation has exposed previously protected airlines, flying primarily 'point-to-point' services between an origin in one country and a destination in another, to greater competition and, as a result, cost pressures. These cost pressures on one hand, and liberalisation on the other, incentivised network airlines to join forces. **Figure 2.1** shows that the global market share has increasingly been captured by very large carriers (whose ranks some low-cost carriers have joined over recent years).

Figure 2.1: Liberalisation has resulted in the largest carriers capturing an increasing share of the market

Market share of the 20 largest airlines (% of total revenue passenger kilometres (RPK)), 1974-2014



Source: Deutsche Bank (May 2012), 'Global Airline Sector – Achieving Financial Stability through Consolidation', page 7

- 2.9** There has been notable consolidation in the US, largely because this is more straightforward within a single country, where ownership rules present fewer barriers. By 2012, the five largest US carriers held 66% of domestic seat capacity, compared to 53% in 2008.⁸ This trend appears likely to continue, following the recent merger between American Airlines and US Airways, which will create the world's single largest carrier.
- 2.10** The European market has not yet seen the same degree of consolidation, but even so its full-service sector is increasingly dominated by three groups: Lufthansa, which also owns airlines including Austrian and Swiss; Air France-KLM; and the International Airlines Group, which incorporates British Airways, Iberia and a number of smaller airlines. By 2012, the five largest individual EU carriers held 50% of intra-EU seat capacity, a relatively smaller share of their home market than their US counterparts, but still a significant increase compared to the 35% they held in 2008.⁹
- 2.11** At the global level, however, the industry is still relatively fragmented, with many countries continuing to impose restrictive ownership rules. One response has been the development of 'alliances' between airlines. The membership of these alliances, which were first established in the late 1990s, has grown rapidly. Star Alliance

⁸ Airports Commission analysis of Sabre ADI

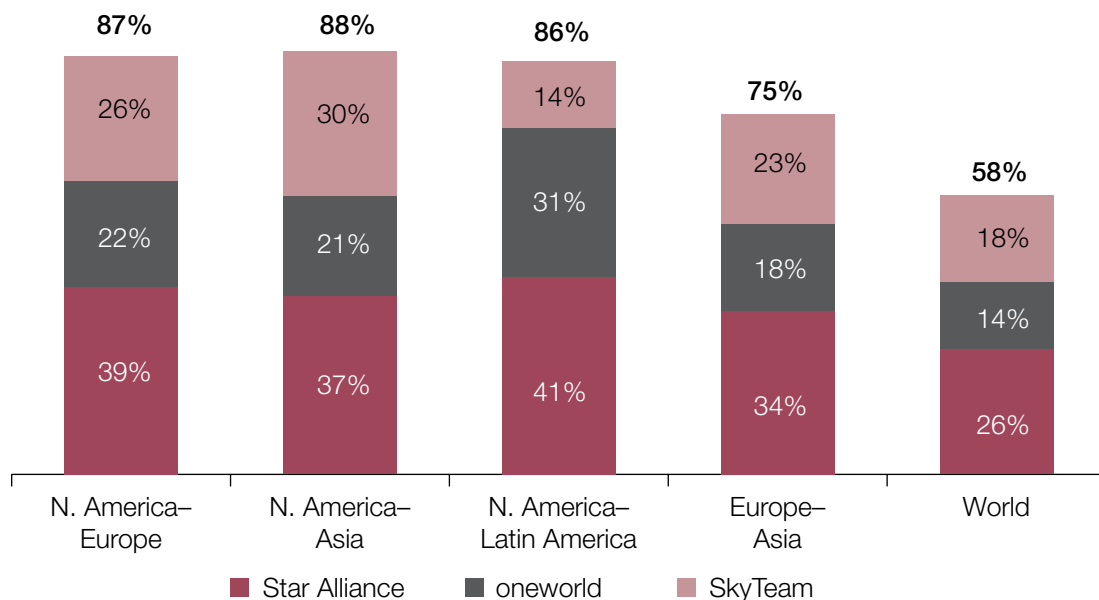
⁹ *Ibid*

began in 1997 with just five members (Lufthansa, United, Air Canada, Thai Airways and SAS). By 2013 it had 28 members, including two major Chinese airlines and Latin American and African carriers.

- 2.12** By 2012, 58% of global airline seat capacity was controlled by one of the three major alliances, oneworld, SkyTeam and Star Alliance. Beginning as relatively loose marketing partnerships they are increasingly taking on a fuller role, with co-operation between alliance members ranging from limited partnerships on specific routes through to joint ventures and quasi mergers. Most recently they have also begun to co-ordinate investment in shared facilities, including integrated check-in areas at major airports.

Figure 2.2: The three major alliances hold over half of global seat capacity

Airline alliance market share by seat capacity, January – June 2012



Source: Deutsche Bank (May 2012), 'Global Airline Sector – Achieving Financial Stability through Consolidation', page 8

The rise of Middle Eastern and south east Asian carriers

- 2.13** The development of a more competitive commercial environment for airlines has coincided with a shift in relative economic power from west to east. As a result, many of the fastest growing airlines are Middle Eastern and south east Asian, posing a challenge to legacy carriers and alliances based in Europe and North America.

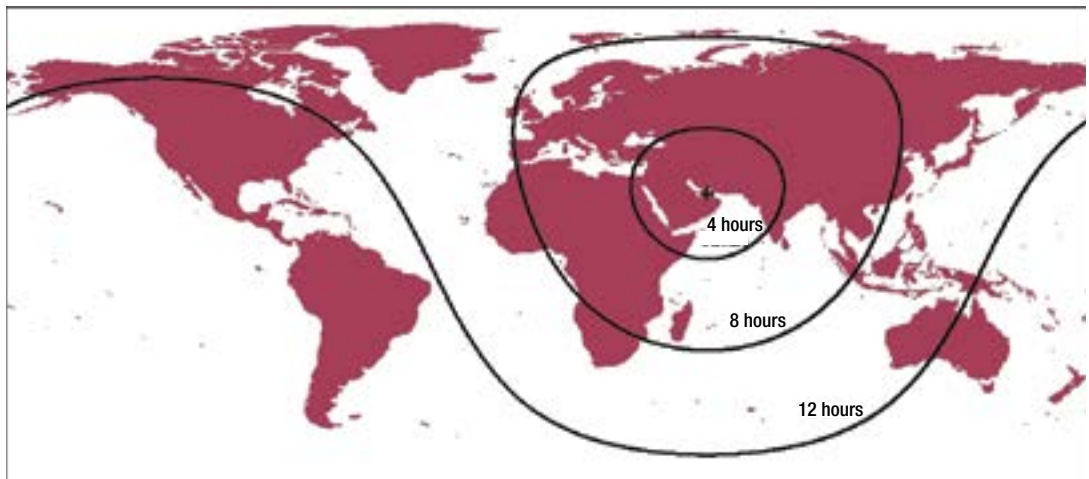
Box 2a: The rise of the Middle Eastern aviation hubs

One of the most significant developments in the global aviation sector over the past decade has been the emergence of the Gulf airports and in particular Dubai, which is now the largest aviation hub in the Middle East and one of the largest in the world. The current airport, Dubai International, is the primary hub for Emirates airline. It is also home to flydubai, a low-cost airline operating to 60 destinations across the Middle East, Africa, and Eastern Europe.

Dubai's aviation model is quite different from those of the major European hubs. Dubai has a smaller domestic market which makes its aviation sector more reliant on international passengers. Its extraordinary growth, averaging around 12% per year in international passengers, is a function of its strategic location, which makes it well placed to serve emerging markets in Asia and Africa. Around two-thirds of the world's population lives within eight hours' flight from Dubai.

Figure 2.3: Dubai is geographically well-placed to serve emerging markets in Asia and Africa

Please note the contour lines represent estimated flight times only and may differ slightly from the actual routes taken.



Source: DfT

Box 2a: Continued

The Emirate has attempted to build on this natural geographical advantage through heavy investment in aviation, culminating in the construction of the new five-runway airport at Dubai World Central. These aggressive expansion plans have been made possible not only by Dubai's financial resources and activist economic policy, but also by its smaller population and abundance of land in the desert, which mean that airport development does not encounter the same barriers as in many European countries.

The rise of Dubai was not widely predicted. The UK Government's 2003 White Paper *The Future of Air Transport* contains only one mention of Dubai, in the context of Emirates commencing a new route from Glasgow International Airport.

- 2.14** The largest of the Middle Eastern airlines, Emirates, has been growing much more quickly than its European and American competitors. While a decade ago Emirates was outside the top 10 global airlines by passenger-kilometres flown,¹⁰ and behind the biggest American and European airlines, over the past five years it has doubled the number of passenger-kilometres flown and in 2012 was fourth in the ranking. Meanwhile, United Airlines and Lufthansa Group increased their number of passenger-kilometres flown by little more than a half.¹¹
- 2.15** The Middle Eastern carriers pursue different strategies in relation to the established legacy airlines and airline alliances. Qatar Airways has become a member of the oneworld alliance, whereas Emirates is creating links through bilateral partnerships with other airlines. For example, it has entered into a partnership with Qantas, which means that passengers travelling between Australia and Europe now stopover in Dubai. This gives them access to a greater range of destinations through the joint Qantas and Emirates network. Etihad's strategy is based around taking equity stakes in other airlines which can link in to its route network, including low-cost carriers such as Air Berlin.
- 2.16** A number of Asian carriers have joined alliances or entered into code share agreements. Turkish Airlines, based at Istanbul Atatürk Airport, joined Star Alliance in 2008. Air China, which has a well-developed route network in Asia, became an official member of SkyTeam in 2011. China Southern Airlines serves SkyTeam's

¹⁰ IATA (2012), World Air Transport Statistics 57th edition, <https://www.iata.org/publications/Pages/wats.aspx>. All references to this document will be simplified to 'IATA'

¹¹ *Ibid*

routes to Australia, where it competes with Qantas, Emirates, Singapore Airlines (Star), Malaysian Airlines (oneworld) and Cathay Pacific. India's flag carrier, Air India, is not an alliance member, but does have code share agreements with airlines including Air Canada, Lufthansa, Singapore Airlines, and Turkish Airlines.

- 2.17** It is not clear whether more Middle Eastern and Asian carriers will opt to join alliances and integrate their services into these global networks, or whether many will remain non-aligned and extend their networks to compete with them. Either of these moves could have significant impacts on the global airline industry.

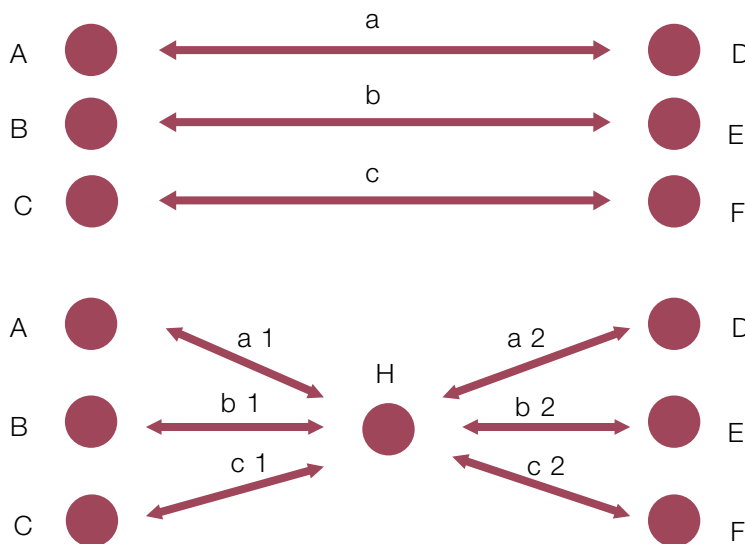
Strengthening hub-and-spoke networks

- 2.18** The consolidation of the airline industry and the rise of alliances have gone hand-in-hand with the strengthening of 'hub-and-spoke' networks based around the largest airports. In hub-and-spoke networks, airlines and alliances route their traffic through one or more key airports ('hubs'), with feeder traffic from other airports in the network ('spokes') supplementing local origin and destination traffic at the hubs. This model developed first in the US, before spreading to Europe during the 1990s and 2000s, and more recently to Asia and the Middle East. **Box 2b** explains the concept of an aviation hub in more detail.
- 2.19** For airlines and alliances, pooling traffic in this way maximises yields, and concentrating operations at a few key airport locations can help to drive down operating costs. For passengers, the hub-and-spoke model maximises the choice of destinations within a route network, although sometimes at the expense of some direct connections.

Box 2b: What are aviation hubs and how do they work?

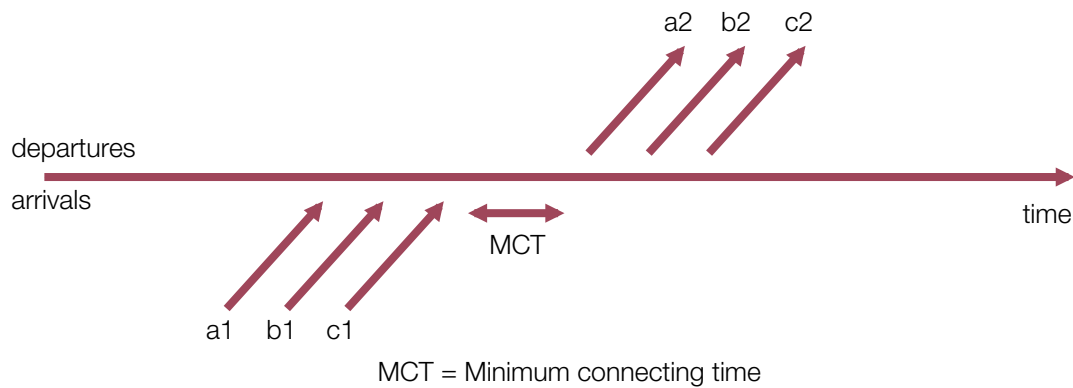
In a hub-and-spoke model, airlines and alliances focus their route networks on one or more key airports which maximise connecting opportunities for passengers. For example, an airline that operates direct services between three pairs of airports (A-D, B-E, and C-F) could instead route its flights via a hub (H) as shown below.

This creates more route options, with passengers travelling from any airport in the network now able to access five different destinations (six, including the hub itself). Furthermore, the additional passengers transiting through the hub make it more viable for the airline to add new routes at that airport or increase frequencies on existing routes, bringing further connectivity benefits. On the other hand, such a model may incentivise airlines to replace some thinner direct routes with routes that involve a transfer, which is less convenient from the perspective of those passengers who travel on this particular route.



Not all airports are equally suited to hosting an aviation hub. Typically an airline or alliance will want to concentrate its flights into 'waves' of arrivals and departures, with a short interval to transfer arriving passengers and luggage onto connecting flights. To facilitate this, the airport must have sufficient runway, apron, and terminal capacity to enable this type of scheduling, and its infrastructure must be designed to enable efficient transfer of passengers and luggage. The minimum connecting time is a measure of the shortest possible time to transfer between flights at a given airport, but what matters more to airlines is the average connecting time, a measure of the typical time taken to transfer.

Box 2b: Continued



Aviation hubs are the product of network airlines (or alliances) and airports working together to maximise connecting opportunities. It has historically been difficult for an airport to act as a hub without an airline that wants to use it as one (although some airports such as London Gatwick and Milan Malpensa have schemes in place to assist 'self-connecting' passengers). Conversely, an airline cannot operate an effective hub without an airport that is equipped for appropriate scheduling and efficient transfers.

2.20 Aviation hubs first emerged in North America after the liberalisation of the US aviation sector, for example the development of the Delta Airlines hub at Hartsfield-Jackson Atlanta, and the American Airlines hub at Dallas-Fort Worth. Later the model spread to Europe, through the development of the oneworld hubs at London Heathrow and Madrid Barajas, the SkyTeam hubs at Paris Charles-de Gaulle and Amsterdam Schiphol, and the Star Alliance hub at Frankfurt. Star Alliance also operates secondary hubs in Munich and Düsseldorf.

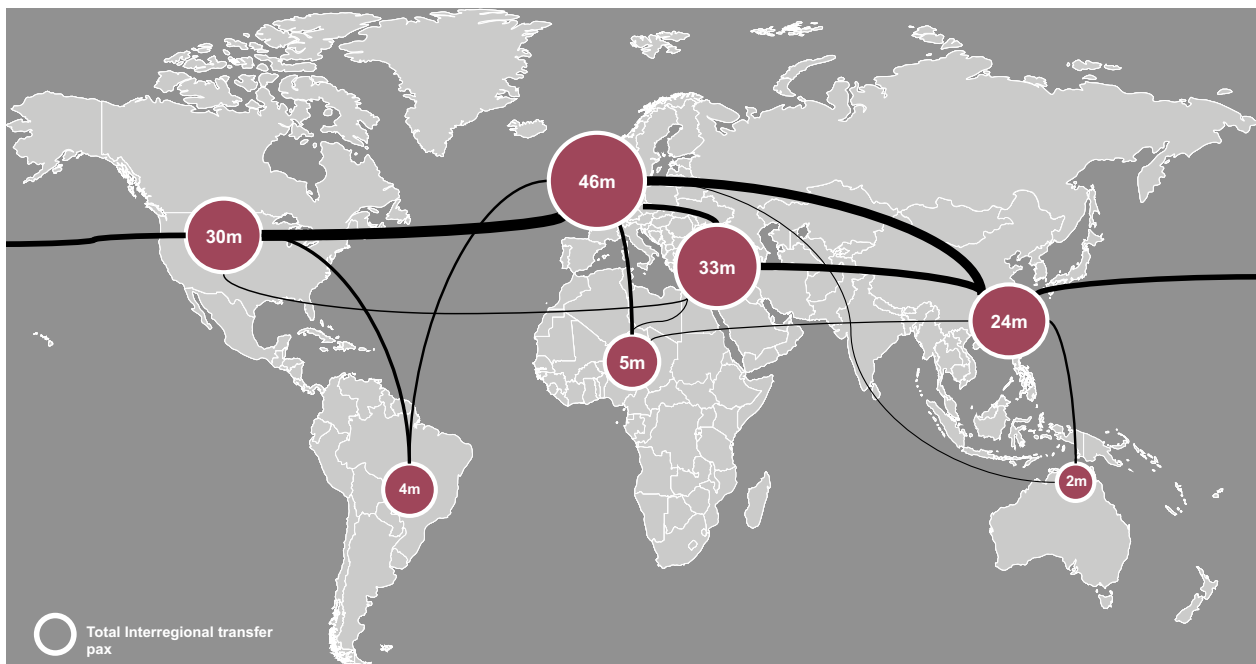
2.21 The European hubs serve distinct but overlapping markets, with their specialisation reflecting geography, trade links, language, culture, and colonial history. For instance, London has particularly good connections to North America, while Madrid is more focused on Latin America and southern Europe. Similarly, Paris tends to serve francophone destinations, while Amsterdam operates more flights to northern Europe.

2.22 Over the past decade, new hubs in the Middle East and Asia have emerged, driven by rapidly increasing numbers of passengers from south east Asia. Of particular importance to international transfer passengers is the Emirates hub at Dubai International. Atatürk International is among the fastest-growing major international airports in the world. Turkey has also set out plans to build a new airport in Istanbul, at a cost of more than \$5 billion. Beijing Capital International is now the second busiest airport in the world by passenger traffic and could become increasingly important as a hub in the future.

2.23 There is a division of labour between the major international aviation hubs, which is partly a function of geography. For example, Middle Eastern hubs are particularly well positioned as stopover points on trips between South Asia and Europe, but are less suited for trips between North Asia and North America, where European hubs are more natural places to transfer, as shown in **Figure 2.4**.

Figure 2.4: Different international hubs are better placed to compete in different markets due to their location

Dominant Interregional Transfer Passenger Flows, 2012



Note: The thickness of the line is indicative of the passenger movements on the route

- 1) excludes direct passengers between regions as well as any passengers requiring more than one connection
- 2) The top 15 routes (excluding connections to/from Central America and the Caribbean) have been included

Source: PwC analysis based on Sabre ADI

- 2.24** Geography is not the only factor that determines the location of international aviation hubs. The availability of suitable airport infrastructure, the nature of economic, fiscal and regulatory regimes in different countries, and historic, cultural and trading links all play a part.
- 2.25** Where a country or city is successful in developing one of its airports into a major hub, this can bring significant benefits. Hubs provide local people and businesses with a greater range of direct connections, to further-removed destinations, and at higher frequencies, than would generally be possible with local origin and destination demand alone. This not only benefits those using the hub by reducing the time (and potentially cost) involved in travelling by air, but the greater connectivity associated with hubs can also have wider benefits for local economies, for example by attracting investment to the area and creating jobs.
- 2.26** Hubs are particularly important for countries or cities that lack large origin and destination (OD) markets. Dubai, for example, with a population of just over 2 million, would find it much more difficult to support a comprehensive route network than London on the basis of OD demand alone.
- 2.27** Hubs also come with some potential downsides, given the scale of the airport infrastructure necessary to support them. Routing traffic through a single airport location concentrates environmental and other negative impacts in one place. These impacts include aircraft noise, air pollution, landscape alterations, and surface transport congestion.
- 2.28** The number of people affected can be reduced by locating the airport further away from major population centres, though this tends to make it more time-consuming and costly to access, eroding some of the benefits that the hub would bring and reducing its attractiveness for local origin and destination passengers. These are inescapable trade-offs for any airport development, but particularly pronounced in the case of a big hub with large volumes of traffic.
- 2.29** These trade-offs, combined with the recent economic downturn, have acted as a check on capacity expansion at major airports in Europe. The fourth runway at Frankfurt, finally completed in 2011, proved particularly contentious, and expansion at Amsterdam Schiphol has required a lengthy mediation process and the imposition of stringent caps on ATMs.

A diversifying low-cost sector

- 2.30** The development of very large carriers and alliances, and the global hub-and-spoke networks that they operate, has not arrested the growth of airlines that focus primarily on point-to-point connections. Over the past twenty years the rise of the low-cost airline model has been dramatic.
- 2.31** In 2012, Ryanair was the biggest airline in the world in terms of international passengers carried, whilst easyJet was ranked third, after Lufthansa. Even on the basis of total passengers carried, both domestic and international, Ryanair is still the sixth biggest airline in the world and the biggest European airline.¹²
- 2.32** Low-cost airlines are built around reducing operating costs in order to offer relatively cheaper fares. This approach has been most successful in highly liberalised aviation markets, in which there are fewer bilateral or regulatory constraints and it is comparatively easy to begin operating at a new airport and to open new routes and services.
- 2.33** While the cost-cutting approach is at the centre of all low-cost airline business models, different airlines have pursued slightly different strategies as described in **Box 2d**. These strategies may have implications for the type of airport capacity needed in the future.

12 IATA

Box 2c: Low-cost airline business models

Low-cost airline models were pioneered by carriers such as Southwest Airlines in the US (1980s) and Ryanair in Europe (early 1990s). Low-cost airlines offer mostly direct connections to short-haul destinations. They have opened up routes previously considered commercially unviable, and attracted price-sensitive (often leisure) passengers away from full-service airlines.

Their business model typically includes:

- high aircraft utilisation with rapid aircraft turnaround;
- a small number of efficient aircraft models (often Boeing 737 or Airbus A320);
- a high proportion of online ticket sales and check-in to reduce administration; and,
- a single, standardised service, with supplementary charges for additional services, like seat reservations or priority boarding.

Beyond these common elements, there are some important differences in low-cost models, for example:

- **Ryanair** has generally marketed itself as ‘ultra low-cost’. The airline tends to operate from smaller, less congested airports for cost and scheduling reasons, and has not sought to compete directly with legacy carriers on the majority of its routes.
- **easyJet** also has a strong focus on providing low-cost, efficient services, but flies more frequently to primary airports, competing directly with legacy carriers. It also has a stronger focus on attracting business travellers, providing more flexibility in terms of ticket sales and priority boarding.
- **Norwegian Air Shuttle** established a base at Gatwick Airport in spring 2013, offering services to a wide range of European airports. It has recently signalled its intention to move into the long-haul market, purchasing several Boeing 787s to operate on services to destinations including Bangkok, New York, Fort Lauderdale and Los Angeles.

2.34 The growth of the low-cost sector has had profound effects. Many previously underused airports have seen significant growth in passenger numbers, and routes previously unserved by aviation have been opened up and operated profitably.

Traditional network airlines have been forced to reduce fares significantly on many short-haul routes to compete effectively for traffic, and in some cases have set up low-cost subsidiaries of their own. In the case of Lufthansa, for example, all short-haul routes other than those operated out of Frankfurt and Munich will shortly be transferred to its low-cost subsidiary, Germanwings.

- 2.35** In the process, the divide between ‘low-cost’ and ‘full-service’ carriers is being eroded. In 2012, around one fifth of passengers flying low-cost from big UK airports like Gatwick, Manchester and Birmingham were business travellers.¹³ Low-cost carriers also no longer operate only to secondary airports; they account for a substantial proportion of traffic at both Schiphol and Charles de Gaulle, and even at Heathrow and Frankfurt some low-cost services operate.
- 2.36** There is also increasing evidence of collaboration between low-cost and full-service carriers. Middle Eastern carriers such as Etihad and Emirates have taken significant stakes in European low-cost carriers, and the Spanish low-cost carrier, Vueling, is owned by International Aviation Group, which also owns British Airways and Iberia. Air Berlin has now joined the oneworld alliance, and it is possible that the transfer of many Lufthansa services to Germanwings may see the low-cost carrier working increasingly closely with Star Alliance, although it is not currently a member.
- 2.37** These trends towards increasing collaboration could result in low-cost carriers supporting the hub-and-spoke networks through providing a short-haul feed into long distance services. Some already claim there is a high level of ‘self-connecting’ amongst their passengers, even if they do not directly support such connections. This type of travel may grow in the future.
- 2.38** The low-cost airline model has been most successful on short-haul routes, with flights up to four or five hours using narrow-bodied jets. It has not yet proved effective on longer flights, where fuel accounts for a greater proportion of flight costs, rapid aircraft turnaround is more difficult, and passengers expect more legroom and comfort, which are harder to provide at low-cost. In addition, because low-cost airlines tend to offer a single, standardised service, they cannot increase prices for business and first-class passengers in order to keep economy-class prices low, which is the model typically used by network carriers to support the viability of their long-haul routes.
- 2.39** However, as new, fuel-efficient, long-haul aircraft are developed, this may provide new opportunities for low-cost carriers to enter these markets, particularly if they can be

¹³ DfT analysis of 2012 CAA survey data at Gatwick, Stansted, Luton, Manchester, Birmingham, Bristol, Cardiff, East Midlands, and Exeter, based on respondents travelling on ELFAA member airlines at selected airports

combined with other efficiencies. Norwegian's entry into the long-haul market, for example, has been enabled through the purchase of several Boeing 787 jets.

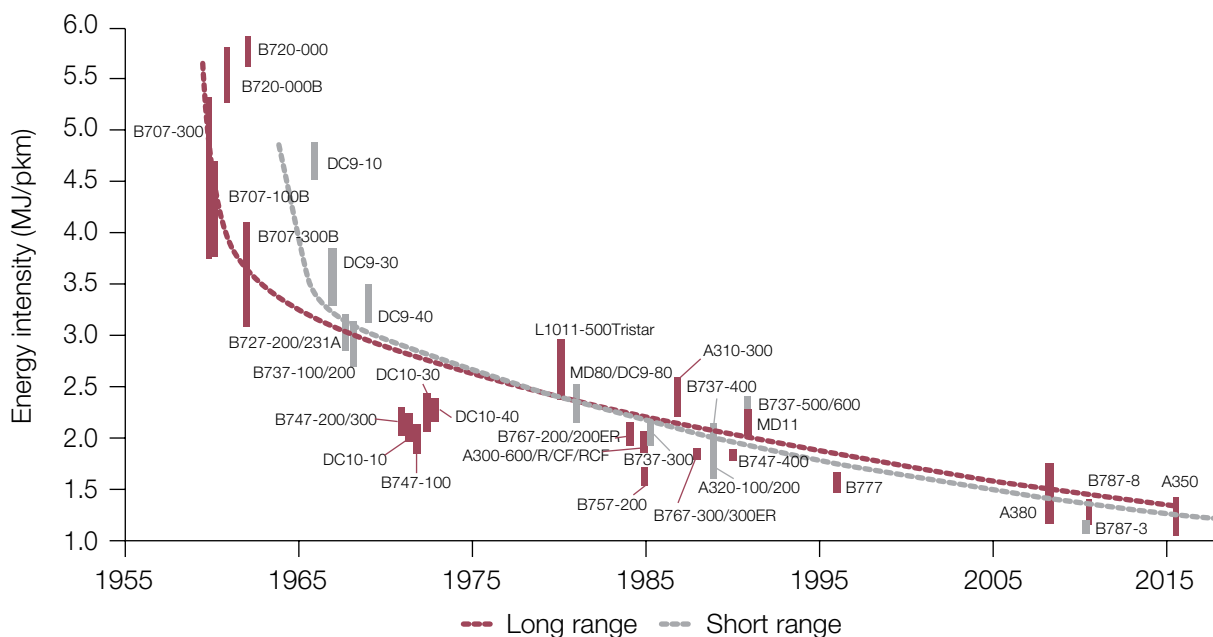
- 2.40** The way in which the low-cost sector develops, and the consequent implications for other carriers, could have profound effects on the future shape of the overall aviation industry, as well as affecting the nature and scale of any additional capacity required in the UK.

Technological change

- 2.41** The evolution of new airline business models and global route networks has been facilitated not just by liberalisation of the sector, but also by new technologies. The first few decades of the air transport industry were characterised by very rapid technological progress, primarily reflected in faster aircraft cruising speeds. Since the 1960s, however, passenger capacity and aircraft range have increased most significantly, although fuel efficiency and noise performance have also continued to improve.
- 2.42** Over the past fifty years, mostly due to the developments of engine and aircraft technology, the trend towards more fuel-efficient and quieter aircraft has continued, as shown in **Figures 2.5** and **2.6**.

Figure 2.5: Aircraft fuel efficiency has been steadily improving

Historical and forecast improvements in aircraft fuel efficiency, 1955-2015¹⁴



Source: International Energy Agency (2009), 'Transport, Energy and CO₂'

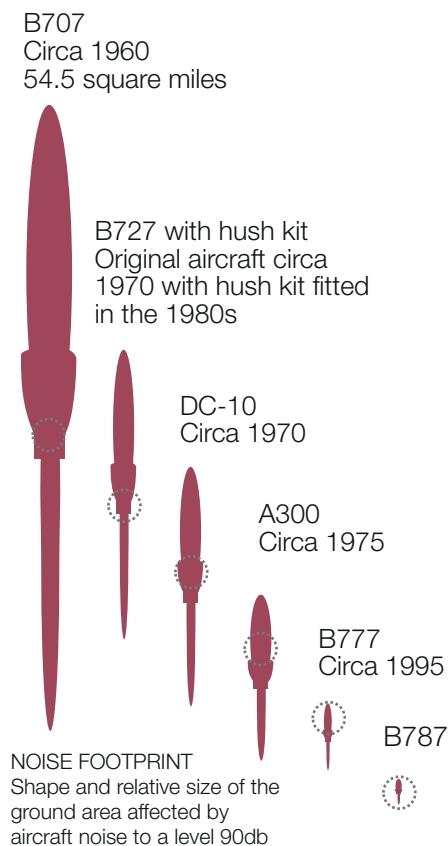
¹⁴ <http://www.iea.org/publications/freepublications/publication/name.3838,en.html>. Note: The range of points for each aircraft reflects varying configurations, connected dots show estimated trends for short and long-range aircraft

2.43 The improvements in noise performance have been accompanied by increases in flight numbers at many airports and therefore the overall effect for those living near airports may not be as significant as implied in **Figure 2.6**. Nevertheless, as shown in **Chapter 3**, an overall trend of reducing impacts can be discerned.

2.44 Passenger capacity and aircraft range have been increasing over time in each aircraft category – small, medium and large. In the short-haul market for small aircraft, the A320ceo and Boeing 737 families will gradually be replaced with a new generation of aircraft – A320neo and Boeing 737 MAX – that are quieter, more fuel efficient and will be able to fly greater distances. For example, the A320neo is about 15% more fuel efficient and has a range approximately 10% greater than its predecessor, the A320. The Boeing 737 MAX 8 that will replace the currently operated 737-800 is expected to deliver similar fuel-efficiency savings in relation to its predecessor as does the A320neo; its range is expected to be almost 1,000km greater than that of the 737-800.

Figure 2.6: The introduction of new aircraft is reducing aviation noise footprints

Reduction in aircraft noise over time¹⁵



Source: Australian Government (December 2008)

15 Geoffrey Thomas, Christine Forbes Smith, Guy Norris, Steve Creedy and Rachel Pepper, 'Plane Simple Truth', quoted by the Australian Government (Dec 2008), 'National Aviation Green Paper – Flight Path to the Future', http://www.infrastructure.gov.au/aviation/publications/pdf/Aviation_Green_Paper_final.pdf

- 2.45** The same trend can be observed in the market for medium- and long-haul aircraft. For example, the A350-800 is expected to take approximately 20 more passengers onboard which will be a significant capacity improvement in comparison to the A330-200 (A330-200 can take up to 253 passengers in a 3-class seating arrangement). It can also fly 2,000km further than its predecessor, a distance that is roughly equivalent to a flight between London and St Petersburg. The Boeing 787-8 Dreamliner is expected to fly between 3,000 and 4,000km further and take about 20 to 40 passengers more onboard than the 767-200ER and 767-300ER respectively. It is also expected to be about 20% more efficient than its predecessors.
- 2.46** But the global fleet of the future will on average be served with smaller planes. As Airbus' and Boeing's current order books show, the smaller, more fuel-efficient models are proving more popular with airlines than 'superjumbos', very large wide-bodied planes such as the Boeing 747-8I and the Airbus A380 that mostly serve the thickest routes, often from major hubs. Whereas there are only 143 current orders for A380s, 72 of which have been placed by the Middle Eastern carriers that specialise in intercontinental hubbing, there are 789 orders for A350s and 754 orders for Boeing 787s.
- 2.47** During the 2000s, Boeing prioritised the development of the 787, a mid-size, fuel-efficient aircraft. Airbus subsequently followed suit with the A350. Both carriers also invested in the development of the new generation of more fuel-efficient, short- and medium-haul aircraft with greater ranges – the A320neo and the Boeing 737 MAX. The 787 and A350 are more flexible than 'superjumbos', and are suitable for operation on spokes within hub-and-spoke networks, or on point-to-point routes. The increased range and greater efficiency of these aircraft are acting to reduce the scale of passenger demand needed to make long-haul routes commercially viable.
- 2.48** This may make it possible for some low-cost airlines to successfully enter the long-haul market. Although currently only 84 medium- and long-haul aircraft are on order by low-cost airlines, this is still a significant increase compared to the current fleet of around 60 medium- and large-sized aircraft operated by these airlines, and a clear sign that some low-cost carriers now consider it possible to succeed in this market.
- 2.49** The popularity of the A350 and Boeing 787 could therefore signal a decline in the importance of the hub-and-spoke model, as airlines become able to bypass hubs and operate more long-haul point-to-point services. Alternatively, aircraft like the B787 and A350 could ultimately reinforce the hub-and-spoke model, as their greater range brings more potential spokes within the reach of each hub.

Demand for air travel

2.50 The factors that are driving change in the global aviation industry, such as globalisation, technological progress, and the growth of economies like China and India, are also reshaping demand for the services it provides. Combined with changing consumer preferences and the development of alternatives to aviation, they are affecting both the air passenger and air freight markets.

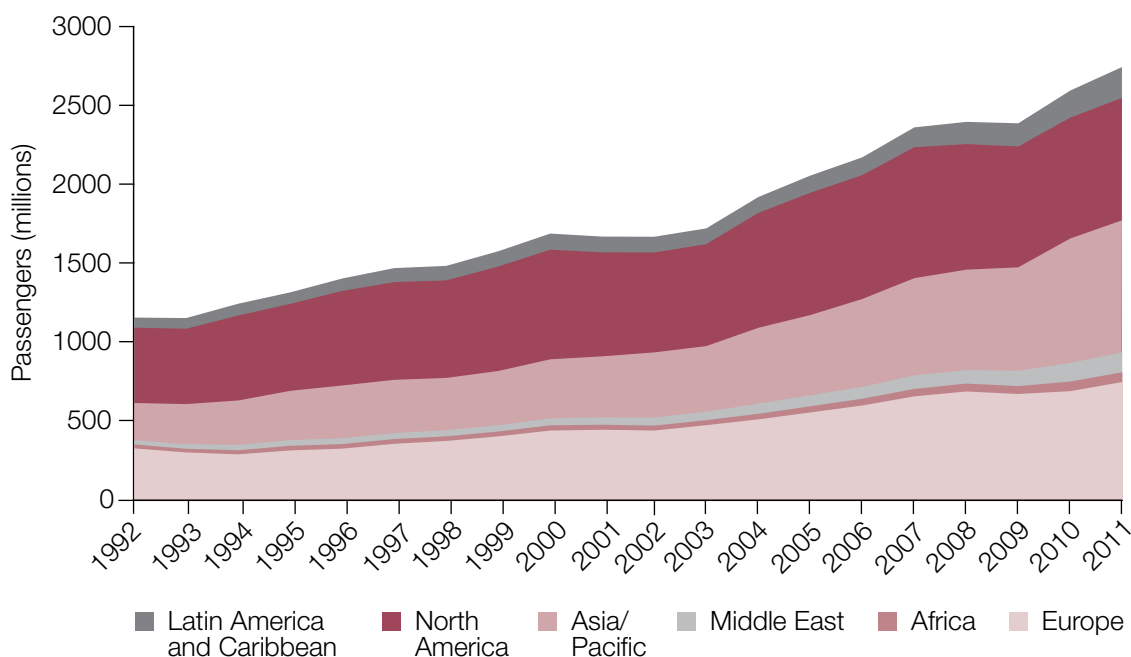
The air passenger market

2.51 Passenger demand for air travel has been on a persistent upward trend since the middle of the twentieth century, and has grown strongly since the 1970s. Despite some brief interruptions, for example during the first Gulf War, after 9/11, and during the recent economic downturn, the long-term upward trend is clear. It has been driven by economic growth, increasing affluence, and real-term reductions in air fares.

2.52 As **Figure 2.7** shows, demand growth is increasingly coming from emerging economies, particularly in the Asia-Pacific region. Countries like China, India and Indonesia are likely to see a significant boom in travel over the coming decades, as the size of their middle-class and affluent populations increases. For example, one recent study forecast that Chinese travellers will make 100 million outbound trips from China by 2020, compared to 36 million in 2010.¹⁶

Figure 2.7: The strongest growth in passenger demand has been in the Asia-Pacific region

Regional distribution of scheduled traffic – passengers carried, 1992 – 2011¹⁷



Source: ICAO

¹⁶ Boston Consulting Group (2012), 'Surviving the Squeeze – Winning Strategies for a Changing Airline Industry', p.4

¹⁷ Based on services of airlines of ICAO member states

- 2.53** The composition of passenger demand is also being affected by changes in the ways people live and work. Over the past decade, the EU aviation market has experienced a surge in demand for air travel to visit friends and relatives (VFR) as more people take advantage of increasing European integration to live, study and work outside of their country of origin. VFR travel could become an increasingly important market.
- 2.54** The low-cost airlines have been adept at exploiting these developments. The estimated seats available on direct flights between the UK and Poland have increased by around 4.8 million since 2002.¹⁸ In 2012 91% of these seats were available from airlines that are part of the European Low Fares Airline Association (ELFAA).

The air freight market

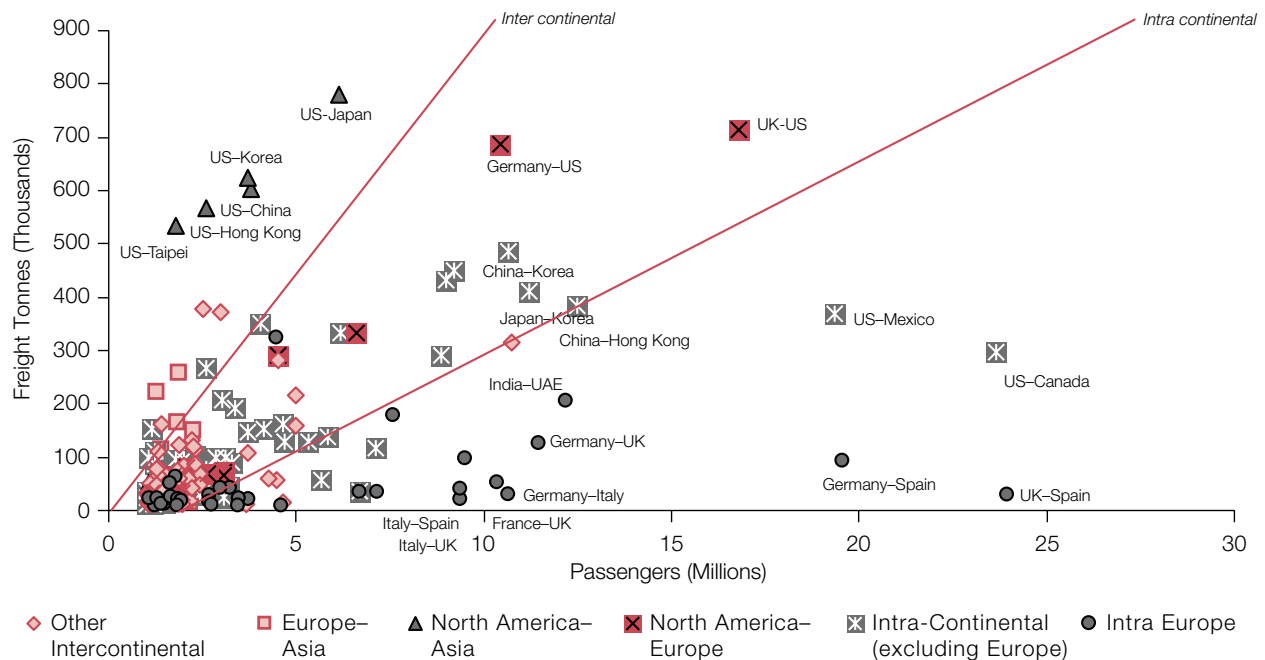
- 2.55** Historically the air freight market has grown at a similar rate to the passenger market. Around \$6.4 trillion of goods now travel by air each year, equating to around 35% of all world trade by value,¹⁹ though the past few years have been more difficult for the industry, as growth in international trade has slowed following the financial crisis.
- 2.56** As **Figure 2.8** shows, international air freight and air passenger flows are correlated, particularly on intercontinental routes. Where alternative modes of transport are available, the link is weaker. For example, the level of air freight between EU countries is lower relative to the number of passengers on these routes, given the availability of road transport.

¹⁸ Department for Transport analysis of CAA airport statistics

¹⁹ IATA (December 2013)

Figure 2.8: International air freight and passenger flows are correlated

Country by country passengers vs. freight volumes in 2012



Source: PwC analysis based on IATA Airline Industry Forecast 2013-17

2.57 Two distinct business models now operate within the freight sector. ‘Freight forwarders’ provide a link between freight customers and those with air freight capacity, typically full-service airlines which provide cargo capacity on long-haul passenger services, known as ‘belly hold’ freight. Some low-cost carriers, such as Air Asia, Norwegian Air Shuttle, and Southwest Airlines, run limited freight operations, but others such as easyJet and Ryanair prefer to avoid the additional complexity this would bring to their flight operations.

2.58 ‘Integrated air freight’ companies are dedicated logistics companies, such as FedEx, DHL, and UPS, that offer a complete end-to-end express delivery service.²⁰ In contrast to the forwarding model, integrated freighters typically control the entire logistics chain from collection to delivery. They tend to have an extensive surface transport network as well as an in-house fleet of dedicated freighter aircraft. They normally operate from dedicated freight hubs with more relaxed night flight regimes, such as Memphis and Louisville in the US and Brussels and Leipzig in Europe.

Alternatives to aviation

2.59 In the passenger market, there is potential for high-speed rail to be an attractive alternative to flying for many short-haul point-to-point routes, and it typically

20 Flightglobal (October 2013), ‘Airline Business Special Report, Cargo 2013’

captures a majority of the market on routes where the total rail journey time is no more than 3-4 hours. For example, on the London-Paris and London-Brussels routes, the Eurostar rail service has captured around 80% of the total rail/air market.

Chapter 4 discusses the impact of high-speed rail on forecast demand for aviation in the UK.

- 2.60** New communications technologies, such as videoconferencing, also offer alternatives to flying in the business sector. WWF-UK has carried out research and advised businesses on this issue.²¹ Their evidence suggests that some businesses are keen to cut back on flights and to use videoconferencing instead, as a cost-saving measure. This seems to have been catalysed by the recession, but in some cases there is evidence that the change in company behaviour may be permanent.
- 2.61** However, as the Committee on Climate Change and others have argued, the scope for videoconferencing to replace air travel should not be overstated.²² Face-to-face contact is likely to remain important in many business contexts, and the scope for videoconferencing to replace flights for leisure or for visiting friends and relatives is much more limited.
- 2.62** As 3D printing becomes more widely used, it could enable more localised production of some consumer goods, with potentially significant impacts on global supply chains. However, the nature of the products that are most reliant on air freight, such as machinery, pharmaceuticals and perishables, is such that 3D printing is unlikely to have a significant impact in the near future.

Aviation and the global climate

- 2.63** Aviation has a significant impact on the Earth's climate, through emissions of carbon dioxide (CO₂), nitrogen oxides (NO_x), water vapour, sulphates and soot, and through the formation of contrails and aircraft induced cirrus cloud. Globally, aviation accounts for around 1–2% of greenhouse gas (GHG) emissions, but is expected to make up a growing proportion of the total as other sectors decarbonise.
- 2.64** Aviation is harder to decarbonise than other sectors because of the lack of an obvious low-carbon alternative to aviation fuel (kerosene). In addition, the long service life of aircraft compared to most other vehicles means that it takes longer

21 WWF, 'One in Five Challenge', http://www.wwf.org.uk/how_you_can_help/get_your_business_involved/one_in_five_challenge/. For a similarly optimistic view of the potential for teleconferencing to reduce business travel, see Cairns (2010), 'Can teleconferencing reduce business travel'

22 CCC (2009), 'Meeting the UK aviation target', pp. 78-81. See also Mokhtarian (2009), 'If telecommunication is such a good substitute for travel, why does congestion continue to get worse?'

for new technologies to penetrate the aircraft fleet than, for example, surface vehicle fleets.

- 2.65** The Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report argues that total CO₂ from all anthropogenic sources would need to be limited to a cumulative budget of 1 trillion tonnes if the world is to have a 'likely' chance of limiting temperature rise to 2°C.²³ This is very unlikely to be achieved if aviation emissions are not controlled, so aviation is a crucial part of overall climate change policy.
- 2.66** The aviation industry itself recognises this. The International Air Transport Association (IATA), the trade association for the world's airlines, has adopted a set of targets to mitigate the climate impacts of aviation.²⁴ These include:
- an average improvement in fuel efficiency of 1.5% per year from 2009 to 2020;
 - a cap on net aviation CO₂ emissions from 2020 (carbon-neutral growth); and,
 - a reduction in net aviation CO₂ emissions of 50% by 2050, relative to 2005 levels.
- 2.67** Currently expected technological and operational improvements will help mitigate the climate impacts of aviation. Aircraft have become steadily more fuel-efficient over the past fifty years, but the historical rate of improvement in fuel efficiency has not been sufficient to offset the rate of growth in air travel, meaning that aviation emissions have been on a steady upward trajectory.
- 2.68** The industry has also been trialling alternative fuel sources. Biofuels are now officially certified for use up to 50% blend with conventional jet fuel. However, there are important sustainability concerns around large-scale biofuel use. The Committee on Climate Change (CCC) and others have highlighted that:
- lifecycle emissions savings from biofuels vary significantly depending on the production route, and can be reduced significantly where growth of biofuel feedstock results, directly or indirectly, in land-use change;
 - aviation will have to compete for scarce biofuels with other sectors such as road transport, shipping, household cooking and heating, and energy generation; and,
 - it is unclear whether sufficient land and water will be available for growing biofuel feedstock on a large scale, given projected population growth and rising living standards in developing countries.²⁵

23 IPCC, 'Fifth Assessment Report', <http://www.ipcc.ch/report/ar5/wg1/>

24 <http://www.iata.org/policy/environment/Pages/climate-change.aspx>

25 Committee on Climate Change (2009), 'Meeting the UK Aviation Target – options for reducing emissions to 2050', pp. 96-119

- 2.69** Because fuel-efficiency improvements and biofuels use will not be sufficient to tackle the climate effects of aviation, further measures will be necessary to address the remaining emissions gap, ideally through a global framework to control aviation emissions. Establishing such a framework has, however, proved challenging. For example, it is hard to strike an equitable balance between developed countries (which are responsible for the majority of aviation emissions to date) and developing countries (which will be responsible for an increasing share of future emissions).
- 2.70** In the past few years there have been some important steps towards a global agreement on aviation emissions through the European Union and at the International Civil Aviation Organisation (ICAO), although significant challenges remain as set out in **Box 2e**.

Box 2d: Towards an international framework to tackle aviation emissions

The International Civil Aviation Organization (ICAO), the United Nations agency responsible for aviation, has been debating options for a global market-based measure to tackle aviation emissions. Market-based measures could include emissions trading schemes or emissions offsetting. ICAO believes that such a measure would ensure that emissions reductions are delivered in the most cost-effective and flexible manner.

But progress towards a global market-based measure has been relatively slow. At its most recent summit in Montreal in September 2013, ICAO agreed to develop a global market-based measure, and member nations will report back in 2016 with proposals for a scheme that could be implemented by 2020. There are many obstacles still to overcome in these negotiations and success is not guaranteed.

In lieu of a global deal, the EU has included aviation emissions in its Emissions Trading System (EU ETS) since January 2012. The EU ETS is a cap-and-trade system, covering flights arriving at or departing from airports in the European Economic Area (EEA), irrespective of the nationality of the carrier. Tradable emissions allowances are issued up to the level of the cap, and allocated to market participants through a mixture of free allocations and auctions. The initial annual cap for aviation emissions has been set at 97% of average emissions between 2004 and 2006. From 2013 to 2020, it will be reduced to 95% of 2004–2006 emissions.

Box 2d: Continued

The ETS has provoked significant opposition from third-party states, including the United States, Russia, China and India. These countries argue that the ETS infringes their sovereignty (by covering non-EU airlines) and is extra-territorial (by including emissions outside EU airspace). Twenty-six nations have signed a declaration formally opposing the inclusion of aviation in the ETS, and several have directed their airlines not to comply with the ETS, or are contemplating doing so. As a result the ETS is currently in partial abeyance. The European Commission (EC) announced in November 2012 that it would ‘stop the clock’ on the enforcement of ETS obligations on flights between European airports²⁶ and the rest of the world, pending the outcome of negotiations at ICAO. Following the ICAO summit in September 2013, the EC has stated that it is assessing the ICAO decision in more detail before deciding on its next steps.

The future of the global aviation sector

2.71 The future development of the global aviation sector remains difficult to predict. Market liberalisation and technological change have fundamentally changed the structure of the industry. It is unclear whether the full impact of these changes has yet been felt. It is also uncertain whether the future will see these trends persist, stop, or perhaps even reverse.

2.72 There are a number of unanswered questions:

- will airline alliances, and the hub-and-spoke networks that they operate, remain central to the way the industry works? If so, how will they develop?
- if the hub-and-spoke model does remain central, will the Gulf carriers and Middle Eastern airports continue to grow and capture increasing market share?
- might a wider range of airports start to operate some form of hub, even where they lack a major hub carrier, for example through enabling passengers to ‘self-connect’ more easily?
- alternatively, will new aircraft such as the Boeing 787 and A350, with their greater ranges, make more long-haul destinations viable as point-to-point routes, resulting in a relative decline in the importance of hubs?

²⁶ Classified as the airports located in the European Economic Area (EEA), including for this purpose Croatia, Switzerland and the dependent territories of EEA States

- if long-haul point-to-point becomes more viable, could low-cost carriers start to move into this market, using the reduced fuel costs made possible by aircraft like the Boeing 787 and A350 to undercut the network carriers?
- will a global climate change scheme be agreed, and if so, what will be its impact on patterns of aviation demand?

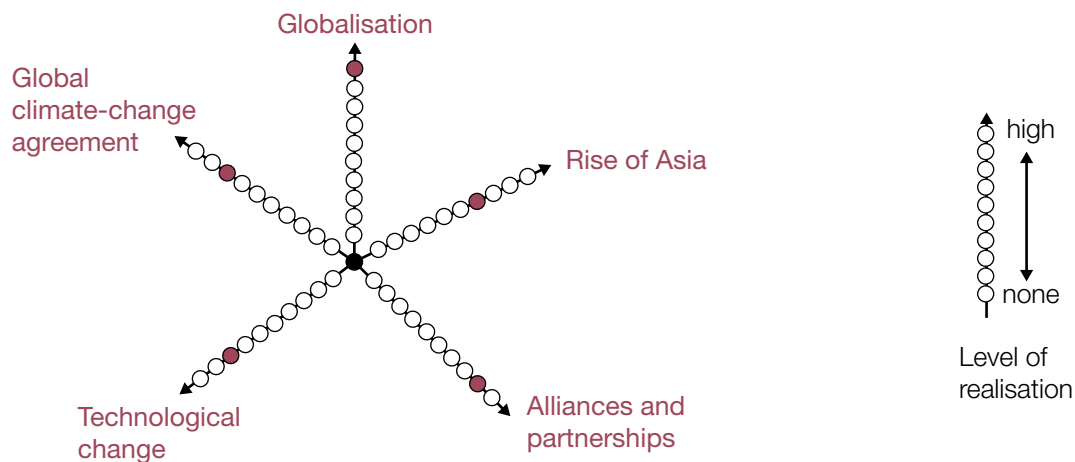
2.73 These uncertainties could have major implications for the nature and scale of airport capacity needed in the UK. To ensure that its analysis can take account of these uncertainties, the Commission has developed four scenarios for the future of the aviation sector. Each scenario has different implications for the respective market shares of hub-and-spoke and point-to-point networks, and for the participation of UK airports in global route networks.

2.74 The four scenarios have been developed by combining different assumptions in five key areas discussed in this Chapter:

- **Globalisation:** Will the liberalisation of the global economy, including the aviation sector, continue?
- **Rise of Asia:** How far will the world economy's centre of gravity shift from west to east?
- **Alliances and partnerships:** Will existing carriers and new market entrants cooperate, through alliances or partnerships, or will they compete with one another?
- **Technology:** Will the trend towards longer range, more fuel-efficient aircraft like the A350 and B787 continue?
- **Climate change agreement:** Will governments sign a global climate change agreement that levels the playing field between airlines?

Scenario A: Global growth

Hub-and-spoke dominates the aviation market; Europe within major global traffic flows



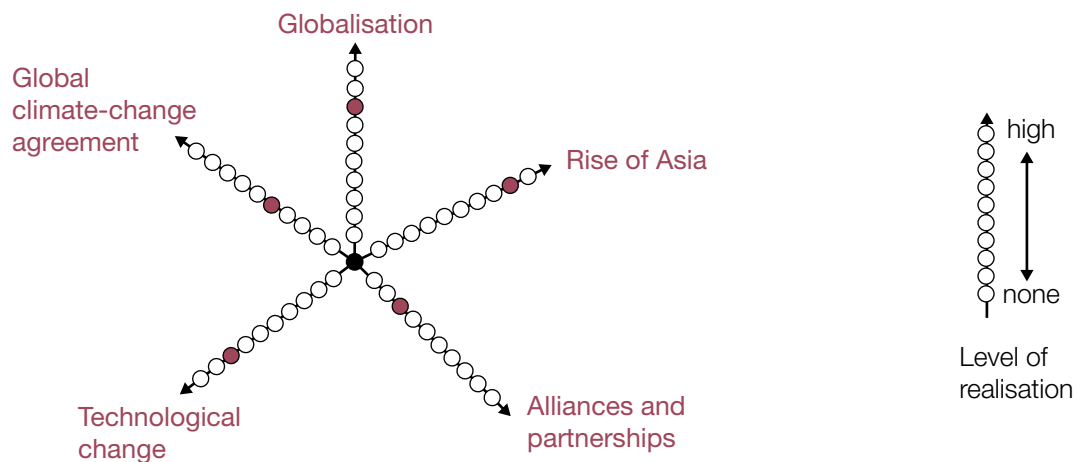
2.75 This scenario is characterised by strong economic growth in an increasingly global economy, with technology used successfully to mitigate climate change and other sustainability challenges. This results in continued rapid growth in aviation demand, with the role of major aviation hubs and airline alliances strengthened around the world.

2.76 For this scenario to materialise, the following need to happen:

- **Globalisation:** Continued liberalisation of the global economy, including in the aviation sector where countries sign a global Open skies agreement.
- **Rise of Asia:** Continued growth of middle-class and affluent populations in Asia, leading to strong demand growth, and strengthening the position of Far East aviation hubs and carriers.
- **Alliances and partnerships:** Alliances and partnerships between US, European and Asian carriers enhance the global hub network.
- **Technology:** Rapid growth in the new generation of fuel-efficient wide-bodied aircraft, A350s and Boeing 787 Dreamliners supports hub-and-spoke networks by providing more feeder routes into hubs.
- **Climate change agreement:** A global deal is signed that ensures a level playing field between airlines.

Scenario B: Relative decline of Europe

Hub-and-spoke dominates the aviation market; Europe outside major global traffic flows



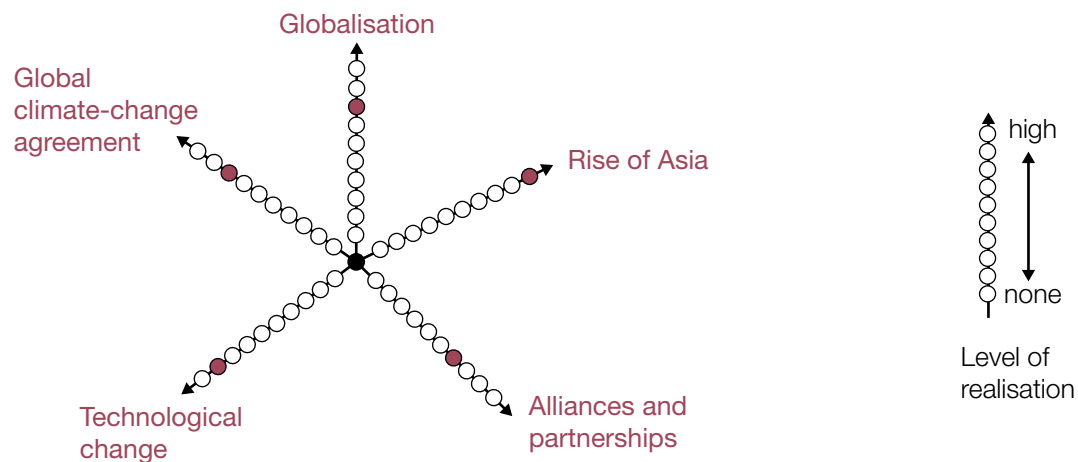
2.77 Scenario B also sees strong economic growth and increasing globalisation. However, this scenario is characterised by more aggressive airline competition, especially between legacy carriers and new market entrants from emerging economies. This results in a decline in the importance of European aviation hubs, as European airlines are frequently out-competed by Middle Eastern and Asian carriers.

2.78 For this scenario to materialise, the following need to happen:

- **Globalisation:** Continued liberalisation of the global economy, including in the aviation sector.
- **Rise of Asia:** Growth of middle class and affluent populations in Asia, leading to strong demand growth, and strengthening the position of Far East aviation hubs and carriers.
- **Alliances and partnerships:** Middle and Far Eastern carriers and airports develop a dominant role through aggressive competition and selective bilateral partnerships as the role of global alliances declines.
- **Technology:** New longer range aircraft like A350s and Boeing 787 Dreamliners enable Middle and Far Eastern carriers to bypass European hubs and fly directly to second-tier European airports.
- **Climate-change agreement:** Partial climate-change agreement that creates inequality between airlines in the developing and developed worlds.

Scenario C: Low-cost is king

Point-to-point dominates the aviation market; Europe within major global traffic flows



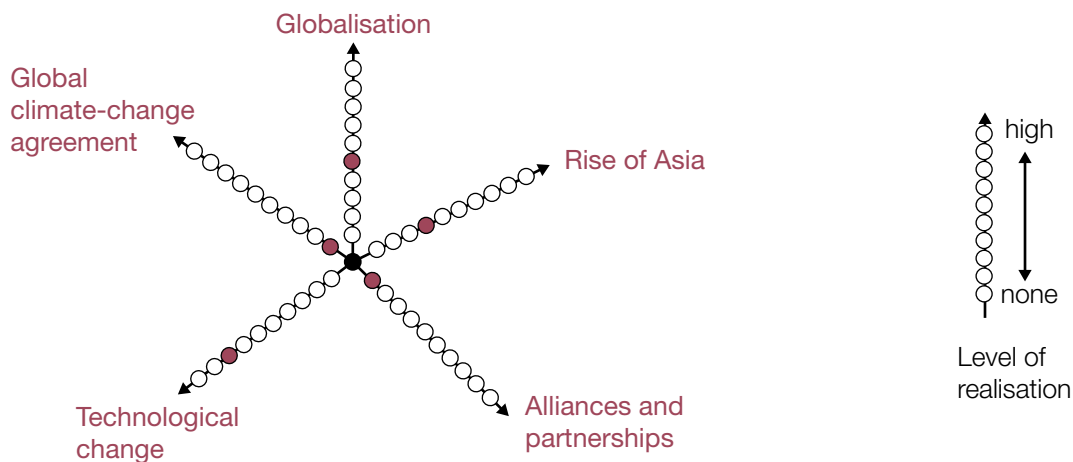
2.79 Scenario C sees a decline in the importance of hubs throughout the world as low-cost carriers move into the long-haul market and self-connecting becomes more common. By 2040, low-cost and charter airlines capture over 50% of the market, transforming the shape of the aviation sector.

2.80 For this scenario to materialise, the following need to happen:

- **Globalisation:** Continued liberalisation of the global economy, including in the aviation sector.
- **Rise of Asia:** Growth of Asian middle classes results in increase in price-sensitive leisure traffic, which increases the market-share of low-cost carriers at the expense of network airlines.
- **Alliances and partnerships:** Low-cost Asian carriers become key players in the global aviation sector, and they have few incentives to enter formal alliances.
- **Technology:** New longer range aircraft like A350s and Boeing 787 'Dreamliners' enable more people to fly point-to-point.
- **Climate change agreement:** Global climate-change agreement that levels the playing field between airlines.

Scenario D: Global fragmentation

Point-to-point dominates the aviation market; overall relative decline in global traffic flows



2.81 Scenario D involves a combination of pessimistic assumptions. The world faces a decline in global growth prospects and the fragmentation of the world economy, as the strong growth and liberalisation of the late 20th century increasingly looks like a one-off ‘blip’. Countries turn inwards, adopting more interventionist and protectionist policies. While technological developments keep on changing the airline industry, there is no political appetite for a global ‘Open Skies’ agreement or a global climate-change deal. This pessimistic scenario of stalled growth and hindered global governance results in a more negative outlook for the aviation market.

2.82 For this scenario to materialise, the following need to happen:

- **Globalisation:** Countries try to insulate themselves from the perceived ‘downsides’ of globalisation, such as volatile capital flows and mass migrations, by creating explicit or implicit barriers.
- **Rise of Asia:** Slowdown in growth prospects in Asia, as global markets suffer from a rise in protectionism.
- **Alliances and partnerships:** Airlines compete aggressively for a relatively smaller pool of passengers, resulting in the partial break-up of global alliances.
- **Technology:** New longer range aircraft like A350s and Boeing 787 Dreamliners enable more people to fly point-to-point.
- **Climate change agreement:** No global climate change agreement.

- 2.83** These scenarios are not comprehensive, but they do capture a number of the key uncertainties around the future of the aviation sector. Their implications for UK airports are discussed in **Chapter 4**, where the scenarios are used to test the Commission's conclusions on the UK's future airport capacity requirements.
- 2.84** The next Chapter discusses how UK airports operate at the moment. It provides a high-level overview of the structure of the UK airports sector, and considers how well UK airports have adapted to changes in global aviation.

Chapter 3

The UK airports sector

SUMMARY

The global developments described in **Chapter 2** have also driven significant changes in the UK aviation sector. The consolidation around major hubs has entrenched the dominance of the London aviation market and particularly Heathrow, the UK's largest airport, which is the main base for British Airways, the UK's sole network carrier. Meanwhile, successful and dynamic point-to-point carriers operate at other UK airports. This has made the UK the biggest aviation market in Europe, and London the largest OD market in the world.

Alongside the impact of global trends, developments at the national level are changing the UK aviation sector. These include the break up of BAA Ltd, the development of competition within the London airport system, and a new statutory framework reducing carbon emissions. Growth in demand for aviation has also been tempered by the economic downturn.

These developments were largely unforeseen by previous studies of airport capacity.

The one thing that has not changed significantly is the UK's physical airport infrastructure, and particularly runway capacity. The only new runways built over recent decades have been at London City and Manchester airports. The main London airports have benefited from new terminals, but are still reliant on runway capacity which was built in the middle of the twentieth century.

The industry has responded well both to the constraints of the existing infrastructure and to the new, more competitive environment. The largest UK airports operate their runway infrastructure more efficiently than any others in the world. The UK is still one of the best connected countries in the world. And competition between major airports may drive some further improvements over the coming years.

But problems are starting to emerge and are likely to get worse. Heathrow is effectively full. Gatwick is operating at more than 85% of its maximum capacity, and is completely full at peak times. Capacity constraints are making it more and more difficult for airports and airlines to operate efficiently, lay on new routes, and deal with resilience issues.

More intensive runway use also makes it harder to offer appropriate and predictable respite from noise for people living and working near airports.

The current approach of forcing ever greater volumes of traffic through the existing infrastructure, if continued, would also have increasingly detrimental effects on the national economy, businesses, and air passengers.

The Commission's analysis suggests that the costs of failing to address these issues could amount, over a sixty-year time period, to:

- £18-20 billion of costs to users and providers of airport infrastructure.
- £30-45 billion of costs to the wider economy.

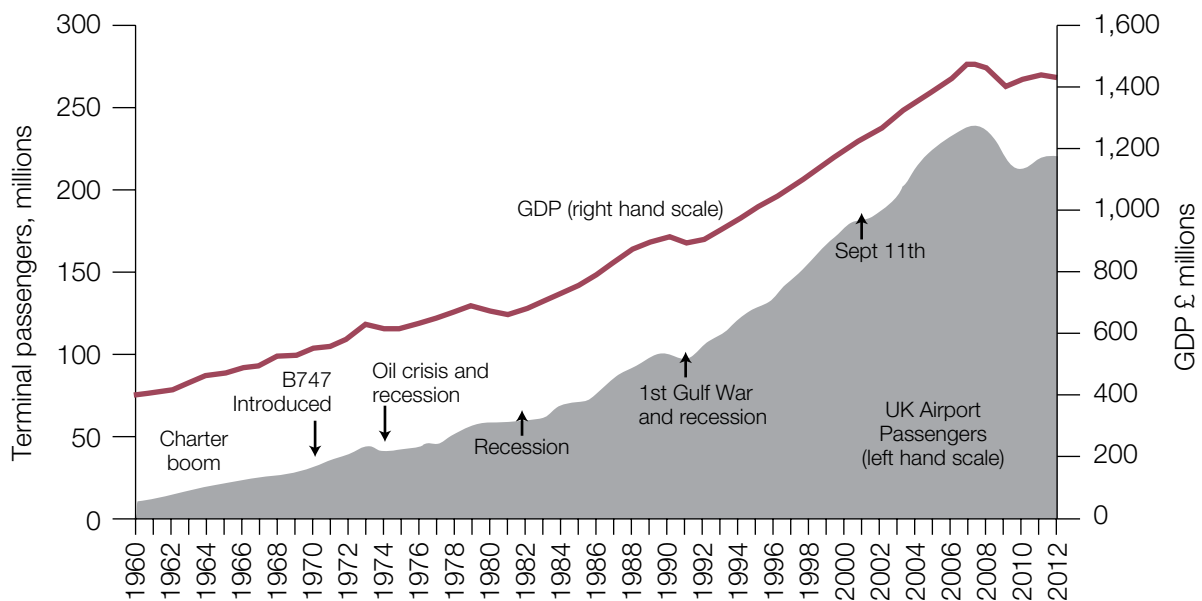
- 3.1** Since the *Future of Air Transport* White Paper was published in 2003, the UK airports sector has faced a number of significant challenges. These have been driven by broader developments in the global aviation sector, described in **Chapter 2**, but also by changes to the policy and regulatory environment in the UK.
- 3.2** This chapter looks at how well UK airports have adapted to these changes, and whether the UK is well-placed to maintain its position as Europe's leading international aviation hub.

The aviation market in the UK

- 3.3** Since the 1960s, UK air passenger demand has tended to rise in line with, and at times slightly faster than, economic growth. There was a sharp fall in aviation demand between 2007 and 2009 as a result of the economic downturn, but it has more recently returned to a pattern of growth. This is shown in **Figure 3.1**.

Figure 3.1: Historically passenger demand for aviation has risen in line with or faster than GDP since 1960

Terminal passengers at UK airports and GDP, 1960-2012

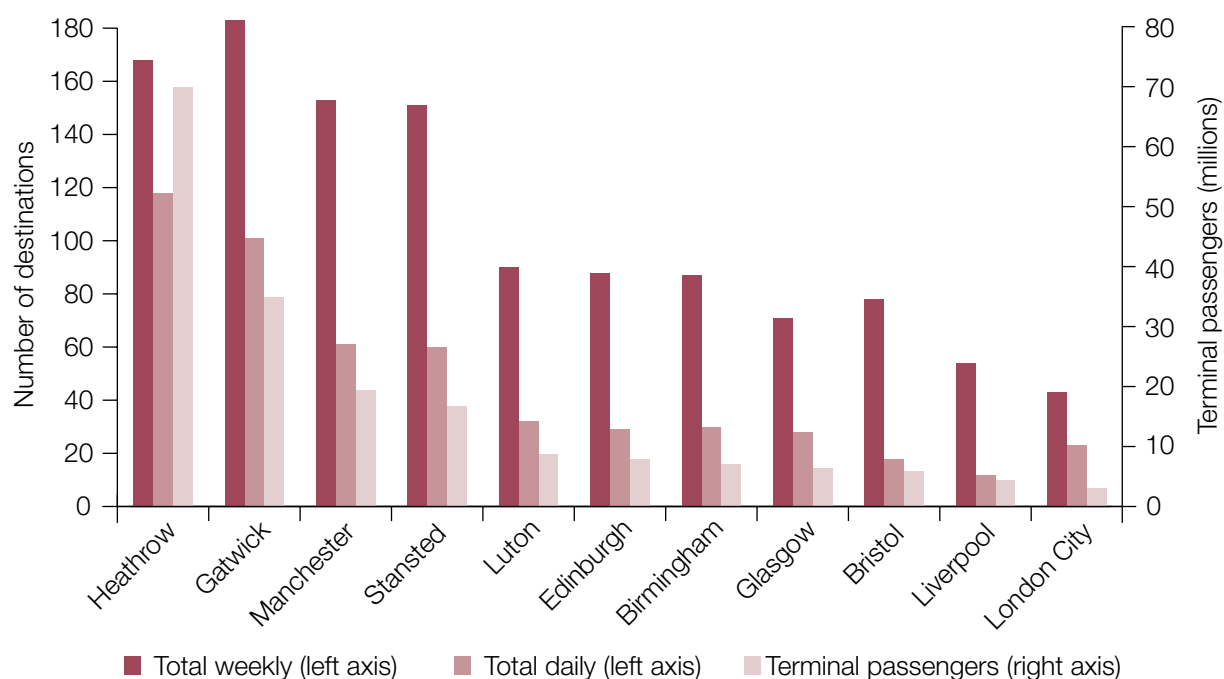


Source: DfT analysis based on CAA statistics and ONS data

- 3.4** While the focus of the aviation debate in the UK is often on passenger travel, the market for air freight is also significant to the UK aviation sector and wider economy. Both markets tend to have the same needs in terms of connectivity as 70% of cargo by volume is shipped in the belly hold of passenger aircraft.
- 3.5** These markets are served by a diverse range of airports, from a major alliance hub, through substantial low-cost carrier bases to small regional airports focusing on short-haul and domestic routes. Passenger demand is, however, highly concentrated on the four largest airports, which serve noticeably higher numbers of passengers and destinations than other UK airports, as seen in **Figure 3.2**.

Figure 3.2: The UK air travel market is highly concentrated at the country's four largest airports

Number of passengers and destinations served, selected airports in 2012²⁷



Source: DfT analysis based on CAA airport statistics

The role of the London airport system

3.6 Three of these four airports are within the London system. A number of factors contribute to this concentration of aviation services in London and the surrounding regions (South East and East of England):

- London and the South East are the most populous regions in England, each with more than 8 million inhabitants. The East of England is the fourth most populous (after the North West);²⁸
- these three regions contribute more than 40% of total UK GVA, and GVA per head in all three regions is higher than in any other part of England;²⁹
- the highest average incomes in the UK are also seen in these regions, with wages in London some 20% higher than the national average;³⁰

²⁷ Definition of a weekly service is at least 52 passenger flight departures to that destination in a year. Definition of a daily service is at least 362 passenger flight departures to that destination in a year.

²⁸ ONS (2012), 'Annual Mid-Year Population Estimates for England and Wales', Table 3, http://www.ons.gov.uk/ons/dcp171778_315456.pdf

²⁹ ONS (2013), 'Regional Gross Value Added (Income Approach) 2013', http://www.ons.gov.uk/ons/dcp171778_291684.pdf (NB: GVA per head in Scotland is slightly higher than in the East of England, but lower than in the South East or London.)

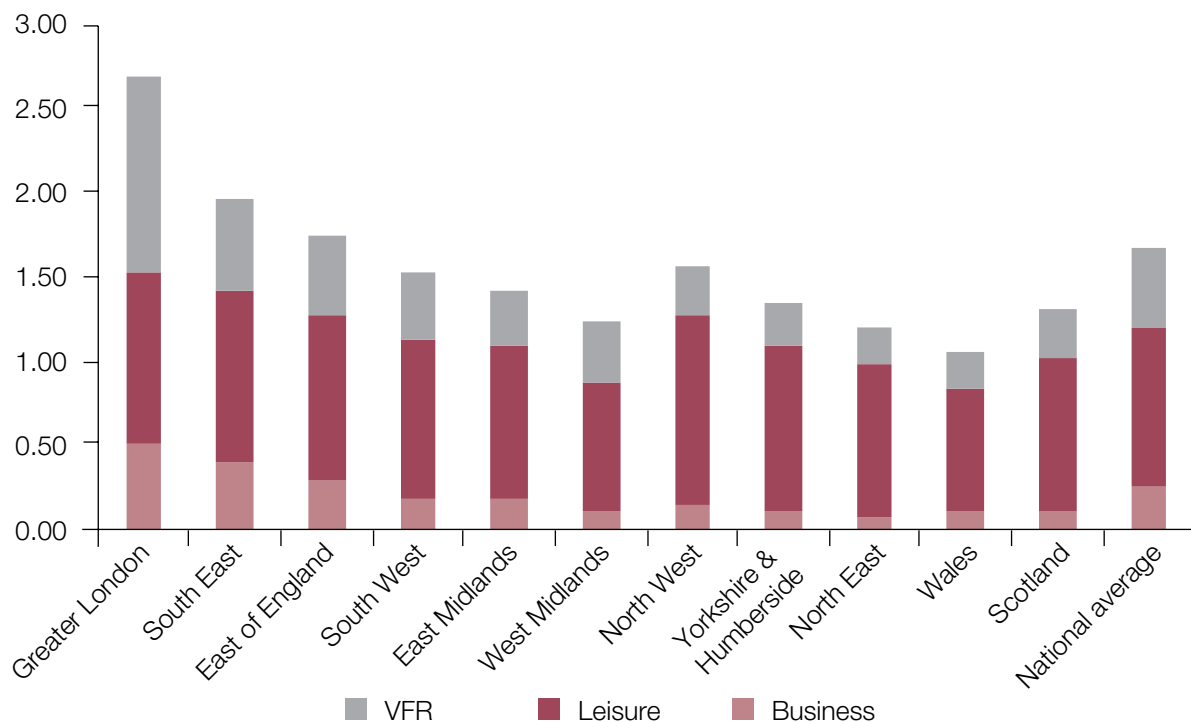
³⁰ Regional Economic Analysis, Changes in real earnings in the UK and London, 2002 to 2012, <http://www.ons.gov.uk/ons/rel/regional-trends/regional-economic-analysis/changes-in-real-earnings-in-the-uk-and-london--2002-to-2012/index.html>

- almost a quarter of London's population are non-UK nationals, compared to less than 10% for England as a whole;³¹ and
- more than a third of Londoners were born outside the UK.³²

3.7 As can be seen in **Figure 3.3**, the result is a higher propensity to fly in these regions than in the UK as a whole, with only the North West region also approaching the national average. This pattern is likely to be strengthened further in the future by the comparatively strong population growth forecast for London, where the population is predicted to rise from approximately 8 million currently to almost 10 million by 2031.³³

Figure 3.3: London has the highest propensity to fly across all the UK's regions

Passengers flying abroad per head, by UK region and purpose of travel (several years weighted to 2010 levels)



Source: DfT analysis based on CAA Passenger Survey and ONS population statistics

3.8 London is also a significant international business destination, with the fifth largest city economy in the world and an estimated GDP in 2012 of over £450 billion.³⁴ A recent study for the CAA found that London is considered the most important European destination by airlines, concluding that its '*potential strategic importance to airlines is*

31 ONS (2013), 'Population by Country of Birth and Nationality Report, August 2013'

http://www.ons.gov.uk/ons/dcp171776_324663.pdf

32 Census 2011

33 Greater London Authority (2012), 'Round Population Projections', <http://www.london.gov.uk/sites/default/files/Update%2005-2013%20GLA%202012%20round%20population%20projections.pdf>

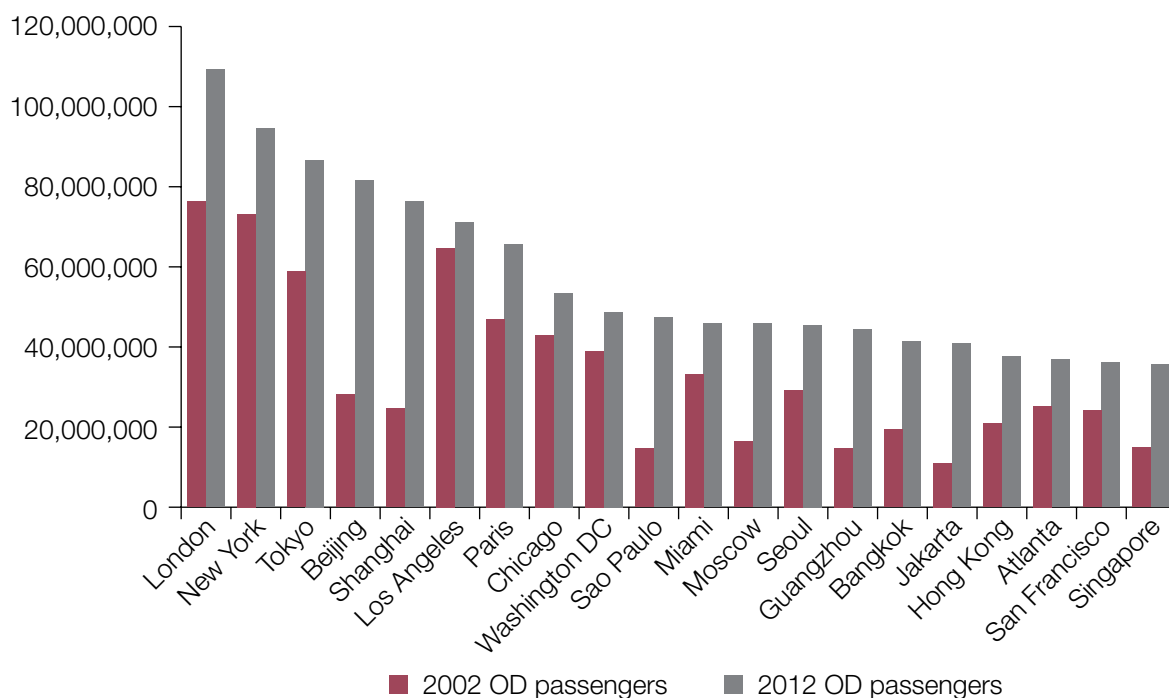
34 Global Metro Monitor (2012), 'Slowdown, Recovery, and Interdependence Research', Appendix 2, <http://www.brookings.edu/research/reports/2012/11/30-global-metro-monitor>

expected to persist if not increase’ and that ‘it is unlikely that the combination of volume and value that defines London can be replicated elsewhere.’³⁵

3.9 These factors have contributed to London continuing to accommodate the largest OD aviation market in the world, despite increasing competition from Chinese and other emerging market cities, as shown in **Figure 3.4**.

Figure 3.4: London still retains the biggest OD market in the world

20 biggest OD markets in the world in 2012; 2002 and 2012 figures



Source: PwC analysis based on Sabre ADI

3.10 The size of the London market enables the London airport system to play a crucial national role, supporting a much denser network of routes for UK passengers and businesses than can be provided elsewhere in the country. Survey evidence compiled by the Institute of Directors shows that Heathrow is the most regularly used airport for business travel amongst its members in seven out of twelve UK regions, and either the second or third most regularly used in all of the others.³⁶

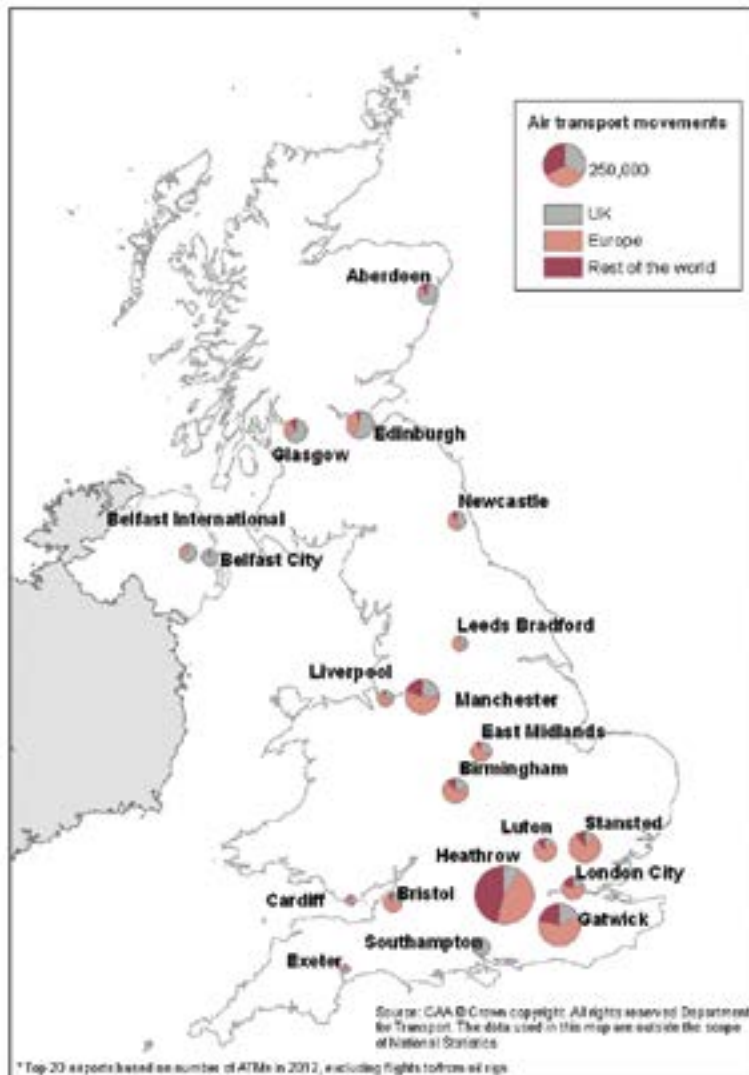
3.11 The role played by London airports is particularly important for long-haul connectivity. Although all of the UK's major conurbations are served by one or more airports, long-haul routes, whose higher cost base requires a greater concentration of demand, are focused heavily on the London airport system, and particularly at Heathrow, as **Figure 3.5** shows.

³⁵ CAA (October 2013), 'The Strategic Importance of London to Airlines', <http://www.caa.co.uk/docs/78/rpt%20strategic%20importance%20of%20London%20final.pdf>

³⁶ Institute of Directors (2012), 'Infrastructure for Business: Flying into the Future', p.56

Figure 3.5: London airports play a crucial role in providing long-haul connectivity

20 biggest UK airports by ATMs, 2012



Source: DfT analysis based on CAA airports statistics

Heathrow Airport – consolidation at a single hub

3.12 For many decades, Heathrow has been the UK's busiest airport and the main base for British Airways, the country's sole network carrier. The trend towards consolidation and partnership outlined in the previous chapter has reinforced Heathrow's position as the UK's most important international gateway for both aviation passengers and freight. Key developments have included:

- **The end of British Airways' dual hub operation.** British Airways operated hubs at both Heathrow and Gatwick throughout the 1990s, but following a fall in aviation demand in the early 2000s reversed that strategy in 2002. Since then, BA has continued to reinforce its hub network at Heathrow, with long-haul

services at Gatwick being focused primarily on point-to-point leisure markets.³⁷ BA's subsequent withdrawal from Birmingham Airport has further strengthened this consolidation.

- **The introduction of the EU-US 'Open Skies' agreement.** This agreement, discussed in more detail in **Chapter 2**, ended the previous bilateral arrangement, which only allowed two US carriers to operate at Heathrow. Four additional US airlines moved services from Gatwick to Heathrow as a result.
- **Consolidation of alliance operations.** Heathrow Airport Ltd's investment programme has enabled each of the three aviation alliances to strengthen the concentration of their operations in a single terminal. The majority of British Airways' services are now operated from Terminal 5. Star Alliance members will be based in the new Terminal 2 when it opens and SkyTeam airlines are based in Terminal 4. This is being accompanied by significant investment on the part of the alliances in dedicated facilities at their 'home' terminals.

- 3.13** As a result of this consolidation, the vast majority of transfer passengers using UK airports now pass through Heathrow. Although they are not as high a proportion of total traffic as at Frankfurt or Amsterdam Schiphol, transfer passengers are vital to maintaining the strength of the airport's route network. Analysis carried out by the Commission suggests that most of these transfers take place within alliances, a trend which may be reinforced by the consolidation of operations.
- 3.14** Approximately a quarter of flights at Heathrow carry more than 40% transfer passengers, including routes to key emerging markets destinations such as Hyderabad, Mexico City and Buenos Aires, as well as a number of North American cities.³⁸
- 3.15** The increasing concentration of long-haul and network services has driven ongoing growth in passenger numbers at Heathrow (interrupted during the economic downturn by a 2% reduction between 2007 and 2009) and the continuing operation of the airport's two runways at close to the 480,000 air traffic movements limit specified in Heathrow's 'planning cap'.
- 3.16** In contrast, other European hub airports continue to operate with substantial spare runway capacity available. This can however be overstated – for example, Amsterdam Schiphol has six runways, but is in practice generally able to operate only three at a time and is itself subject to a planning cap of 510,000 movements by 2020.
- 3.17** With Heathrow effectively full, airlines operating there have tried to get the highest return from the limited capacity available. They have done this by concentrating on

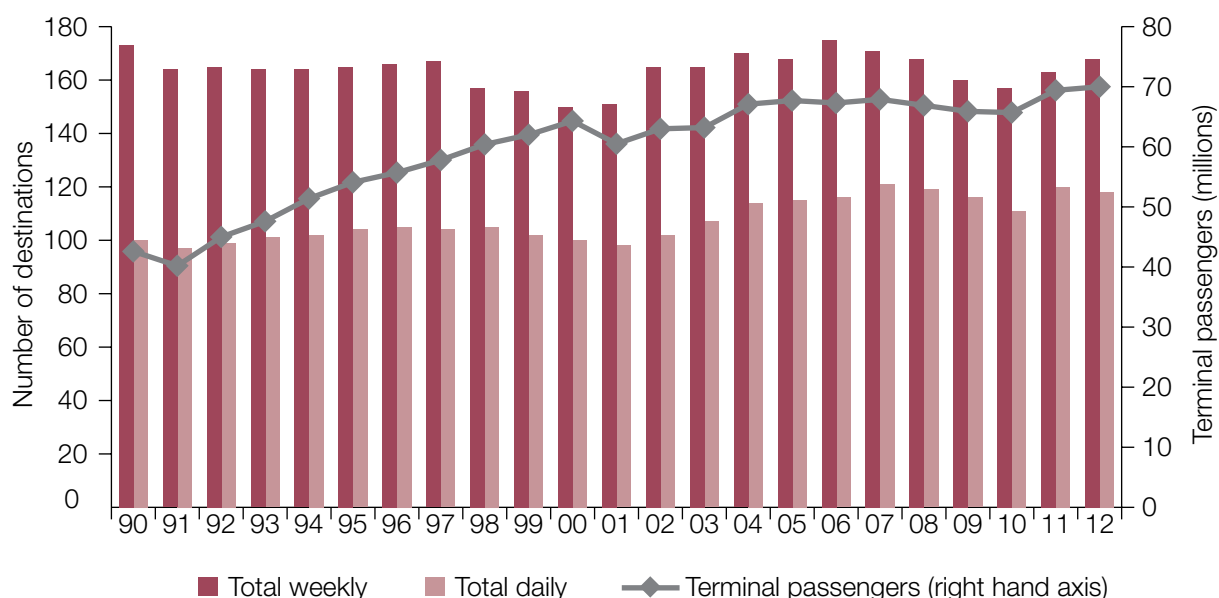
³⁷ CAA (2008), 'Connecting Passengers at UK Airports', paragraph 2.9

³⁸ Commission analysis of data taken from Sabre Airport Data Intelligence

the thickest routes. This has led to service frequencies gradually increasing but the total number of destinations served each week remaining broadly constant over time, as shown in **Figure 3.6**.

Figure 3.6: At Heathrow passenger numbers and service frequencies have increased but the numbers of overall destinations served have remained roughly constant

Number of passengers and destinations served at Heathrow, 1990-2012³⁹



Source: DfT analysis based on CAA airport statistics

3.18 The attractiveness of Heathrow to airlines is in part driven by its high yields compared to other London airports. In 2012, airlines operating out of Heathrow earned approximately 21 US cents per passenger mile on average. In contrast, the average yield at Stansted was approximately 15 cents per passenger mile and at Gatwick just under 10 cents.⁴⁰ Even allowing for the difficulty and cost of acquiring slots at Heathrow (the value of a slot pair is estimated at roughly £25-30 million⁴¹) and its higher charges compared to other London airports, this makes it commercially attractive to many airlines. This is further underlined by the high number of business and first class passengers using Heathrow compared to all other UK airports.

³⁹ Definition of a weekly service is at least 52 passenger flight departures to that destination in a year. Definition of a daily service is at least 362 passenger flight departures in a year to that destination

⁴⁰ Commission analysis of data taken from Sabre ADI

⁴¹ Deloitte (2008), 'Open Skies – Open for Business', [http://www.deloitte.com/assets/Dcom-UnitedKingdom/Local%20Assets/Documents/UK_THL_OpenforSkiesOpenForBusiness_May08\(2\)!!1!!..pdf](http://www.deloitte.com/assets/Dcom-UnitedKingdom/Local%20Assets/Documents/UK_THL_OpenforSkiesOpenForBusiness_May08(2)!!1!!..pdf) (N.B. It should be noted that this is higher than the price implied by IAG's £172.5 million purchase of BMI in 2012, which saw them acquire 42 slot pairs)

- 3.19** Heathrow is also by far the largest UK freight airport, accounting for 64% of the UK total air freight by volume.⁴²

Box 3a: Air freight in the UK

In 2012, 2.3 million tonnes of cargo were transport through UK airports. Heathrow dominates air freight activity, due to its connectivity and availability of direct cargo links to intercontinental destinations. It accounts for 1.5 million tonnes of air freight, 95% of which is carried as belly hold. The second busiest cargo airport was East Midlands with 264,000 tonnes (11% of total UK freight tonnes) most of which was carried by dedicated freighters (rather than belly hold), and dominated by freight forwarding and express services.⁴³

UK-Asia and UK-East Africa routes have the highest freight content, by weight, relative to passengers, both routes with high levels of machinery and transport equipment, and the UK-East Africa route also featuring perishables. Other routes, such as the UK-North America are thick freight and passenger routes. The value of these thick freight routes are derived through the relatively high value of the goods transported, particularly in relation to UK exports. These tend to be focused on high value manufacturing, pharmaceuticals and luxury goods, all of which require fast, reliable transportation over long distances, which only air freight can offer.

While the largest global air freight market players are the express carriers, FedEx and UPS (dominated by business mail and parcels), the UK air freight market is dominated by belly hold cargo at Heathrow. This has led to a buoyant ‘freight forwarder’ market, taking advantage of the connectivity offered by the UK’s passenger services. This, according to the industry, has lead to a “passengers lead, freight follows” business model in the UK. BA, the UK’s largest freight carrier, derives only 7% of its revenue from cargo with the majority derived through passenger services. However, this additional revenue can be the difference between a loss-making/profit making route.⁴⁴ The “passenger leads, freight follows” business model is further evidenced by a fall in freight volumes at Gatwick Airport since 2008, which coincided with a consolidation of US and other long haul flights to Heathrow. As the Gatwick long-haul services reduced, they were replaced by an increase in LCC operations – which tend not to offer freight services.

42 CAA Airport Statistics, http://www.caa.co.uk/docs/80/airport_data/2012Annual/Table_13_1_Freight_by_Type_and_Nat_of_Operator_2012.pdf

43 CAA Airport Statistics

44 *Flightglobal*, Cargo 2013 report

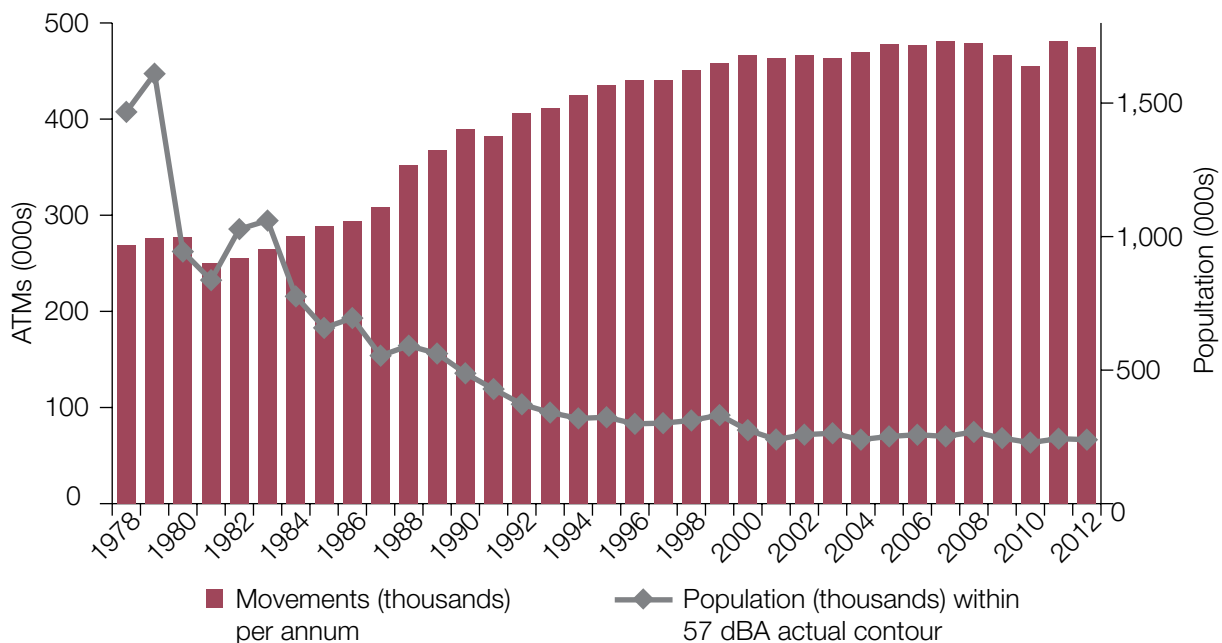
3.20 An additional important factor in Heathrow's attractiveness for airlines and passengers is its location close to central London. Heathrow's location has strongly affected the economic profile of the city, acting as a strong magnet for businesses along the M4 corridor stretching from central London to Reading and Slough.

3.21 The downside of Heathrow's proximity to central London is the number of people affected by the day-to-day running of the airport, and in particular by aviation noise. These impacts have led to significant opposition to any further expansion of runway capacity at Heathrow, including to changes in the way the airport operates. Despite the use of complex operating procedures to reduce noise impacts and provide regular periods of respite for communities living around the airport, more people are affected by aviation noise around Heathrow than around the other four major European hubs – Amsterdam, Paris, Madrid and Frankfurt – combined.

3.22 But this does not mean that noise from Heathrow has been affecting more and more people over time. On the contrary, a continuous rise of air traffic movements at the airport has been accompanied with a steady fall of numbers of people who live within the $57L_{Aeq}^{45}$ contour, the standard UK metric for assessing aviation noise impacts, as shown in **Figure 3.7**.

Figure 3.7: The number of people living within Heathrow's $57L_{Aeq}$ contour has fallen significantly despite higher numbers of air traffic movements

Numbers of people living within the $57L_{Aeq}$ contour and the numbers of air traffic movements



Source: CAA

45 Throughout this report all references to $57L_{Aeq}$ contours refer to $57L_{Aeq16h}^{45}$ unless otherwise stated

- 3.23** This inverse relationship between the numbers of aircraft using Heathrow and the numbers of people affected by significant levels of noise living within its $57L_{Aeq}$ contour is mostly due to improved aircraft technologies, and also to takeoff and landing procedures designed to minimise noise impacts.
- 3.24** The dramatic fall in the numbers of people living within Heathrow's $57L_{Aeq}$ contour between the early 1980s and early 1990s was due to the retirement of the first generation of jet aircraft, notably the Hawker Siddeley Trident (retired at the end of 1985) and Boeing 707 (retired by BA in late 1984) as they used to make up a large part of BA's fleet. Another very noisy aircraft, the Vickers VC-10, was retired by BA in 1981, and in 2003 Concorde services were discontinued.
- 3.25** Although this trend has slowed significantly over the last decade, further reductions in noise impacts can be expected over the coming years as a new generation of planes, including both wide-bodied aircraft such as the Boeing 787 and A350 and narrow-bodied jets such as the A320neo and Boeing 737 MAX, are introduced. But the changes may not be as dramatic as those seen in the 1980s and 1990s.
- 3.26** The Commission is aware of the effect that aviation noise can have on people who live and work near airports. **Box 3b** sets out the Commission's work to date on noise and the approach it will be taking to this issue in the next phase of its work.

Box 3b: Aviation noise

The Commission looked in depth at the issue of aviation noise in its *Aviation Noise* discussion paper, published in July 2013. The paper outlined the noise situation at the UK's airports and how it compared with other international airports. It also explored different ways of measuring noise and its impacts, and considered potential noise mitigation techniques.

The paper generated a strong response, eliciting over 400 replies from airports, local councils, campaigners, members of the public, politicians, acoustic specialists and others. These responses outlined the importance of measuring noise impacts accurately, and of evaluating its effects transparently. The responses also made clear to the Commission the strength of feeling of those living under flight paths. The paper and all technical responses to it can be viewed in full on the Commission's website, alongside a summary of the non-technical responses submitted.

Respondents to the paper made it clear that there are a number of credible metrics to measure noise and its effects, and that a comprehensive noise assessment should employ a range of them, which is the Commission's intention. In January 2014 the Commission will publish its draft *Appraisal Framework*, setting out in detail its suggestion for how these assessments should be undertaken in relation to the short-listed proposals for airport expansion.

Respondents also agreed that aviation noise has the potential to damage the health and quality of life of those exposed to it. A number of respondents testified that living under a flight path can cause annoyance, adverse health and, at times, deep unhappiness. The Commission wishes to account fully for the negative impact that aviation noise can have on quality of life, and to consider it alongside the more positive impacts on quality of life that an airport may have on its surrounding population. Further analysis of these topics will be undertaken in the second phase of the Commission's work.

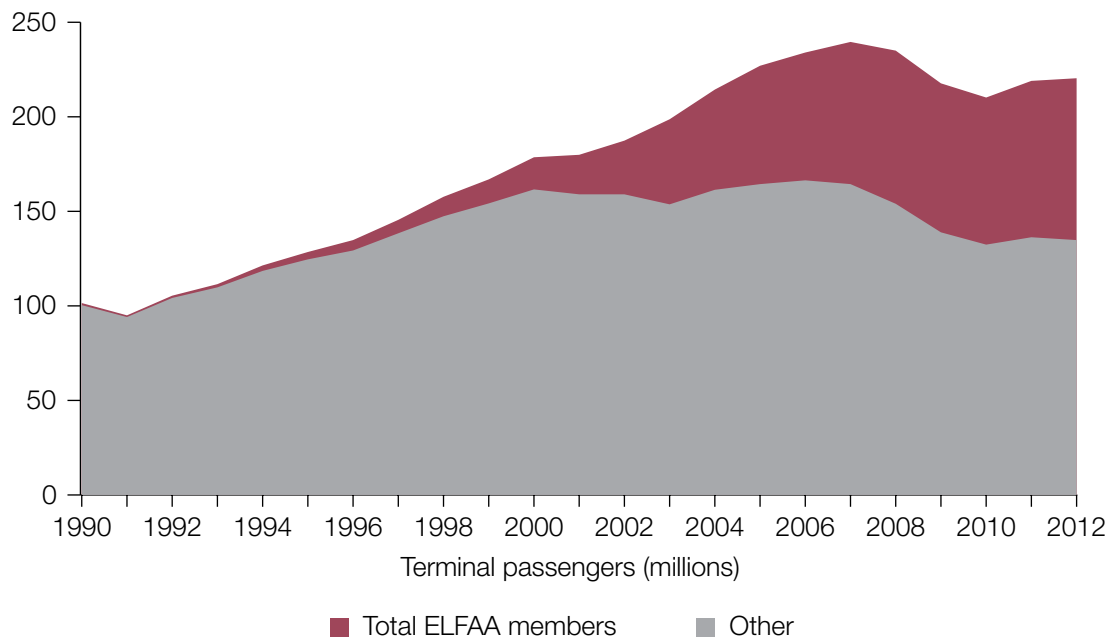
Further discussion on the Commission's *Aviation Noise* discussion paper is located in **Chapter 5**.

The impact of new market entrants

- 3.27** As BA's services have consolidated at Heathrow, and capacity constraints have seen the scale of Heathrow's route network remain static, a range of new carriers have entered the market at other London airports and across the UK, establishing entirely new routes or competing directly against services offered by legacy carriers. This reflects the global trend towards increased competition and the development of substantial point-to-point networks, outlined in **Chapter 2**.
- 3.28** Since the early 1990s the low-cost sector has seen significant growth in the UK, the pace of which has for several years outstripped that seen in other sectors of the market. **Figure 3.8** shows the scale of UK growth achieved by ten European low-cost airlines,⁴⁶ all of which are members of the European Low Fares Airline Association (ELFAA), compared to the wider aviation market. The sector now accounts for almost 40% of UK passenger journeys.

Figure 3.8 The most significant growth in demand over recent years has been seen in the low-cost sector

Passengers at UK airports by ELFAA membership, 1990-2012



Source: DfT analysis based on CAA airport statistics

⁴⁶ The low-cost airlines are easyJet, flybe, Jet2.com, Norwegian Air Shuttle, Ryanair, Sverige Flyg, transavia.com, Vueling, Volotea and Wizz Air

- 3.29** This rapid growth has seen easyJet and Ryanair grow into two of the world's ten largest airlines by international passenger numbers, with major bases at Gatwick and Stansted respectively, and routes established at a large number of airports across the UK. Flybe and Jet2 have also seen substantial passenger growth, serving approximately 10 million and 5 million passengers respectively in 2012, mainly out of the UK's regional airports.
- 3.30** The UK's low-cost network is not restricted to the leisure market. Low-cost airlines also provide links for foreign workers to their home countries, particularly in the European Union, and routes from UK regional airports to European business destinations and hub airports. In 2012, around 40% of passengers flying with low-cost airlines from UK airports were visiting friends or relatives abroad. Also, around one fifth of passengers flying low-cost from big UK airports like Gatwick, Manchester and Birmingham were business travellers.⁴⁷
- 3.31** Low-cost carriers have also established a number of domestic routes to London airports other than Heathrow, enabling both improved access to the capital and opportunities to self-connect to onward flights. For example, in 2011, 27% of Flybe passengers into Gatwick self-connected to another service.⁴⁸
- 3.32** The impact of the Gulf carriers on the UK market has also been substantial. Not only have they established high frequency routes into Heathrow, which have seen Dubai grow into the airport's second largest passenger market after New York JFK, but they have also opened new services from a number of UK regional airports. Emirates now serves Birmingham, Glasgow, Manchester and Newcastle, as well as Heathrow and Gatwick. Both Etihad and Qatar offer services from Manchester and Heathrow. The substantial onward route networks available from these airlines' hubs, particularly to South Asian and Far Eastern destinations, have opened up many new opportunities for long-haul travel from Manchester and other regional airports.
- 3.33** The impact of the low-cost airlines and Gulf carriers on UK regional connectivity to destinations outside Western Europe has been transformational. This is reflected in **Figure 3.9**: in 2003 there were no services to African destinations from regional airports, but by 2013 more than 1 million seats per annum were available.

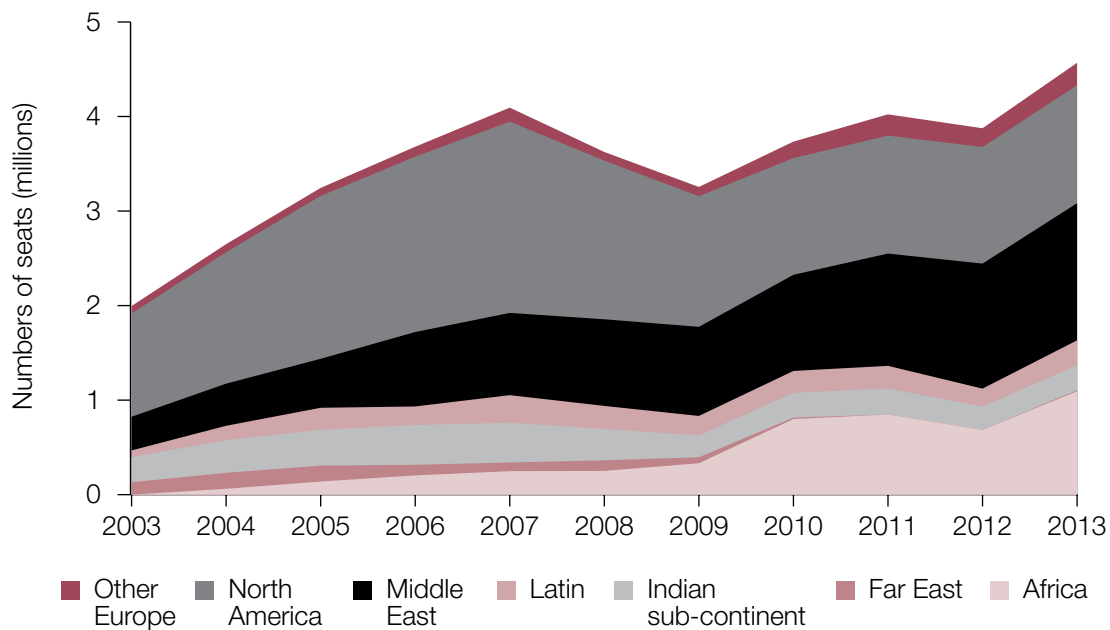
47 Commission's analysis of ELFAA data (2012) for Gatwick, Stansted, Luton, Manchester, Birmingham, Bristol, Cardiff, East Midlands, and Exeter, taken from 'Passengers travelling on ELFAA member airlines at selected airports'

48 CAA (2011), 'Passenger Survey'

3.34 Over the same period, capacity to the Middle East rose from approximately 350,000 seats per annum to almost 1.5 million. Capacity to North America and South Asia has declined since 2007, but even allowing for this the number of seats offered from regional airports to destinations outside of Western Europe stands at some 500,000 above the pre-recession peak.

Figure 3.9: The last decade has seen a significant increase in capacity from UK regional airports to destinations outside Europe

Number of seats from non-London airports to destinations outside Western Europe, 2003-2013⁴⁹



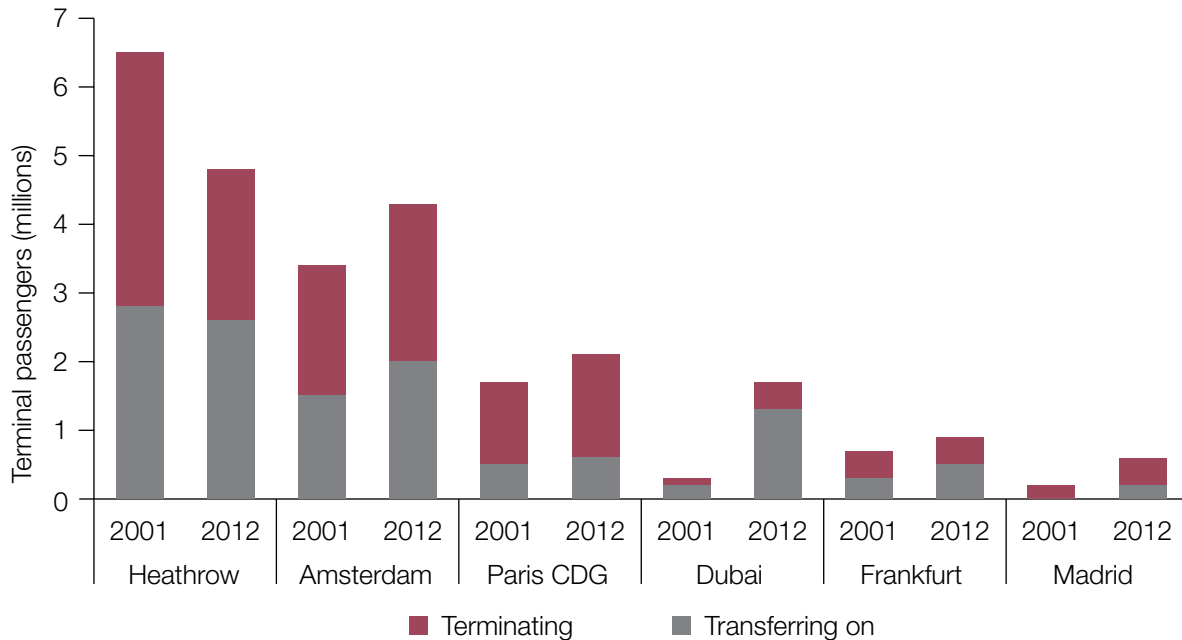
Source: CAA analysis based on OAG data

3.35 These developments have also created new connecting opportunities for passengers from UK regions. As can be seen in **Figure 3.10**, while a larger number of UK passengers still fly to Heathrow than to any other hub their numbers declined, particularly for terminating but also for transferring passengers. In contrast, the other European hub airports and Dubai have all seen growing demand over the same period.

49 CAA Analysis of Official Airline Guide (OAG) data

Figure 3.10: Increasing numbers of passengers from UK regional airports are connecting through hubs other than Heathrow

Estimated number of passengers flying between non-London airports and hubs and terminating or transferring at the hub, 2001 and 2012



Source: DfT analysis based on CAA airport statistics

The changing UK policy context

3.36 Alongside these developments in the global aviation sector, a number of recent changes at the national level have also affected UK airports.

Enhanced competition

3.37 Potentially the most important change has been the fundamental shift in the sector's competitive landscape as a result of the Competition Commission's March 2009 decision to require BAA Ltd to sell a number of its airports. This decision led to the sale of Gatwick Airport to Global Infrastructure Partners (GIP) in October of the same year. This was followed in February 2013, after BAA had abandoned a long-running attempt to challenge the decision in the Courts, by Manchester Airport Group's purchase of Stansted Airport.

3.38 The level of private sector ownership of UK airports was already unusually high prior to the break up of BAA Ltd. The privatisation of the British Airports Authority in July 1987 had seen the three largest London airports, together with Glasgow, Edinburgh, Aberdeen and Southampton airports, become privately owned. The pattern of ownership at other airports varies. Manchester Airport Group remains

majority publicly owned, for example, and 49% of shares in Birmingham Airport are local authority owned (with a further 2.5% owned by the airport's employees). Many other airports are fully private sector enterprises, for example: Peel Holdings fully owns both Liverpool John Lennon Airport and Robin Hood Airport.

- 3.39** The sale of Gatwick and Stansted created a unique competitive environment in the London and South East aviation market. As set out in **Box 3c**, while there are a range of ownership models across the world, fully private sector ownership is still rare.

Box 3c: Ownership of major international airports

- The City of New York owns JFK and LaGuardia Airports, and Newark International is owned by the City of Newark. All three airports, as well as a number of smaller aviation facilities, are operated by the Port Authority of New York and New Jersey under long-term operating leases. This allows the Port authority to operate them as a system and they do not directly compete.
- Tokyo's two airports are both publicly owned, but by different bodies. Haneda Airport is owned by the Japanese Ministry of Land, Infrastructure, Transport and Tourism, whereas Narita is owned by the Narita International Airport Corporation. This Corporation was set up in 2004 with a view to privatisation, but remains 100% publicly owned.
- Schiphol Airport is owned by Schiphol Group, which is a wholly public sector company in which the Dutch Government and the City of Amsterdam are the major shareholders. In addition, Aeroports de Paris and Schiphol Group each hold an 8% stake in the other. Schiphol Group also wholly owns and operates Rotterdam and Lelystad Airports, and holds a 51% stake in Eindhoven Airport. The group came close to privatisation in early 2000s, but this was not taken forward.
- Aeroports de Paris is a public company which owns and operates Charles de Gaulle, Orly and Le Bourget airports, as well as a number of smaller airfields around Paris. The French Government holds a 50.6% share and 8% is owned by Schiphol Group. The remaining shares are owned by a combination of private sector companies, institutional investors, individual shareholders and employees.

Box 3c: Continued

- The operator of Frankfurt Airport, FRAPort AG, is owned by a range of investors. A majority stake is held by the public sector, with the Hesse regional Government owning 31.4% and the City of Frankfurt 20.1%. In addition, Lufthansa owns 10%, with the remaining shares held by a range of private and institutional shareholders.
- Dubai International Airport and Dubai World Central are owned by the Government of Dubai.

3.40 Since its sale to Global Infrastructure Partners, Gatwick Airport has sought to enhance its competitive position:

- in 2011, the airport began a £1.2 billion pound investment programme to improve its terminals and other facilities;
- new long-haul routes have been introduced to emerging market destinations including China, Vietnam and, from spring 2014, Indonesia;
- in spring 2013, a second low-cost carrier, Norwegian Air Shuttle, made the airport into its base; and,
- the Gatwick Connect service has been implemented to facilitate transfers for self-connecting passengers.

3.41 In addition, Manchester Airport Group, the new owners of Stansted have concluded long-term deals with the airport's two largest carriers, Ryanair⁵⁰ and easyJet,⁵¹ which will see new routes introduced and a significant increase in passenger numbers. The Group has also started an £80 million investment programme in the airport's terminal facilities.⁵²

Climate change legislation

3.42 A second important change has been the establishment of a legislative framework for reducing greenhouse gas emissions, through the Climate Change Act 2008. The Act set out a legally binding target to reduce overall UK emissions by at least 80% below 1990 levels by 2050 and a system of five-year carbon budgets. It also

50 <http://www.ryanair.com/en/news/ryanair-agrees-10-year-growth-deal-at-stansted>

51 <http://www.stanstedairport.com/about-us/media-centre/press-releases/easyjet-sign-long-term-deal-to-double-traffic-at-stansted>

52 [http://www.stanstedairport.com/about-us/media-centre/press-releases/transport-secretary-launches-£80-million-terminal-redevelopment-\(1\)](http://www.stanstedairport.com/about-us/media-centre/press-releases/transport-secretary-launches-£80-million-terminal-redevelopment-(1))

established the Committee on Climate Change (CCC), an independent statutory body to advise the Government on emissions targets and report to Parliament on progress towards meeting them.

- 3.43** Separate from the statutory framework, in the context of its 2009 decision to allow an expansion of Heathrow airport, the then-Government adopted a target that gross CO₂ emissions from UK aviation in 2050 should not exceed 2005 levels. Analysis undertaken by the CCC at that time suggested that aviation demand growth of around 60% between 2005 and 2050 was compatible with that target, given prudent assumptions around aircraft fuel efficiency and biofuels use.
- 3.44** Whilst the target of constraining aviation emissions to 2005 levels in 2050 is not itself part of the legally binding framework, legislated carbon budgets have been set on the assumption that aviation emissions out to 2050 are constant at the level of the EU ETS cap in 2020. Given that the EU ETS has been set with reference to average emissions between 2004 and 2005 (i.e. very close to 2005 emissions levels), the previous Government's target and the currently legislated budgets are very similar. A significant overshoot of 2005 aviation emissions levels in 2050 would therefore imply more challenging reductions in other sectors, if the overall UK emissions target is to be met.

Airport expansion

- 3.45** The broader aviation policy context also shifted significantly following the 2010 election, when the incoming government rejected the airport expansion plans which had been supported by the previous administration.
- 3.46** Airport expansion in the UK has been politically controversial for many decades, since the establishment of the Roskill Commission in 1968 to consider options for a third London airport. **Box 3d** sets out the key milestones in the period between then and the publication of the 2003 Aviation White Paper.

Box 3d UK aviation policy over the last 50 years

- 1963 Stansted recommended as the location for a new London airport
- 1966 Government sets up Interdepartmental Committee to revisit case for Stansted
- 1967 Ministerial statement announcing decision to develop Stansted
- 1968 Government sets up the Roskill Commission to recommend a new London airport
- 1971 Roskill Commission recommends Cublington, Oxfordshire as new airport for London Government selects Maplin Sands, Foulness to be London's new hub airport
- 1974 Maplin Sands proposal abandoned by the Government
- 1978 Aviation White Paper identifies Heathrow capacity as 'restricted'
- 1979 'Gatwick Agreement' between BAA and West Sussex County Council that there would be no operational second runway at the airport before 2019
- 1990 Government commissions the study on airport capacity 'Runway Capacity in the South East Study' (RUCATSE)
- 1997 RUCATSE concludes that expanding Heathrow 'would afford the greatest benefits'. Planning permission granted for second runway at Manchester Airport
- 2001 Second runway at Manchester Airport completed
- 2002 Government publishes SERAS (South East of England Regional Air Services Study) with options for new runway capacity in the South East
- 2003 Air Transport White Paper supports a third runway and sixth terminal at Heathrow and a second runway at Stansted
- 2006 Government Progress Report confirms commitment to third runway at Heathrow and a second runway at Stansted
- 2007 Government consults on expanding Heathrow
- 2009 Government backs a third runway decision (subject to conditions) and rules out mixed-mode operation of existing runways at Heathrow
- 2010 Coalition Government reverses third runway decision and rules out new runways at Gatwick or Stansted
- 2011 Government publishes 'scoping document' on a 'sustainable framework for UK aviation'
- 2012 Government publishes draft aviation policy framework for further consultation. Independent Airports Commission established in November

Adapted from Source: Aviation Foundation, Fifty Years of Indecision – a timeline of UK aviation policy (http://www.aviation-foundation.org/docs/Timeline_50YearsOfIndecision_Final.pdf)

- 3.47** The 2003 White Paper, *The Future of Air Transport*, was informed by a national consultation exercise seeking views on a wide range of options for new airport infrastructure. As well as indicating the Government's support for expansion at a number of regional airports, it concluded that new runways should be built at Stansted and, subject to certain environmental conditions being met, at Heathrow. It also recommended that land should be safeguarded for a second runway at Gatwick, in case expansion at Heathrow proved unachievable.
- 3.48** Subsequently, in January 2009, the Labour Government announced, following a further consultation process, that it had concluded that the environmental conditions could reasonably be met and confirmed its support for the Heathrow third runway. In doing so, it proposed that a number of safeguards should be put in place to ensure that the environmental impacts of expansion were appropriately managed.
- 3.49** An initial planning cap of 605,000 air traffic movements at Heathrow was proposed for the period to 2020, with the CAA and Environment Agency responsible for monitoring whether noise and air quality limits were being met prior to any new capacity being released. The Government also stated that the release of any additional capacity would be dependent on advice from the CCC as to whether the industry was on track to meet its climate change target.
- 3.50** The difficulties faced by Heathrow in seeking to expand are not unique amongst European airports. Frankfurt and Amsterdam Schiphol for example have both had to address serious concerns on the part of local communities and accept stringent conditions in order to enable recent expansions to take place, as set out in **Box 3e**.

Box 3e: Challenges to Expansion – Amsterdam Schiphol and Frankfurt Airports

Frankfurt: Until 1984, Frankfurt Airport operated with two parallel runways, oriented roughly east-west. A third, north-south, runway was opened that year, almost twenty years after planning documents had first been submitted. Despite the significant opposition to the third runway, in 1997 a process began to consider options for further expansion. The regional Government put in place a mediated process for over 15 months, which led to a package of measures being recommended, including the construction of a short fourth runway, together with a noise reduction programme and a complete ban on flights between 11pm and 5am.

Box 3e: Continued

The fourth runway opened in October 2011, but local environmental groups have continued to protest on a weekly basis in the airport's terminals.

Furthermore, as at Heathrow, the question of aviation noise has become a significant local political issue, the recently elected Lord Mayor of Frankfurt having campaigned on an explicitly anti-airport platform. As Mayor, he has joined the supervisory board of the airport, significantly reducing the likelihood of any relaxation of the conditions on the airport's operations or any further expansion.

Amsterdam Schiphol: In order to manage long-standing tensions between the Dutch Government's and the airport's ambitions for expansion at Amsterdam Schiphol and the concerns, principally around noise effects, of local communities, a 'roundtable' approach was introduced in 2006, independently chaired by a former politician, Hans Alder, and known as the Alderstafel. This brought together a range of stakeholders including national and local Government, the airport, local business groups and community representatives, all of whom were required to participate in discussions, with a clear mandate to negotiate and agree a solution.

The Alderstafel agreed in 2008 that medium-term growth (to 2020) at the airport should be subject to an overall cap of 510,000 air traffic movements, and that a wide-ranging package of measures to mitigate and compensate for noise effects should be put in place alongside this.

In addition, two other airports in the Schiphol Group could expand to accommodate a total of 70,000 ATMs, so that point-to-point services could use other infrastructure while Schiphol itself focused on its hub operations. Any further expansion beyond 2020 would be subject to a noise envelope (see **Chapter 5**) with the benefits from any improvements in noise performance due to technological change to be split equally between the airport and local communities. The Alderstafel remains in place to monitor the delivery of its recommendations.

- 3.51** Despite these safeguards, the proposed expansion of Heathrow remained highly controversial. It was opposed by the Conservative and Liberal Democrat parties in the run-up to the 2010 election and was cancelled following the formation of the Coalition Government. Subsequently, the Airports Commission was established to review these issues afresh.

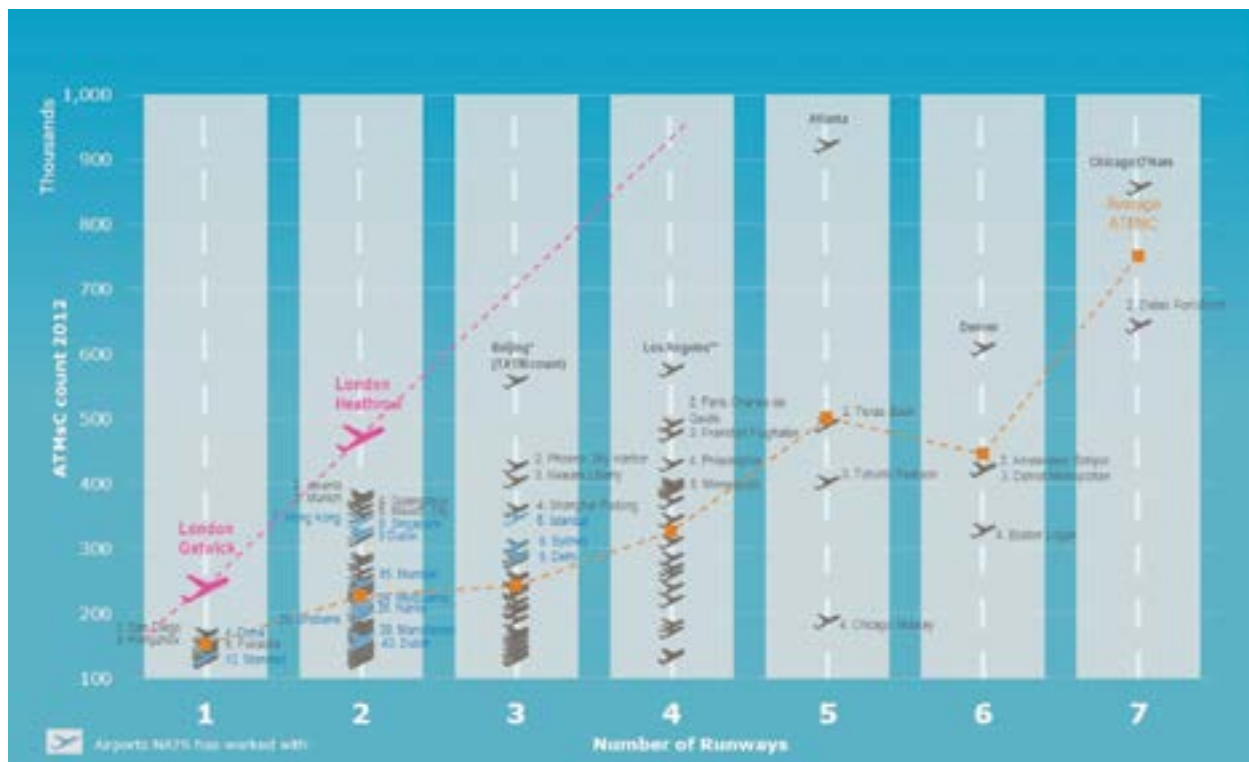
The performance of UK airports

3.52 Whilst there have been significant developments in the policy and regulatory environment for UK airports, the contentious nature of airport expansion proposals has ensured that the physical airport infrastructure has changed little. New terminals have been built, and existing ones extended at a number of airports, including Terminal 5 and the new Terminal 2 at Heathrow. But the only new runways to be constructed since the end of the Second World War are at London City Airport, which opened in 1997, and the second runway at Manchester Airport, which opened in 2001.

3.53 The consequence is that the UK's two largest airports must generate a higher level of capacity utilisation from their runways than any comparable airports in the world, as shown in **Figure 3.11**.

Figure 3.11: Heathrow and Gatwick have the highest runway utilisation in the world

Runway utilisation at selected airports measured in number of ATMs per runway, 2012

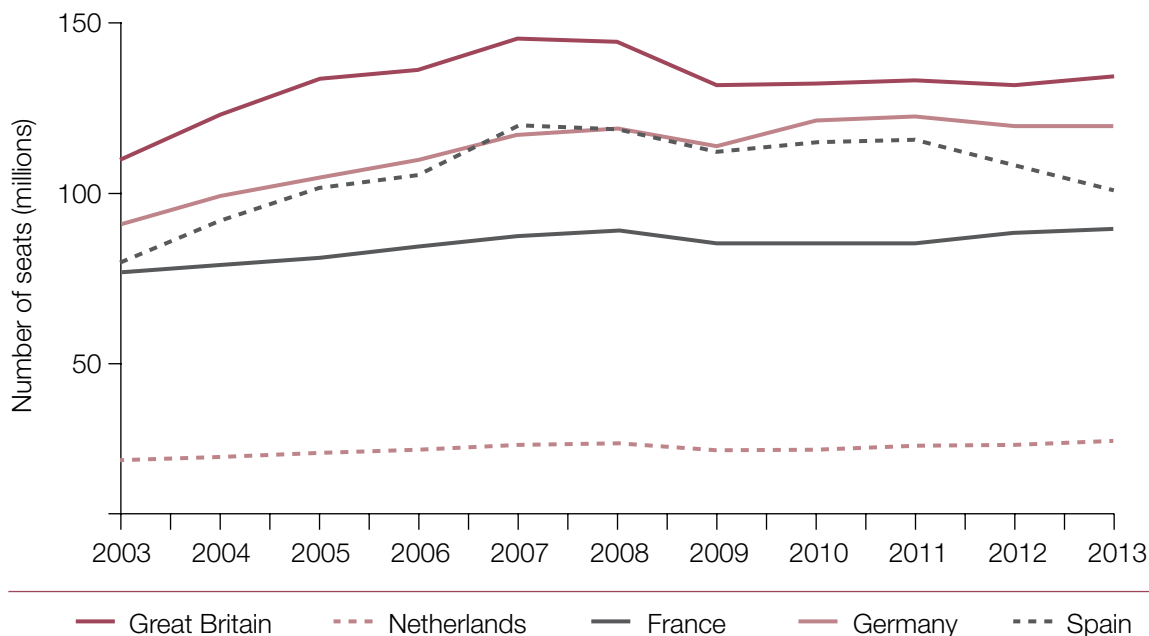


Source: NATS

- 3.54** Heathrow is subject to a planning cap of 480,000 ATMs per annum, which broadly equates to the maximum achievable capacity from its two runways operating under segregated mode. It has operated more than 470,000 movements – almost 98% of capacity – in six of the last ten years. Only in 2010, when air traffic across Europe was affected by the Icelandic volcanic ash incident, did average utilisation drop below 95%, and even then by less than 2%. This rate of capacity utilisation is well above the point at which high levels of reliability can be maintained and delays avoided.
- 3.55** While no other UK airport operates as close to capacity as Heathrow, Gatwick operates at over 85% capacity over the course of the year and above 90% in the summer peak season. Almost no take-off or landing slots are unused in the busiest hours of the day.
- 3.56** Despite these constraints, the UK aviation sector continues to perform well. Available seat capacity and the number of destinations served out of UK airports remain higher than from any comparable European country, as can be seen in **Figures 3.12** and **3.13**.

Figure 3.12: UK has more seats available on a daily basis than any other European country

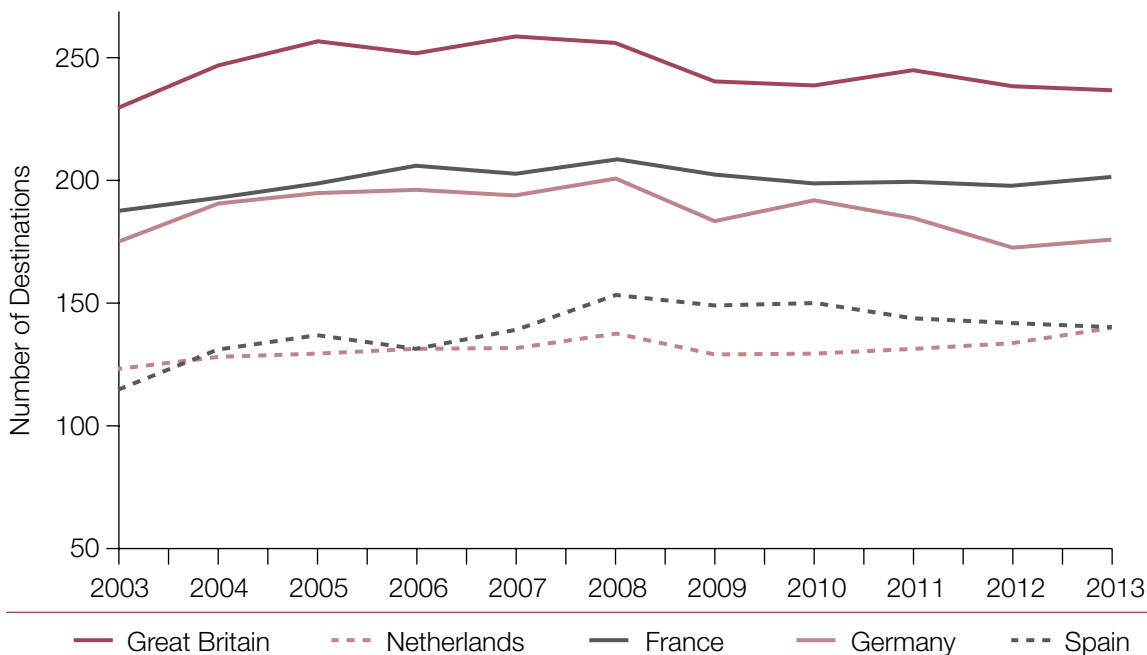
Seat capacity available daily, 2003–2013



Source: CAA analysis based on OAG data

Figure 3.13: UK serves more destinations on a daily basis than any other European country

Number of destinations served daily, 2003–2013



Source: CAA analysis based on OAG data

3.57 Heathrow continues to serve the largest number of international passengers of any airport in the world. Over the past five years, international passenger numbers have risen at Heathrow from roughly 61.5 million in 2008 to 65 million in 2012 – this compares to 56 million at Paris Roissy-Charles de Gaulle, and 51 million at both Frankfurt and Amsterdam Schiphol in 2012.⁵³

The effects of constraining capacity

3.58 Nonetheless, some negative effects from constraints on capacity at the UK's key airports are beginning to be felt, and these may become more widespread and severe over time. These include impacts on resilience, fares, air connectivity, the UK's international hub status, and the wider economy.

Resilience and delays

3.59 In the immediate term, the most significant effect of operating at the limits of available capacity is reduced airport resilience. This can result in more regular and substantial delays for passengers.

3.60 The day-to-day operational performance of an airport needs to be resilient to unforeseen events, whether they arise from airline behaviour or from extraneous

⁵³ ICAO data of top 25 airports ranked by international passengers in 2012 and earlier where available

events such as fog, low visibility, or strong winds. The capacity constraints at Heathrow are currently limiting the airport's ability to respond to such events.

3.61 In 2008 the CAA commissioned a report into the resilience of the UK's runways.⁵⁴ This found that during the period April 2007 to March 2008, Heathrow suffered 13 days when arrivals capacity was restricted to less than 90% of the norm (disastrously disrupted with 2000 cancelled flights) and a 47 further days when the flow of both or either of arrivals and departures was severely restricted (significant but recoverable disruption). In contrast, Gatwick suffered no such days, due in part to the availability of spare capacity on its runway which could be used as a 'buffer' to recover from delays. As growing demand sees capacity at Gatwick and other airports increasingly constrained, the issues already experienced at Heathrow will be felt more widely.

3.62 As shown in **Figure 3.14**, Heathrow currently performs slightly worse than its European hub competitors in terms of delay for arriving and departing services, except for Madrid for arrivals. In contrast, following the opening of its fourth runway in October 2011, Frankfurt Airport saw an immediate boost in its reliability, with on-time arrival performance rising by 14%.⁵⁵ In 2012, its annual on-time performance rose above 80% for the first time since it began keeping records in 1997,⁵⁶ and it did not feature in Eurocontrol's list of the top 20 worst performing airports for arrivals. In contrast, both Heathrow and Gatwick were in the top 6 airports on both measures.⁵⁷

54 CAA, 'UK Runway Resilience Study: Final Report',

http://www.caa.co.uk/docs/589/ICF_runway_resilience_final_report_16Feb09.pdf

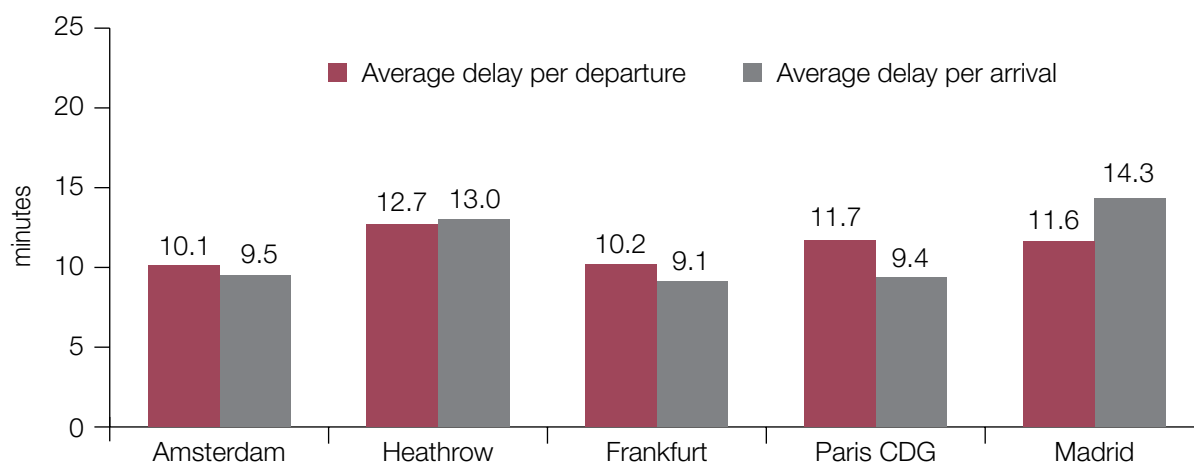
55 <http://www.lufthansagroup.com/en/press/news-releases/singleview/archive/2012/january/30/article/2073.html>

56 FRAport AG (2013), 'The City at the Gates of Frankfurt', http://www.fraport.de/content/fraport/de/misc/binaer/presse/aviation-world-1-2013/jcr:content.file/fra_aviation_world_0113_4view_130304b.pdf

57 Eurocontrol (2012), 'CODA Digest: Delays to Air Transport in Europe', <http://www.eurocontrol.int/sites/default/files/content/documents/official-documents/facts-and-figures/coda-reports/CODA-Digests-2012/coda-digest-annual-2012.pdf>

Figure 3.14: In 2012 Heathrow had a high average delay per departure and arrival compared to other European hubs⁵⁸

Average delay per departure and arrival, selected European hubs in 2012



Source: CODA (December 2013) by Eurocontrol

3.63 Delays, cancellations and unreliability impose costs on passengers and airlines, and ultimately on the wider economy. Longer flight times leave passengers spending time in the air that could be used more productively or enjoyably. Cancelled flights cause frustration and wasted journeys. And uncertainty about arrival and departure times leads to inconvenience and can leave travellers stranded on the runway or in the departure lounge. These issues have environmental consequences, for example in terms of increased emissions as aircraft are required to spend time in holding stacks awaiting the opportunity to land. At Heathrow, they also impact on local residents, as respite from noise is reduced when both runways have to be used for arrivals and departures in order to recover from delays.

3.64 Some of these effects can be monetised to calculate the costs of failing to improve reliability by addressing capacity constraints. **Chapter 5** shows that the implementation of a package of short-term measures to improve airspace and runway operations could deliver benefits to airlines and passengers with a net present value of more than £2 billion over the period to 2030. The Commission has also used a similar methodology to calculate the economic costs that could be incurred if, having implemented the package of short-term measures, no further action was taken to deal with capacity constraints in the London airport system.

⁵⁸ The Eurocontrol figures are based on performance against published timetables, and do not take into account the additional time built into schedules for flights into Heathrow to allow for the regular use of holding stacks to manage arrivals onto the airport's runways. This is discussed in more detail in **Chapter 5**

It estimates that these costs would have a present value of approximately £1.8 billion over the period from 2021 to 2080.⁵⁹

Costs of travel

- 3.65** As well as affecting an airport's resilience, capacity constraints may also affect the fares that passengers pay for travel. In any market, prices are higher when demand outstrips supply. In the aviation market, if the supply of available seats is limited, whether that be through constraints on airline or airport capacity, it can be expected that the price paid, either by the passenger through air fares or the airline through airport charges, will be higher. With Heathrow's runways full, and other UK airports, particularly in London and the South East, forecast to fill up over the coming decades, this would imply that there is potential for prices to rise as capacity constraints bite.
- 3.66** Identifying effects of this kind is challenging given the range of factors that will have an impact on fares, including fuel costs, fluctuations in demand and competition. PwC, on behalf of the Commission, have undertaken research which attempts to isolate the effect of capacity constraints on fares.⁶⁰ This study used fare data from Sabre Airport Data Intelligence for a selection of European airports⁶¹ (a mix of constrained and unconstrained⁶²) and conducted an econometric analysis to examine the relationship.
- 3.67** The study found that capacity constraints are associated with higher fares. Including all airports and routes, fare revenue per passenger mile is found to be on average 18% higher for constrained airports than unconstrained. The difference is even higher on premium routes. When the UK market is considered in isolation the effect is still significant but lower at around 10%. These results should be treated with caution as although the research did identify higher fares at constrained airports, it did not establish a causal relationship.

International Connectivity

- 3.68** A number of stakeholders have argued that the capacity constraints faced by Heathrow are significantly affecting the UK's level of international connectivity, and that other countries, whose hub airports are less constrained, are rapidly catching up with or overtaking the UK.

⁵⁹ This figure is likely to be an underestimate of the potential value of reducing delays. It does not include the value of noise respite and lower CO₂ emissions (from less stacking) and using standard DfT methodology would most likely produce a higher figure

⁶⁰ PwC analysis, "Fare differentials", available on the Airport Commission's website

⁶¹ All airports with scheduled services in France, Spain, Italy, Germany, the Netherlands and the United Kingdom were included in the analysis

⁶² Constrained airports were defined as those operating at above 95% of their ATM capacity in any given year

- 3.69** These concerns should be put in perspective. Heathrow Airport's 'One Hub or None' report highlights 26 emerging market destinations that are served daily by other European hubs but not from Heathrow.⁶³ Six of these, however, are services to second-tier airports in Poland, which are operated by low-cost airlines from other London airports and five are short-haul leisure destinations served from other London airports.⁶⁴ Two of the long-haul destinations cited are already served from Gatwick with a third to be introduced in 2014, and a further four are served from Heathrow, but fewer than seven times a week.⁶⁵ This leaves only eight remaining destinations with no current or forthcoming direct service from London.⁶⁶
- 3.70** An equivalent list of destinations currently served from Heathrow but not from any other European hub can equally be compiled. In 2013 it would include both emerging market destinations such as Dhaka, Freetown, Hyderabad and Karachi, and North American destinations such as Raleigh/Durham, Edmonton, Phoenix and San Diego.⁶⁷
- 3.71** Nonetheless, there is some validity in the argument. Although Heathrow remains the world's busiest international airport, its total route network is less extensive than those of all the other main European hubs, and its long-haul route network smaller than all except for Madrid. **Figure 3.15** shows that Frankfurt and Paris Charles de Gaulle have for some time offered a higher number of long-haul destinations than Heathrow, and more recently Heathrow has also been overtaken by Dubai International and Amsterdam Schiphol.

63 Heathrow Airport Ltd. 'One Hub or None', <http://mediacentre.heathrowairport.com/Media-library/One-hub-or-none-451.aspx>

64 The six Polish cities are Gdansk, Katowice, Krakow, Poznan, Rzeszow and Wroclaw. The five short-haul leisure destinations are Antalya, Bodrum, Dalaman, Hurghada and Izmir

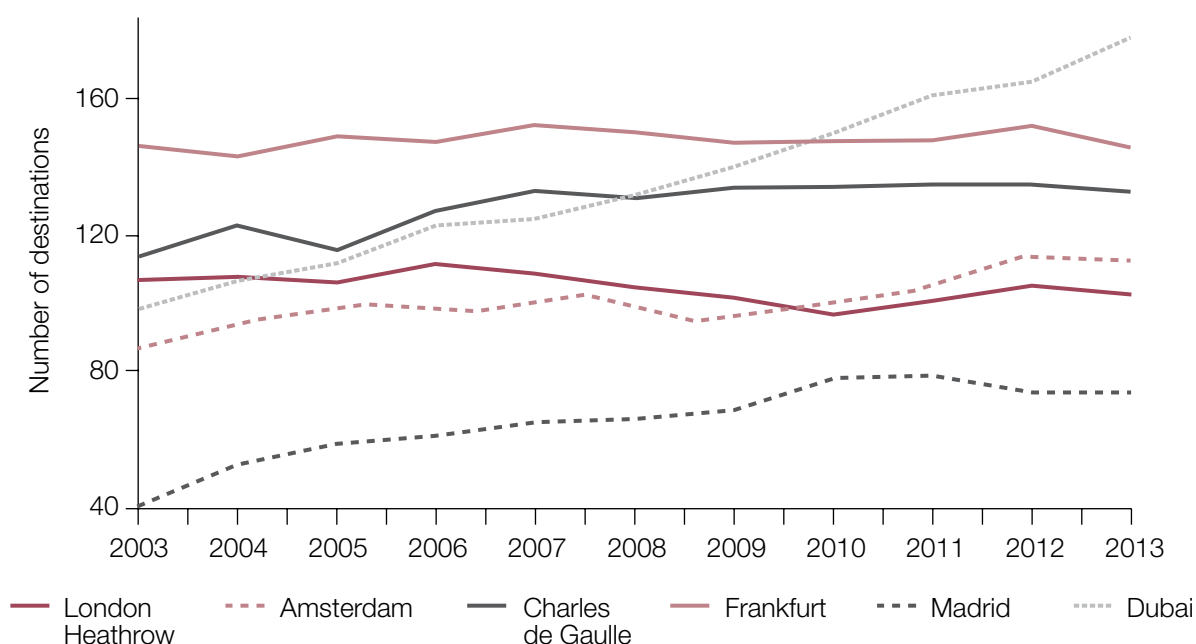
65 Hanoi, Ho Chi Minh City and (in 2014) Jakarta; and Chennai, Guangzhou, Manila and Tehran, respectively

66 The eight remaining destinations are Ankara, Bogota, Caracas, Dammam, Denpasar, Lima, Port Harcourt and Santiago

67 CAA Analysis for Airports Commission

Figure 3.15: Dubai International has seen a dramatic increase in long-haul destinations served since 2003

Changes in number of long-haul destinations at major airports



Source: PwC analysis based on Sabre ADI

3.72 Dubai International has seen particularly rapid growth in international passenger numbers. It is now second only to Heathrow, and forecast to overtake it in the next two years if recent rates of growth are maintained.

3.73 In relation to the number of destinations to emerging markets, which is an important issue for business passengers, the Commission has examined Heathrow's connections to both the BRIC nations (Brazil, Russia, India and China) and a group of a further thirteen countries drawn from the Next 11 and CIVET groupings proposed by Goldman Sachs and the Economist Intelligence Unit respectively.⁶⁸

In respect of the BRIC countries, as seen in **Figure 3.16(a)**, Heathrow has a strong route network into India compared to other European hubs, but has fewer connections than some other European hubs to Brazil, mainland China and Russia.

3.74 The same broad pattern is seen in relation to the second group of emerging market countries. Heathrow's comparative strengths are in relation to destinations in southern Asia (Pakistan and Bangladesh) and other Commonwealth nations, such as Nigeria and South Africa, whereas it performs less well in relation to destinations in Latin America and the Far East.

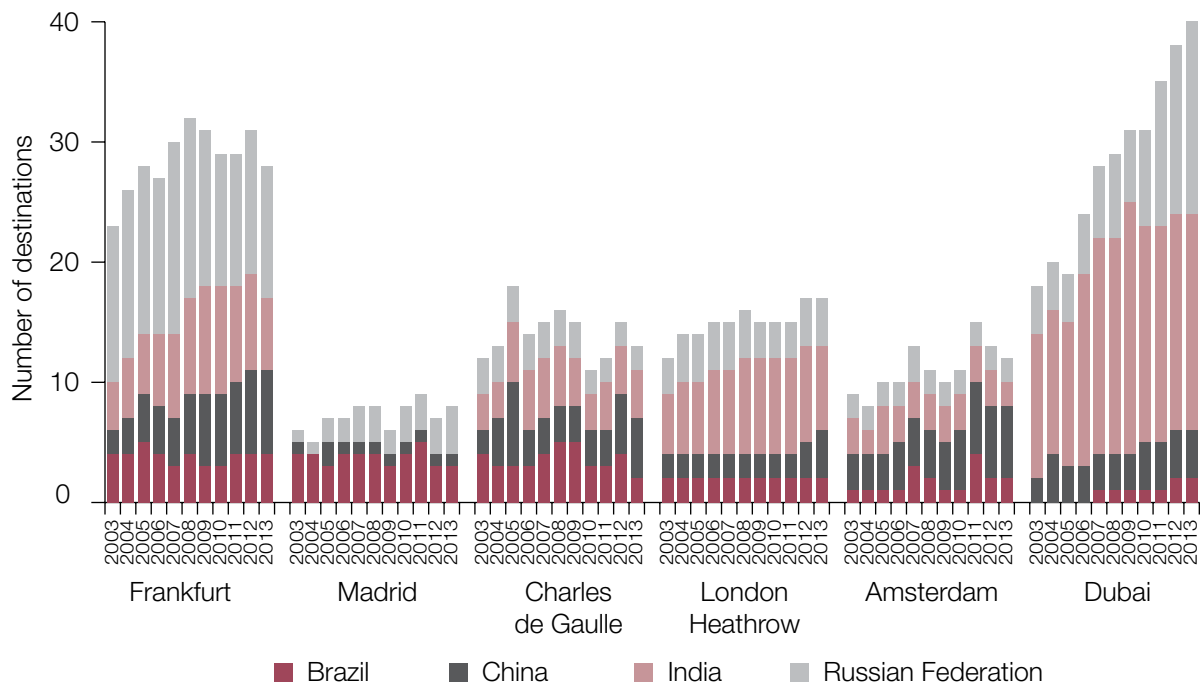
⁶⁸ This group of thirteen includes Bangladesh, Colombia, Egypt, Indonesia, Iran, Mexico, Nigeria, Pakistan, Philippines, South Africa, South Korea, Turkey and Vietnam

3.75 This reflects the trend outlined above in which airlines serving Heathrow have responded to growing passenger numbers by increasing frequencies on existing routes more than by increasing the number of destinations. In contrast to the picture presented in **Figure 3.15**, Heathrow currently serves marginally more long-haul destinations on at least a daily basis than any other European hub. Similarly, as seen in **Figure 3.16(b)** below, when daily routes to the BRIC countries are analysed, Heathrow moves ahead of the other European hubs. Dubai International remains well ahead on both measures, however, driven largely by its strong route network into India, which it is geographically well-placed to serve.

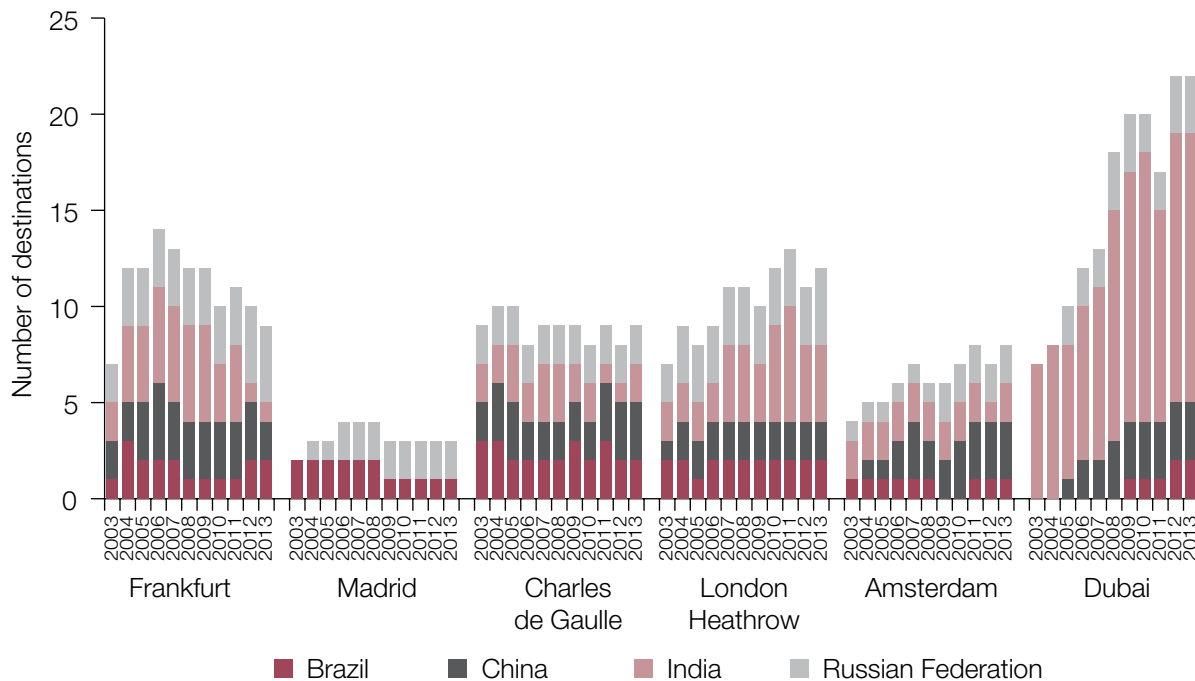
Figure 3.16: Heathrow's comparative strength on routes to BRIC countries is frequency of service rather than total destinations

Number of destinations to BRIC countries from European hub airports across all services and with at least a daily service

a. All services



b. At least daily services



Source: CAA analysis based on OAG data

- 3.76** While the range of destinations offered is important, so is frequency of service, particularly for business travellers who may have less flexibility in the timing of their journeys. It is therefore important to take both factors into account.
- 3.77** In order to assess the overall strength of connectivity at Heathrow compared to less constrained hubs, as well as the broader connectivity of the London and UK airport systems, the Commission has drawn on methodology developed by IATA. This derives a measure of connectivity through combining destinations served and total seats available, weighted by the economic value of the destinations.⁶⁹ Two approaches to measuring economic value have been tested: the size of the aviation market in each destination (as used by IATA) and – to test connectivity to the most important future markets – forecast GDP on the basis of the IMF’s 2013-18 growth projections.⁷⁰
- 3.78** On both indicators, Heathrow has performed well in comparison to other European hubs over the past decade despite its capacity constraints. This applies to both total connectivity and long-haul connectivity, and is driven by the very high frequencies that Heathrow offers to economically valuable destinations. For example, using IMF GDP weights, Heathrow’s strong links to North America make a

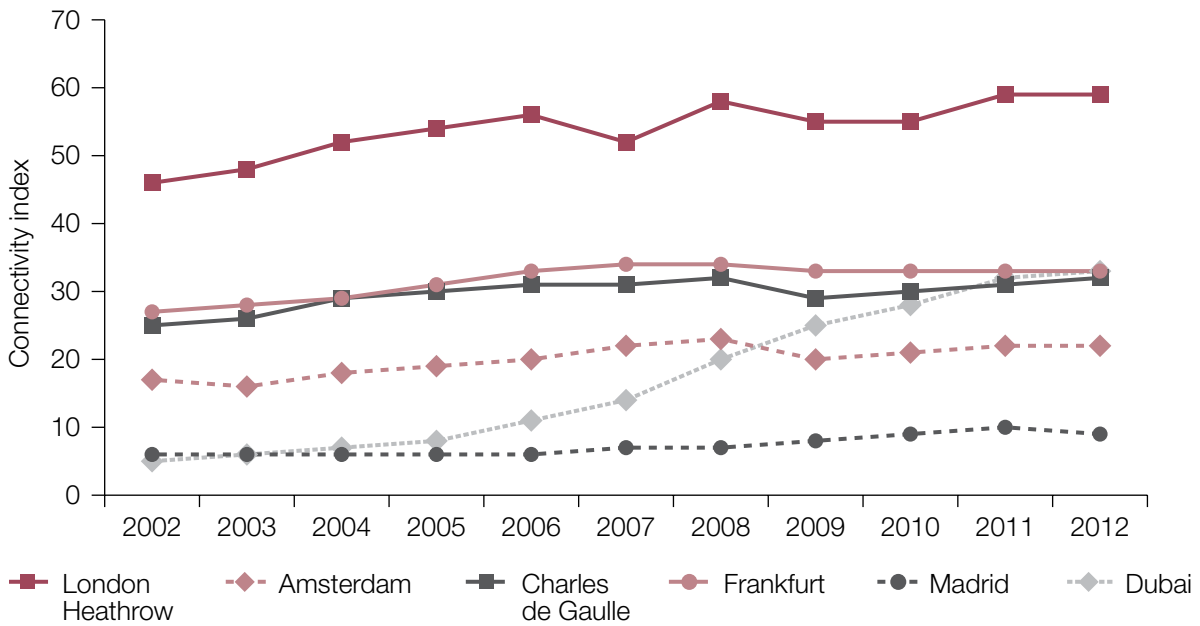
⁶⁹ The Commission conducted the analysis of these measures to address issues highlighted in response to the ‘Aviation Connectivity and the Economy’ discussion paper

⁷⁰ The Commission has tested this analysis further using current IMF data and 2013-18 and 2040-50 growth projections from PwC’s (2013) ‘World in 2050’, http://www.PwC.com/en_GX/gx/world-2050/assets/PwC-world-in-2050-report-january-2013.pdf. The results in each case were broadly in line with those calculated using the IMF projections

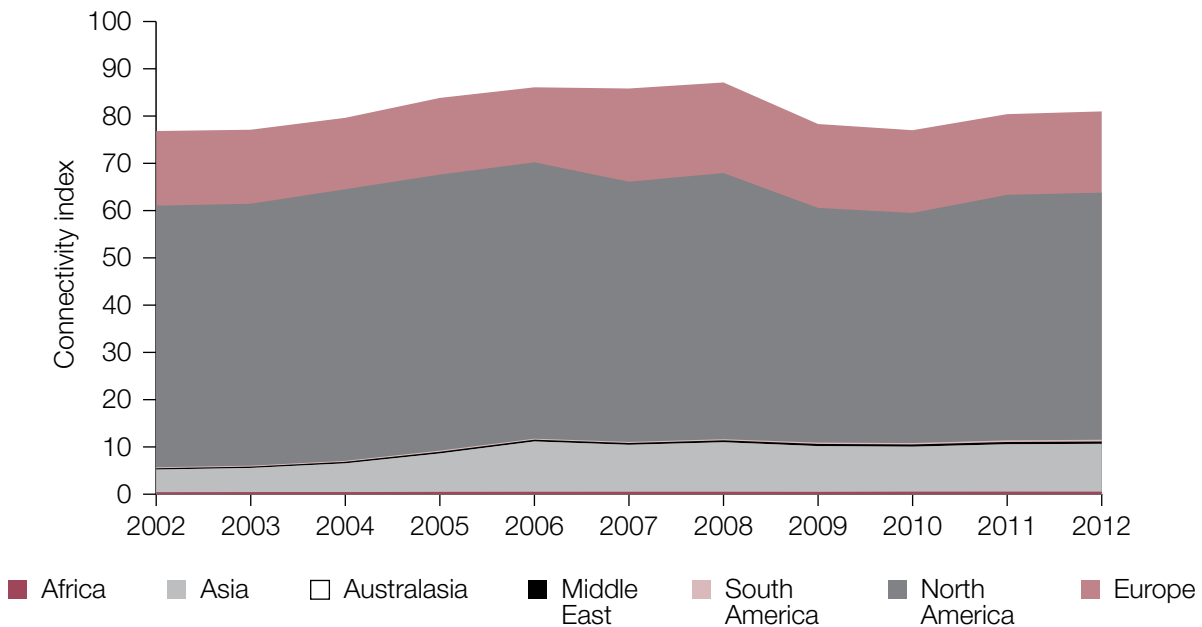
significant contribution to London's overall performance.⁷¹ **Figures 3.17(a) and 3.17(b)** show that no other European hub city has links to North American that dominate to the same extent.

Figure 3.17(a) and (b): Heathrow's high levels of connectivity are driven particularly by its strong links to North America

(a) Long-haul connectivity at airport level, IMF GDP increase 2013-2018 weights



(b) London – geographical breakdown of connectivity index, IMF GDP weights



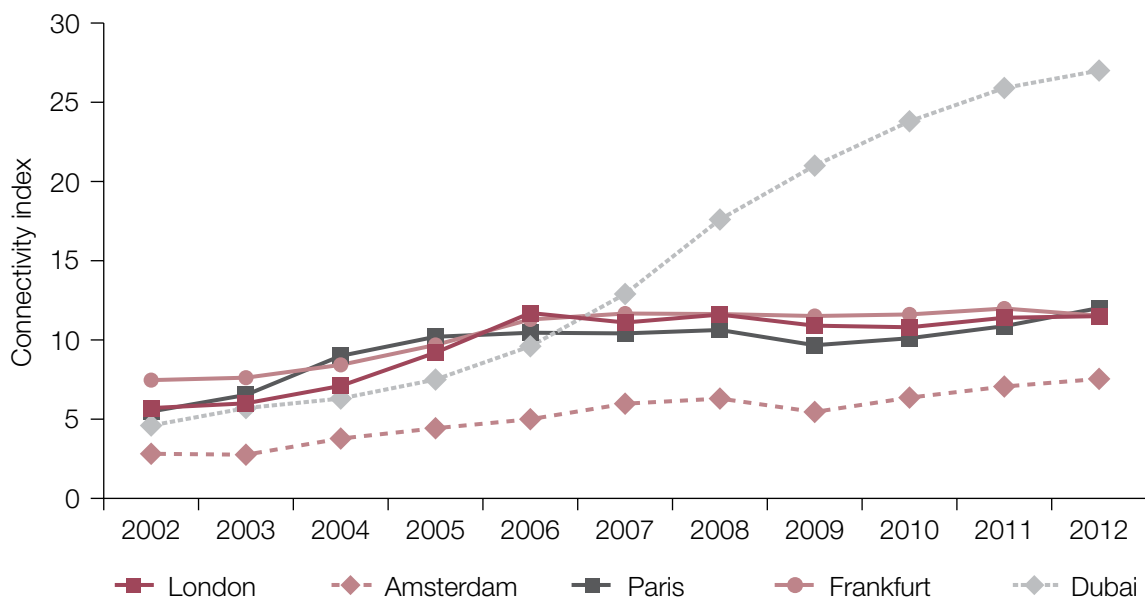
Source: PwC analysis based on Sabre ADI data

71 See PwC analysis for the Airports Commission, 'Comparative Connectivity Analysis'

3.79 Looking beyond routes to North America and Europe, there are clear indications that in other regions Heathrow has not been able to achieve the same dominant position, and that the additional capacity and connectivity available at Gatwick and other London airports is not sufficient to offset that weakness. When connectivity to world regions, excluding North America and Europe, is analysed using the IATA weightings, even including the full range of London airports, London remains ahead of the other European hub cities (although behind Dubai); but when the IMF GDP weights are used to test connectivity to key future markets, London performs no better than other European hubs, as shown in **Figure 3.18**.

Figure 3.18: London's total connectivity to destinations other than North America and Europe is less than other hubs

Total connectivity excluding North America and Europe, IMF GDP weights



Source: PwC analysis based on Sabre ADI

3.80 This suggests that capacity constraints at Heathrow are preventing London achieving the level of connectivity in these markets that might be expected given the comparative strength of its OD market. Options for airport expansion in the UK will need to facilitate new connections to economically important destinations while maintaining the UK's strong position in serving European and North American markets.

3.81 Given the dominant role of the London airports system, these constraints have meant that overall UK connectivity has also declined in relation to its peers. Using the IATA weighting, Germany now outperforms the UK in terms of total connectivity,

and using the IMF weighting, the UK's lead over Germany has been significantly narrowed, as it has in relation to long-haul connectivity.

- 3.82** It is also noticeable that as capacity constraints at Heathrow have tightened, British Airways has not grown as rapidly as its competitors. Between 2002 and 2012, BA increased the overall capacity of its route network, measured in available seat-kilometres, by 14%, whereas Lufthansa increased its network by 50%, KLM by 37% and Air France by 29%.⁷²
- 3.83** This effect is also apparent in the Airports Commission's forecasts (see **Chapter 4**), which provide a further indication of the potential impacts of capacity constraints on connectivity. They show that if runway capacity constraints were alleviated, the size of the UK's overall long-haul route network (again measured in available seat-kilometres) would increase by 7-10% in 2030 and by 7-17% in 2040, depending on the assumption made in relation to constraints on carbon emissions. The impact becomes less strong by 2050, as the market for long-haul travel from regional airports grows, but it does not disappear.
- 3.84** Addressing capacity constraints may not on its own lead to a significant increase in connectivity. The wider economic context may play a role: for example, Frankfurt has not seen any material growth in destinations served or flight frequencies since the opening of its fourth runway in October 2011, with any benefits currently deriving from improvements in resilience and punctuality. Furthermore, the airport has delayed the construction of its third terminal. Other factors may also influence the level of additional connectivity which can be achieved, including aircraft availability, bilateral air services agreements with key states and wider policies in areas such as immigration and fiscal policy.

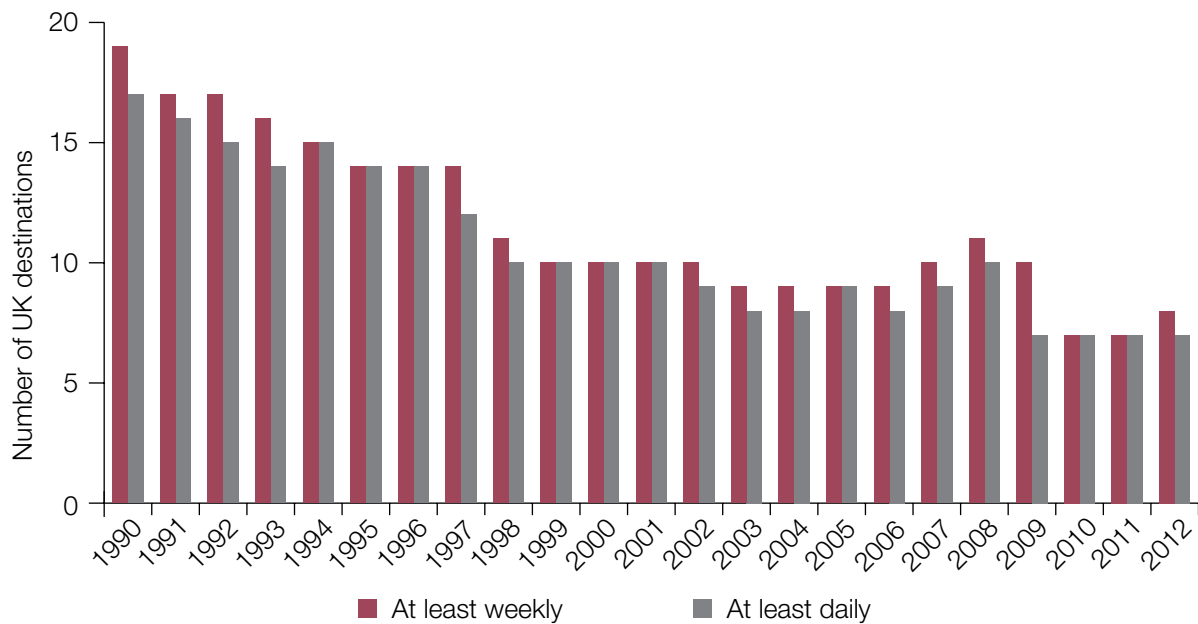
Domestic Connectivity to London

- 3.85** Capacity constraints at Heathrow have also affected domestic connectivity to the airport. While other hubs are attracting more transfer traffic from the UK, Heathrow remains a key access point to international and long-haul travel for many passengers from other UK airports. The number of domestic destinations served from Heathrow has, however, been steadily declining over a number of years, as shown in **Figure 3.19**. By 2040, unless capacity is expanded, the Commission forecasts that the number of domestic destinations served daily from Heathrow will have fallen further to only four.

⁷² IATA. In comparison, Emirates increased its network by 480% over the same period

Figure 3.19: The number of UK destinations served from Heathrow has steadily decreased since 1990

Number of UK destinations with a direct service from 1990-2012⁷³



Source: DfT analysis based on CAA airport statistics

3.86 The Commission has received a number of submissions from stakeholders about the importance of these links.⁷⁴ Connections to other hubs in Europe and the Gulf are a welcome addition to the connectivity available from the UK's regional airports, but they are not generally considered to be a replacement for links to Heathrow. Heathrow offers strong connectivity to a number of important markets, particularly in North America, which is hard to replicate elsewhere.

3.87 In terms of overall connectivity, whereas London's connectivity is on a clear upwards trend since the effects of the recession, the weakening in links to Heathrow has contributed to a continuing decline in connectivity as measured using the IMF weightings.

The UK's hub status

3.88 The strength of Heathrow's route network is underpinned by the airport's transfer passengers, who account for around a third of the airport's overall passenger numbers. Many of the airport's routes to emerging market destinations and smaller North American cities would be unlikely to be viable without transfer traffic to supplement domestic demand.

⁷³ Definition of a weekly service is at least 52 passenger flight departures to that destination in a year. Definition of a daily service is at least 362 passenger flight departures in a year to that destination

⁷⁴ See 'Aviation Connectivity and the Economy' discussion paper

- 3.89** The European transfer market has faced increased competition over the past decade from the newly established hubs in the Middle East and particularly from Dubai, whose market share⁷⁵ increased from 7% to more than 20% between 2002 and 2012, while the only European hub to maintain its market share was Amsterdam Schiphol.
- 3.90** In some segments of the market this is inevitable. The Gulf hubs are well-placed geographically to serve destinations in India and the Middle East and have built up significant route networks in these regions. As a result, they are capturing increasing market share. For example, Dubai's share of transfer traffic on routes between the west coast of the US and India increased from 12% to 50% between 2002 and 2012.
- 3.91** There are, however, market segments in which European hubs can compete more effectively. These include routes from other European cities to a wide range of long-haul destinations and between the east coast of the US and the Far East (where no direct route is available). The distance from Boston to Shanghai, for example, is nearly 20% further via Dubai than via London.⁷⁶
- 3.92** Transfer passengers tend to be highly price sensitive as they often have more choice in how to make their journey than those flying direct. A transfer passenger from New York to Seoul could potentially travel via airports as varied as Frankfurt, Los Angeles, Helsinki or Dubai as well as Heathrow, each served by a different airline. For this reason, transfer passengers may choose to fly via other hubs, as origin and destination demand increases and prices rise at capacity constrained airports. As such demand is more likely to be concentrated on the most profitable routes, this may have a negative effect on growth in the overall route network.
- 3.93** Although Heathrow has broadly maintained the proportion of transfer passengers carried as a percentage of the whole over recent years, the above pattern of concentration on key routes is already evident, as discussed earlier in this chapter. Furthermore, the Commission's forecasts suggest that if capacity constraints at the airport are not alleviated, the number of transfer passengers at the airport will first stagnate and then decline. This sees transfer passengers drop from 22.6 million in 2011 to less than 4 million in 2050, and the number of destinations served from the airport fall by roughly 20% over the same period.

⁷⁵ Drawn from PwC analysis 'Historical trends in international-to-international interliners'. The total transfer market share is defined as the sum of market shares of airports in Amsterdam Schiphol, Dubai, Frankfurt, London Heathrow and Paris Roissy-Charles de Gaulle

⁷⁶ Figures calculated using Great Circle Mapper, www.gcmap.com

3.94 To support its consideration of the role played by transfer passengers in supporting UK connectivity, the Commission also undertook a forecast of future destinations served if international transfer passengers are removed from the UK market altogether. This indicated a significant reduction in destinations served from UK airports, with the most significant effects are seen around 2030, as beyond that point OD traffic begins to build up to the point that it can support some of the lost routes towards the end of the forecast period. This analysis is described in more detail in *Appendix 3: Technical Appendix*.

Impacts on the economy

3.95 The Commission has investigated the economic costs of constraining aviation capacity. Its research and analysis has been informed by responses to the Commission's March 2013 discussion paper *Aviation Connectivity and the Economy*⁷⁷ and is described in more detail in *Appendix 3: Technical Appendix*. The potential impacts are considered at three levels:

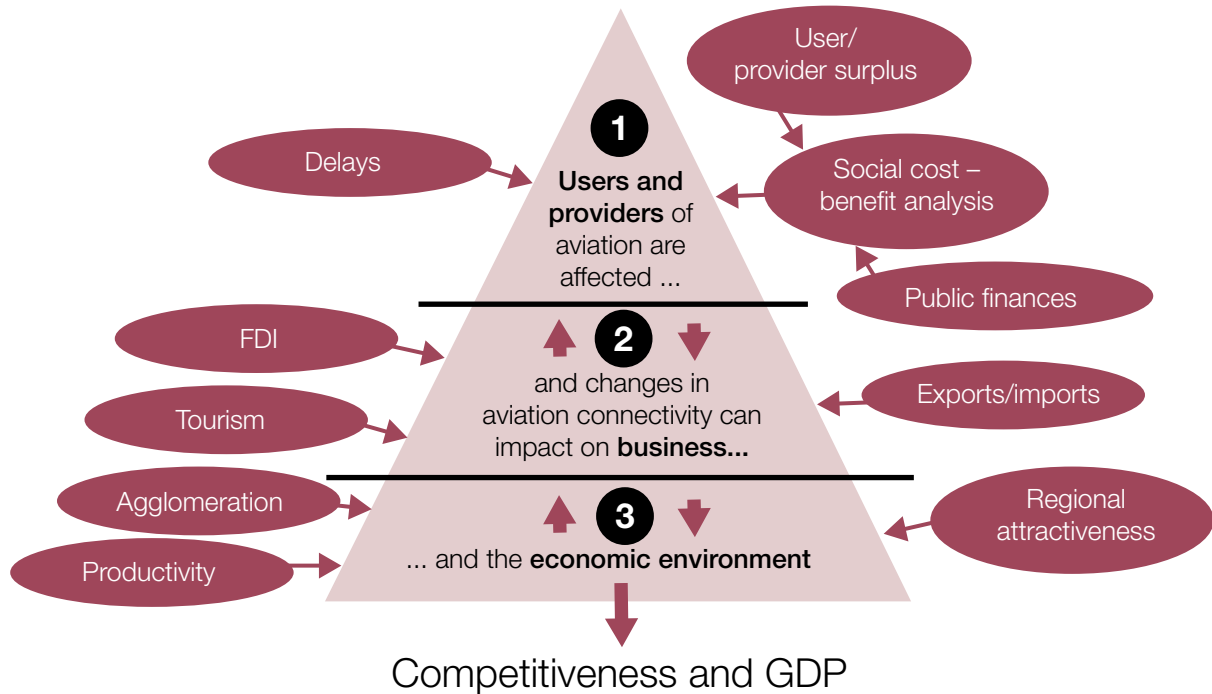
- 1) The economic costs and benefits for providers (airports and airlines) and users (passengers) resulting from a constrained airport system;
- 2) The direct economic impacts on business associated with constrained airport capacity, including impacts on trade, foreign direct investment (FDI) and tourism; and,
- 3) The wider impacts on the economy associated with changes in trade, investment and tourism.

3.96 Previous Government studies looking at the case for additional airport capacity have focused primarily on the first of these impacts. Those costs and benefits are significant, but it is important to take a wider perspective which considers not only the immediate effects on airlines and passengers of capacity constraints, but also how they are transmitted through the wider economy, as presented in **Figure 3.20**.

⁷⁷ Airports Commission, *Aviation Connectivity and the Economy* discussion paper, March 2013, <http://www.gov.uk/government/publications/discussion-paper-on-aviation-connectivity-and-the-economy>

Figure 3.20: As the effects of changes in airport capacity are transmitted through the wider economy, the overall impact becomes dispersed through other sectors and more difficult to measure

How a change in airport capacity/aviation connectivity transmits through the economy



1. Provider and user impacts

3.97 Constraining aviation capacity can have a significant effect on connectivity. It may also drive up the costs of air travel. As a result, passengers may find they need to travel through a more inconvenient airport or via a longer route. They may also simply face a higher price, which may result in some of them deciding not to make their journey at all. As capacity constraints are alleviated, the opposite effect occurs, with travel becoming cheaper, faster and more convenient, and passengers making journeys that they might otherwise have been deterred from undertaking.

3.98 Social cost-benefit analysis is the standard methodology used in the public sector for assessing costs and benefits of this kind. The DfT aviation model has been used to produce an estimate of the welfare costs associated with a constrained airport system, by applying a 'shadow cost' to the cost of travelling from a constrained airport.⁷⁸ This has the effect of restricting demand at an airport to its capacity. These shadow costs can be used to estimate the cost of imposing a capacity constraint.

⁷⁸ The DfT's aviation model includes a social cost-benefit analysis function which is consistent with the HM Treasury Green Book and the DfT's WebTAG appraisal framework

3.99 The results from our analysis indicate that the costs of capacity constraints could be roughly in the region of £18 billion to £20 billion in present value terms between 2021 and 2080,⁷⁹ including the costs associated with delays.

3.100 The appraisal framework underpinning that valuation is highly stylised and does not account for all of the complexities of how the airline industry operates and how airline pricing structures may affect passengers. In reality, the costs of capacity constraints are likely to be reflected in reductions in the number of available destinations, less convenient schedules, and less competition between different carriers, all of which adversely affect passengers but are not fully captured by the appraisal framework. It also excludes some important factors which would be included in an appraisal of specific capacity options. For example, environmental impacts, surface access requirements and impacts on the air freight market are not assessed.

2. Direct business impacts

3.101 In addition to these immediate impacts on passengers, airport capacity constraints may be associated with direct economic impacts upon trade, FDI and tourism. The Commission has undertaken further research in these areas to supplement the previous analysis set out in its *Aviation Connectivity and the Economy* discussion paper, drawing on literature and commissioning an econometric study to consider these links in more detail.

3.102 A review of the literature on trade confirmed that greater connectivity, by air and other means, creates better access to foreign markets by providing cheaper and easier business travel. One study found that such connectivity was found to have led to greater sales efforts in those countries and that more easily available direct client contact plays an important role in increasing trade.⁸⁰

3.103 Trade in services is particularly important to the UK economy and those sectors with the highest propensity to fly are often of significant economic value. For example, the financial sector, which had Gross Value Added of £125 billion in 2011,⁸¹ makes 28% of UK service exports (and 23% of total global financial exports). UK business services exports followed closely behind with a 27% share.⁸² Both sectors see an extremely high level of expenditure on aviation services. Exports of services have generally outweighed imports since 1983, making a substantial positive impact on the UK trade balance.

⁷⁹ 2012 prices. The low end of this range is the cost with a carbon cap in place; the high end is with a traded carbon scenario

⁸⁰ Poole, J (2010) "Business travel as an input to international trade", UC Santa Cruz

⁸¹ www.parliament.uk/briefing-papers/sn06193.pdf

⁸² BIS (Feb 2012) "UK trade performance across markets and sectors"

- 3.104** Air transportation is also an important facilitator of trade in goods. Although UK exports of goods are lower than those of some comparable European countries, the UK is doing relatively well in particular high-tech sectors, such as pharmaceuticals and high-tech machinery. These sectors depend heavily on air freight which accounted for 31% of the UK's total non-EU imports and 46% of the UK's total non-EU exports in value terms in 2011.⁸³
- 3.105** In addition, aviation can play an important role in attracting foreign direct investment. The FDI literature concludes that improvements in infrastructure do stimulate FDI, though the magnitude of this effect varies widely.⁸⁴ This relationship can clearly be seen, however, when considering activity around Heathrow and along the M4 corridor, where a number of multinational companies, such as GlaxoSmithKline and Microsoft, have located headquarters.
- 3.106** The link between aviation connectivity and FDI is supported by survey evidence and some empirical studies.⁸⁵ Strauss-Kahn and Vives (2009), for example, found that the probability of firms in the US relocating to a particular location increased by 90% if there is large airport nearby or 40% if there is a small airport.⁸⁶
- 3.107** Tourists coming to the UK support its GDP through their holiday expenditure. In 2012 alone visitors from abroad spent just under £19 billion in the UK, 84% of which was attributed to those who arrived by air.⁸⁷ Visitors travelling long distances nearly all travel by air, and those tourists tend to spend more per day than European visitors.
- 3.108** The value of outbound tourism from the UK was £32 billion in 2012, negatively affecting the overall UK trade balance.⁸⁸ The UK, however, is not the only country with a tourism trade deficit: so are other developed countries whose citizens travel a lot. Outbound tourism also brings benefits in relation to quality of life, and through supporting routes which are also of benefit to business travellers.
- 3.109** The Commission's econometric study examined the links between aviation connectivity and trade, FDI and tourism. For trade and tourism, it was based on data over the past decade from 164 and 45 countries respectively.⁸⁹ In relation to FDI, the study looked at total UK FDI and regional FDI broken down by the former

83 HMRC analysis

84 NERA (2009), "Transport's Role in Facilitating International Business", version. 26th Jan 2009

85 Bel, G. & Fageda, X. (May 2008) "Getting there fast: globalisation, intercontinental flights and locations of headquarters", *Journal of Economic Geography*, No. 8, P. 471-495

86 Strauss-Kahn, V. and Vives, X (September 2009) "Why and where do headquarters move?", IESE Business School – University of Navarra Working paper no.650

87 ONS IPS 2012

88 *Ibid*

89 The study also attempted to establish the links between aviation connectivity and migration, but no dataset could be identified which would provide statistically significant results

Government Office Regions. UK seat capacity was used as a proxy for aviation connectivity and the approach accounted for other influencing factors. The magnitude of the links and statistical significance varied but a positive relationship was identified in each case, with a 10% increase in seat capacity between the UK and any other given country being associated with an increase in activity of between 1% and 7% across the various areas.

- 3.110** The relationships found in the Commission's research support the view that connectivity by air may play an important role in enabling trade and tourism, and facilitating foreign investment in the UK. The study is not, however, location or country specific and the effects may in reality differ between destinations. An increase in short-haul leisure services to destinations such as Ibiza or Crete may have no noticeable impact on trade or FDI, whereas other destinations will be likely to increase trade by a much larger extent. For example, the Department for Business Innovation and Skills found that on average each flight from Heathrow to a BRIC country carries more than £400,000 in goods exports, with flights to China averaging more than £1 million.⁹⁰
- 3.111** Furthermore, this study took seat capacity as a proxy for connectivity in assessing the effects of capacity constraints. In practice the cost of the constraint would manifest itself in many different ways, such as less attractive travel options, although airlines would seek to make best use of the limited capacity available in a constrained system.
- 3.112** The results should be read with caution as they do not necessarily imply causality, but they do suggest positive relationships between seat capacity and trade, FDI and tourism. This could mean that an increase in seat capacity provides more scope for trade, that growth in trade increases the need for seat capacity, or some combination of the two. Regardless, this implies that any constraints on the capacity of the aviation sector may hinder the UK's ability to develop new trade or foreign investment opportunities or to reap the benefits when such opportunities arise in other ways.

3. Wider economy impacts

- 3.113** The direct economic impacts on trade, FDI and tourism can further impact the economy through 'spillovers', such as productivity improvements and positive agglomeration effects. In most cases these impacts can be considered additional to the direct economic impacts.

90 BIS analysis of HMRC Overseas Trade Statistics

- 3.114** The Commission has undertaken a literature review to investigate the strength and nature of the link between the direct impacts of connectivity (and hence, capacity constraints) and their effects on the wider economy. While the wider economic impacts of tourism were found to be small, the literature review identified a clear consensus that increased trade and FDI (both inbound and outbound) would drive broader improvements in productivity.

Connectivity impacts on GDP

- 3.115** The Commission has also sought to identify broader GDP impacts of aviation capacity constraints.
- 3.116** Many previous studies have attempted to value the GDP benefits of increasing aviation connectivity or the costs to the economy of a capacity constraint. These estimates vary dramatically – from as little as £9 billion to £13 billion over 60 years⁹¹ to as much as £8.5 billion a year by 2021.⁹²
- 3.117** While the findings of these studies indicate that capacity constraints could have a negative impact on the economy, the wide range of estimates suggests that there is considerable uncertainty surrounding the scale of any such impact. In an attempt to understand where in this wide range of estimates the evidence is strongest, the Commission has undertaken additional analysis using Computable General Equilibrium (CGE) modelling to assess the potential overall economy impact of a constrained airport system. **Box 3f** sets out the approach taken in CGE modelling and outlines its potential applications.

91 British Chambers of Commerce (2009), “Economic Impacts of Hub Airports”

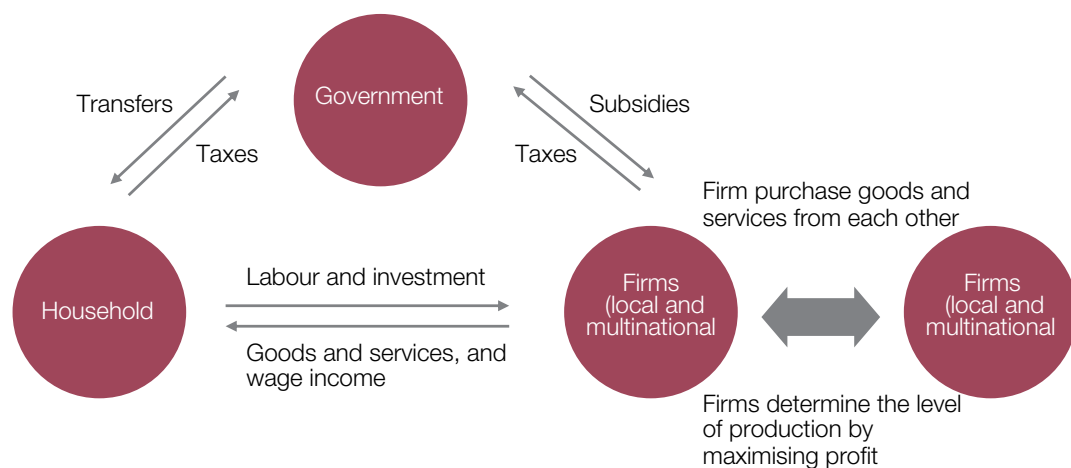
92 Oxford Economics (2012), “The value of aviation connectivity to the UK: a report prepared for Heathrow”

Box 3f: What is a Computable General Equilibrium model?

Over the past 25 years, Computable General Equilibrium (CGE) models have become a standard tool of empirical economic analysis, capturing the economic behaviours of all agents (consumers, producers, Government, investors, etc.) in the economy. **Figure 3.21** shows the economic interactions between households, businesses and the Government captured in the CGE model. Each of these institutions is interlinked through either labour market or capital market flows.

CGE models can be used to undertake scenario analysis to estimate the impact of a policy change on the whole economy. CGE models capture detailed sectoral interactions and account for behavioural responses of firms and households, over both short and long-term horizons. They can therefore account for the overall impact on the economy from a change in the aviation sector. This sets CGE models apart from many transport models which are ‘partial equilibrium’, which means that they use standard supply and demand analysis to find equilibrium in an isolated market.

Figure 3.21: CGE modelling captures the interactions between households, firms and the Government



3.118 CGE models are well suited to evaluate the national economic impact of a capacity constraint in the aviation sector and two different CGE models have been used; the HMRC model and a model owned and operated by PwC. Two different modelling approaches were used to model the capacity constraint, in order to provide a range of estimates. In the HMRC model, the change in seat capacity is applied as a constraint on the aviation sector's output, which causes the price of aviation to

increase and impacts on the rest of the economy. In the PwC model, the constraint leads to lower productivity in the aviation sector, which impacts on the rest of the economy.

- 3.119** The results produced by both models are of a similar magnitude and strongly support the hypothesis that capacity constraints have negative impacts on GDP. They indicate that the limited capacity constraints currently being experienced are unlikely to affect economic activity significantly, but as these become more severe and a wider range of airports are operating at capacity, the effects on the economy will be more significant.
- 3.120** The modelling indicates that by 2030 aviation capacity constraints could depress GDP by between 0.03% and 0.05%. By 2050, as the London airport system becomes completely full, the contraction in GDP is higher, between 0.04% and 0.09%. Assuming a standard 60 year period appraisal, as would commonly be applied to any decision on new infrastructure, the total cost of a capacity constraint, assuming no action was taken, could amount to between £30 billion and £45 billion between 2021 and 2080.⁹³ The upper bound of this range is taken from the HMRC modelling and does not include productivity impacts. The Commission's literature review has indicated that productivity impacts would be likely to be felt, further depressing GDP.⁹⁴
- 3.121** Key limitations of this modelling include the fact they are single country models and are unable to distinguish between the value of different types of seat capacity.⁹⁵ For example, an additional leisure flight from Stansted to Malaga would not have the same value in terms of potential for increased trade or productivity as, say, a business flight from Heathrow to Shanghai. This is particularly important in a scenario where a limit on carbon emissions is in place (see **Chapter 4**) and therefore the benefits of alleviating capacity constraints are likely to relate more to the type and value of travel that is enabled than to changes in overall passenger numbers.
- 3.122** CGE models account for how consumers and businesses might react and adapt to a capacity constraint over time, whereas standard transport models commonly exclude such changes in behaviour. This analysis is helpful in indicating the direction of the impact and its likely scale. Though the analysis suggests that some of the effects stated in the literature appear to be overestimated, it does support the view

93 2012 PV year and price base

94 The Commission has undertaken some simple additional modelling to attempt to assess the potential effect of incorporating productivity impacts in the HMRC model. The results of this analysis showed that GDP could contract by up to 0.17% in 2050. Further details of this analysis can be found in Appendix 3

95 A single country model cannot measure all the possible impacts of a capacity constraint. For example, there may be leakages such as repatriation of profits where there is foreign ownership in the aviation sector

that capacity constraints could impose a significant cost on the economy. However, given the relatively novel approach the Commission has taken, these results should be interpreted with caution.⁹⁶

Conclusions

- 3.123** Heathrow is effectively full and Gatwick is operating at more than 85%. As passenger demand grows, other airports can also be expected to reach capacity over the coming decades. The impacts are already being felt in terms of delay and unreliability, and there is some evidence of an impact on fares. It is also becoming clear that capacity constraints could mean expansion of new connections to economically important places are traded off against the UK's current strong position serving Europe and North America.
- 3.124** Nonetheless, the UK does not face an immediate capacity crisis. The London aviation market continues to be amongst the most attractive and best connected in the world. Gatwick is responding to the continuing capacity constraints at Heathrow by opening new long-haul routes to emerging markets and to the United States. British Airways' recent acquisition of new slots at Heathrow through its purchase of BMI will allow it gradually to expand its route network. The low-cost sector will continue to innovate and introduce new routes at other airports, together with the long-haul travel opportunities opened up by the Gulf carriers. Measures are being taken to strengthen the resilience of operations at Heathrow, with a number of potential further measures identified by the Commission in **Chapter 5**. Similar mechanisms may be feasible at other airports as they reach capacity.
- 3.125** But over time, as capacity constraints propagate through the London and ultimately UK airport system, with more and more airports becoming full, the negative impacts will become harder to manage. The timing is discussed further in **Chapter 4**.
- 3.126** The analysis presented in this chapter has indicated that the costs of failing to address these constraints could be substantial. The social cost-benefit analysis indicates costs with a present value estimate of £18 billion to £20 billion, including delay costs. There is good evidence to suggest that there are also costs associated with lost trade, FDI and tourism, and that these are likely to affect wider UK economic performance. The Commission's analysis of these wider economy impacts of capacity constraints on GDP estimated total costs of £30 billion to £45 billion between 2021 and 2080.

⁹⁶ Particular caution should be taken in using the results in any cost-benefit analysis. The results would also not be appropriate for any commercial case developed in respect of the private financing of aviation infrastructure, which would consider a different range of inputs

3.127 On this basis, the Commission believes that there is a rational economic case for taking action to address capacity constraints. The next chapter looks in detail at how demand may develop in the future and sets out the Commission's recommendations on the nature, scale and timing of the need for additional capacity.

Chapter 4:

The UK's long-term capacity requirements

SUMMARY

UK airports have so far adapted well to a changing world, but problems are starting to emerge, particularly at Heathrow, which is now operating at close to full capacity. While it is not possible to predict with certainty how soon other UK airports will fill up, in planning long-lived infrastructure policymakers need to work with some view of the future, whilst taking account of significant uncertainties.

The Commission has therefore developed a new set of forecasts which improve on the Department for Transport's aviation model, including a new approach to dealing with uncertainty. This addresses many of the issues raised by respondents to the Commission's *Aviation Demand Forecasting* discussion paper.⁹⁷

Across all scenarios considered, including when the UK is meeting its climate change targets, there is forecast to be significant growth in demand for aviation between now and 2050, placing additional pressure on already stressed airport infrastructure in London and the South East. The London airport system is forecast to be under very substantial pressure in 2030, and by 2050 sees demand significantly in excess of the total available capacity.

The Commission's analysis further suggests that there is relatively little scope to redistribute this demand away from London and South East airports. A congestion charge on the UK's busiest airports, to incentivise airlines to use currently under utilised infrastructure, would have a negative effect on UK connectivity and capacity. The scope for other policy levers, such as slot allocation and Traffic Distribution Rules, to redistribute demand, is very limited.

The Commission therefore concludes that there is a case for at least one net additional runway in London and the South East by 2030.

97 Airports Commission, 'Discussion Paper 01: Aviation Demand Forecasting', February 2013
<https://www.gov.uk/government/publications/discussion-paper-on-aviation-demand-forecasting>

In terms of the nature of the capacity that is needed, the Commission does not believe there is a binary choice between providing additional hub capacity or additional point-to-point capacity. Instead, the optimal approach is to continue to invest in an airport system that caters for a range of airline business models. This is particularly important in a competitive airport system, like London, where airlines can choose how to use the available capacity, and the market can be expected to respond dynamically to the provision of new infrastructure. The Commission expects to look further into how each of the shortlisted options may support this overall objective as part of its next phase of work.

The Commission's forecasts indicate that there is likely to be a demand case for a second additional runway in operation by 2050 or, in some scenarios, earlier.

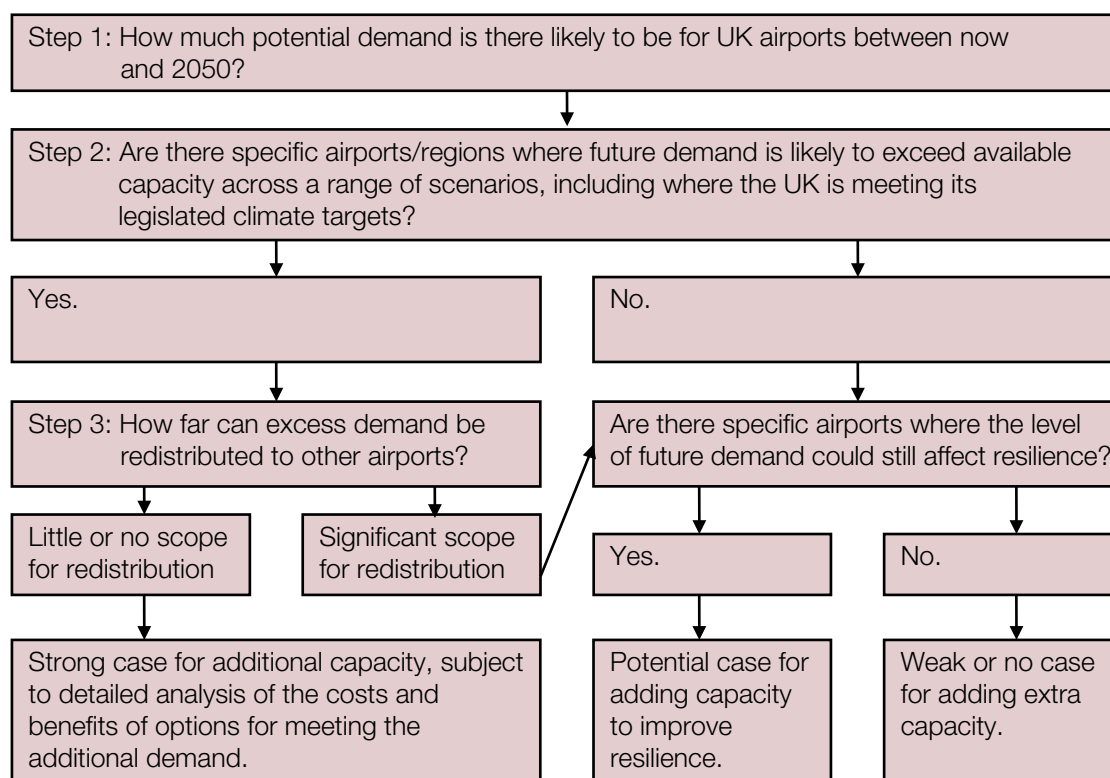
The Commission will carry out further analysis in the second phase of its work programme, including looking at the implications for any future capacity expansion of each of the new runway options shortlisted for detailed consideration. This will enable it to make recommendations to the Government in its final report as to when, how and by whom the case for a second additional runway should be considered.

- 4.1** The UK has to date been reasonably well-served by its existing airport infrastructure. There are signs, however, that some of this infrastructure is being stretched increasingly close to its limits in terms of connectivity and resilience.
- 4.2** It is not possible to predict with certainty how soon these problems will come to a head. Nevertheless, the Government needs to plan for the long-term to ensure that infrastructure is in place to serve the needs of future generations. This should not entail a mechanistic 'predict and provide' approach, where forecasts are treated as straightforward predictions of future need, and infrastructure to meet that need is provided at any cost. Rather, policymakers should use the full range of tools at their disposal, including forecasts, to make informed judgments about what infrastructure should be provided. In doing so, they need to weigh carefully the risks of both over and under provision.
- 4.3** The Commission has therefore developed a new set of aviation demand forecasts and used them alongside other analytical approaches, such as scenario testing and other forms of evidence, including discussion paper responses and expert advice, to reach its conclusions. This chapter explains the Commission's approach in more detail, summarises the results of its analysis, and sets out its key conclusions on the nature, scale and timing of the UK's future airport capacity needs.

The Commission's approach

- 4.4** To estimate the scale and timing of capacity needed, the Commission first developed a set of core forecasts for future aviation demand. It used these to identify airports and regions where future demand is likely to exceed available capacity across a range of scenarios, including where the UK is meeting its climate targets. Finally, the Commission considered the scope for redistributing demand within existing airport capacity using a range of potential policy levers, such as Air Passenger Duty (APD), changes to the slots regime, and Traffic Distribution Rules (TDRs). This process is illustrated in **Figure 4.1**.

Figure 4.1: The Commission's framework for considering the scale and timing of any need for additional airport capacity



Differences between the Airports Commission and DfT forecasts

- 4.5** The Commission has taken the DfT aviation model as the starting point for producing its demand forecasts. The two major components of the model are the National Air Passenger Demand Model (NAPDM), which forecasts passenger demand before taking account of capacity constraints, and the National Air Passenger Allocation Model (NAPAM), which allocates these passengers to airports and can take into account capacity constraints.

4.6 Changes to the forecasting methodology and assumptions have been made in part as a result of responses to the Commission's *Aviation Demand Forecasting* discussion paper. In these responses, some of the criticisms of the DfT's forecasting approach included:

- **The way the DfT accounts for uncertainty in the demand for travel.** A key area of concern was in the reliability of models over a long time period and the approach to uncertainty.⁹⁸ A number of responses recommended that uncertainty would be better incorporated through the use of probabilistic techniques.
- **Forecasting international growth.** Several respondents questioned whether the international regions used in the NAPDM were suitable, with particular concern that the countries contained within the existing groupings were not similar enough to be modelled together.⁹⁹
- **Modelling international traffic.** Respondents generally agreed with the suggestion in the Commission's discussion paper that the inability of the DfT model to capture fully the international transfer passenger market was an important weakness.¹⁰⁰
- **Representing airline and airport competition.** Comments and recommendations were made on the suitability of the model in representing airline and airport competition. Respondents pointed out that there are a number of ways that these markets could develop.¹⁰¹

4.7 The Commission has sought to address these criticisms through the following revisions to the DfT forecasting approach:

- **A revised definition of emerging economies.** The definition of markets used for international forecasting has been re-evaluated in line with several responses to the discussion paper.¹⁰² Several countries, such as Brazil and Indonesia, previously classified as Less Developed Countries (LDCs) have been reclassified as Newly Industrialised Countries (NICs). This is expected to provide better estimates of future demand for travel.
- **Decreased 'demand overspill' from the South East.** Once an airport reaches capacity, prospective passengers either travel to an alternative airport or do not fly at all. In these new forecasts more people choose not to travel at all than to go

98 In particular, this was raised by the Aviation Environment Federation (AEF), Manchester Airports Group (MAG) and Kent County Council

99 Including the Mayor of London and Birmingham, Bristol and Newcastle airports

100 Including Heathrow Airport Limited, British Airways and the Chartered Institute of Logistics and Transport

101 Respondents included British Airways, Gatwick Airport and Gatwick Area Conservation Campaign

102 This was raised by the Mayor of London and Birmingham Airport, amongst others

to another available airport, which has the effect of reducing implausibly high demand growth in the later years of the forecast period at airports such as Humberside and Exeter.

- **Probabilistic forecasts.** Monte Carlo simulation, a statistical technique involving repeated random sampling, has been used to produce a range of all possible levels of output and the probability they will occur for any combination of inputs. This is a better approach to capturing some of the inherent uncertainty in forecasting than traditional high/low scenarios. **Figure 4.2** shows the difference this makes to the national level demand forecast.
- **Modelling overseas hubs.** The biggest overseas hub competitors to London are now modelled to the same level of detail as UK airports. The four newly modelled hubs are Paris Roissy-Charles de Gaulle (CDG), Amsterdam Schiphol (AMS), Frankfurt (FRA) and Dubai International (DXB). The forecasts show that the UK would be successful at re-capturing the majority of the traffic which moves to alternative hubs if capacity constraints are alleviated. The UK only has a 3% share of the international to international transfer passenger market in 2050 when capacity is constrained, which rises to 22% if capacity constraints are lifted.¹⁰³
- **Revisions to model inputs.** The Commission's forecasts include updated oil price assumptions, using forecasts from the International Energy Agency (IEA). These forecasts are available out to 2035, after which the figures have been extrapolated to 2050. These values replace the previously used DECC forecasts, which extended only as far as 2030, as mentioned in a number of submissions.¹⁰⁴ The Commission has taken forward work to improve the assumptions about growth in aircraft size, which have been increased as a result. It has also reviewed the assumptions on aircraft load factors, concluding that they remain appropriate.

4.8 More detail on these updates to the model can be found in the *Appendix 3: Technical Appendix*.

How the model has been used

4.9 The Commission has used the updated model to develop four core forecasts:

- 1) **Carbon traded, capacity unconstrained.** This represents total potential demand for UK aviation, in the absence of any constraints on airport capacity or

¹⁰³ At the median of the range with carbon capped

¹⁰⁴ Including Stop Stansted Expansion and WWF-UK

on aviation emissions. It assumes that aviation continues to participate in existing emissions trading schemes, such as the EU Emissions Trading System (ETS), so passengers face a carbon cost, but no specific emissions level is targeted.¹⁰⁵ It is broadly equivalent to the DfT's unconstrained demand forecast.

- 2) **Carbon traded, capacity constrained.** This is the same as the first forecast, except that it assumes that existing constraints on UK airport capacity persist throughout the forecast period. The difference between this forecast and the first allows the Commission to estimate the scale of unmet demand at national, regional and airport level, and the rate at which airports would fill up in the absence of any limit on carbon emissions. This forecast is broadly equivalent to the DfT constrained forecast.
- 3) **Carbon capped, capacity unconstrained.** This represents the level of aviation demand consistent with the CCC's current assessment of how UK climate targets can be met. It includes a higher modelled carbon price, which ensures that forecast emissions return to 2005 levels by 2050, but assumes no constraints on airport capacity. It is broadly equivalent to the CCC's 'likely' scenario, set out in its 2009 report "*Meeting the UK aviation target – options for reducing emissions to 2050*".¹⁰⁶
- 4) **Carbon capped, capacity constrained.** This forecast assumes both a higher modelled carbon price, as in (3), and the continuation of existing constraints on UK airport capacity, as in (2). It allows the Commission to estimate how existing airport capacity would be used if further policies were introduced to return aviation emissions to 2005 levels by 2050.

4.10 In addition, the Commission has carried out sensitivity tests around the core forecasts, using the scenarios set out in **Chapter 2** to inform some further modelling.

Step 1: How much potential demand is there likely to be for UK airports between now and 2050?

4.11 The carbon traded, capacity unconstrained forecast (1) allows the Commission to estimate total potential demand for UK airports, in the absence of any constraints on capacity or further policies to control aviation emissions. This forecast suggests that unconstrained aviation demand is likely to grow significantly between now and 2050. **Figure 4.2** shows the median forecast for unconstrained demand is 450

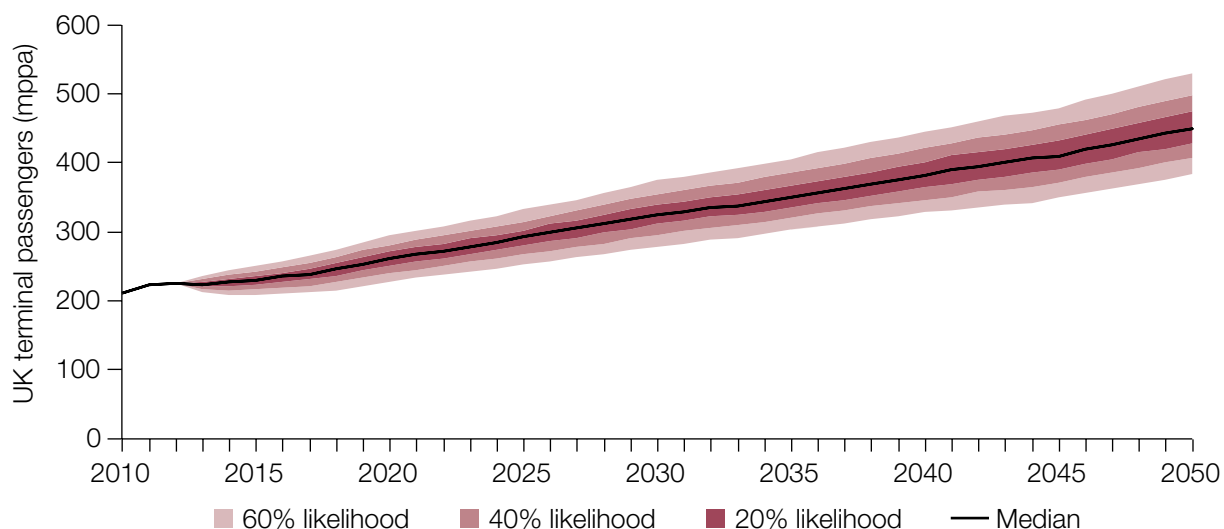
¹⁰⁵ Carbon prices are based on the recommended traded values provided by DECC for use in policy appraisals, and assume aviation is part of the EU ETS until at least 2020, and part of a global carbon market beyond then

¹⁰⁶ Committee on Climate Change (2009), "Meeting the UK aviation target – options for reducing emissions to 2050", <http://www.theccc.org.uk/publication/meeting-the-uk-aviation-target-options-for-reducing-emissions-to-2050/>

million passengers per annum (mppa) in 2050, in a range of 380 mppa to 530 mppa. The median estimate is 7% lower than the January 2013 DfT forecasts.

Figure 4.2: The Commission's forecasts show unconstrained demand would grow significantly up to 2050

Unconstrained national air passenger forecasts, carbon traded, 2010-2050

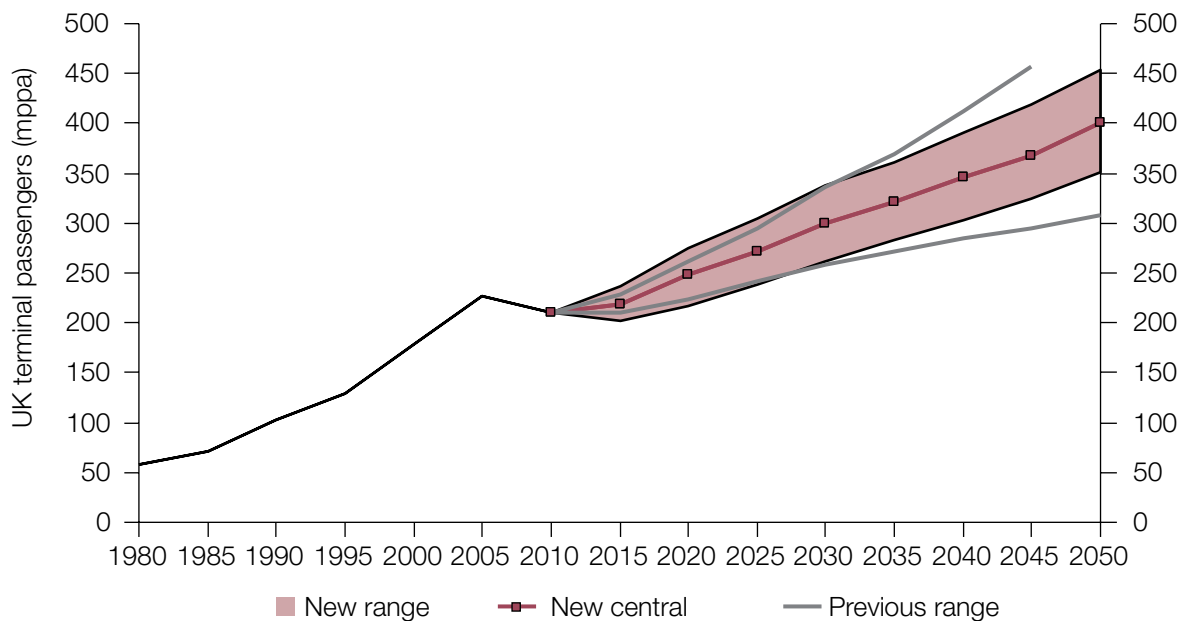


4.12 The carbon traded, capacity constrained forecast (2) shows the effect that current capacity constraints would have, if they are not alleviated. Here the median passenger demand forecast falls from 450 mppa to 400 mppa by 2050, in a range of 350 mppa to 455 mppa. Forecast passenger numbers in this scenario are 4% lower in 2030 and 11% lower respectively in 2050 than the levels forecast by the DfT in January 2013. This reduction is largely explained by the improved modelling of overseas hubs and updated forecasts for UK and foreign GDP.

4.13 The forecasts shown above have been derived using an updated, probabilistic approach to uncertainty developed by the Commission. **Figure 4.3** shows how this new approach to modelling uncertainty produces a narrower range of forecasts than the range based on high and low demand scenarios published by the DfT in January 2013.

Figure 4.3: The Commission's forecasts have a narrower range than DfT's January 2013 forecasts

Constrained national air passenger forecasts, carbon traded, 1980-2050



4.14 The Climate Change Act 2008 set a target for total UK greenhouse gas emissions to be reduced by 80% by 2050, relative to a 1990 baseline. The CCC's current assessment of how this target can be met assumes that CO₂ emissions from UK aviation in 2050 should be at or below 2005 levels.¹⁰⁷

4.15 In its 2009 report the CCC assessed the maximum increase in total UK demand which is likely to be consistent with constraining 2050 aviation emissions to 2005 levels, given best estimates for future technological progress. The Committee's findings, based on its 'likely' scenario, included:

- demand growth of around 60% over 2005 levels would be compatible with keeping aviation CO₂ emissions in 2050 no higher than in 2005, given prudent assumptions on likely improvements in fleet fuel efficiency and biofuels use;
- this equated to an increase in ATMs of around 55% over the same period; and,
- a 60% increase in total UK aviation demand could be consistent with a range of policies as regards capacity expansion at specific airports (it was not the CCC's role to assess the merits of specific airport expansion plans).

¹⁰⁷ Committee on Climate Change (2009), 'Meeting the UK aviation target – options for reducing emissions to 2050', <http://www.theccc.org.uk/publication/meeting-the-uk-aviation-target-options-for-reducing-emissions-to-2050/>

4.16 The Airports Commission's carbon capped, capacity unconstrained forecast (3) updates the previous work of the CCC, using a broadly similar approach. The Commission's updated analysis suggests that:

- based on current forecasts, the compatible level of passenger demand growth is around 67% by 2050;
- this translates into an increase of around 38% in the number of ATMs, given current assumptions around average aircraft sizes and load factors; and,
- as the CCC found, this is compatible with a range of policies on capacity expansion.

4.17 Notwithstanding some differences in the DfT and CCC models, the results are broadly similar. The differences between the estimates can be attributed largely to assumptions regarding load factor and aircraft fuel efficiency. For instance, the CCC model forecasts average load factors of 85% by 2050, whereas the Commission's forecasts are lower at 80%.

Step 2: Are there specific airports or regions where future demand is likely to exceed available capacity across a range of scenarios, including where the UK is meeting its legislated climate targets?

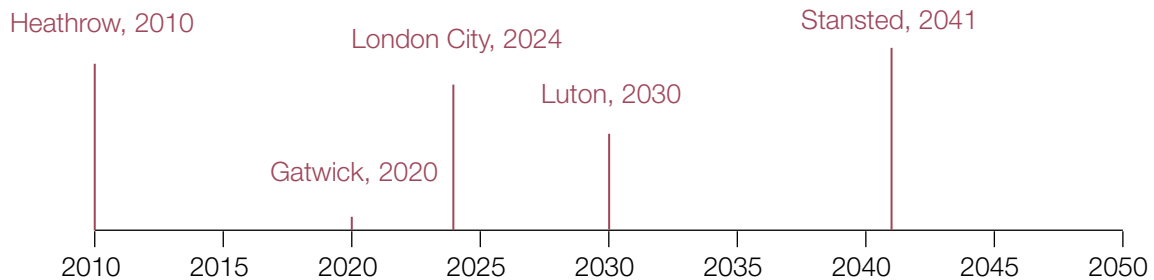
4.18 With aviation emissions capped at a level consistent with current plans to meet UK climate targets, passenger demand at UK airports is forecast to increase from 217 mppa in 2011 to 295 mppa in 2030 and 389 mppa by 2050. This is an average increase of 1.4% a year, compared to historic growth of 4% a year and forecast growth of 1.5% a year without a carbon cap. With the carbon cap now the limiting factor for demand growth overall, passenger numbers do not change significantly between the capacity constrained and unconstrained scenarios. It is rather the allocation of demand between airports and market sectors which alters as capacity constraints are alleviated.

4.19 In the carbon capped, capacity constrained forecast (4), total demand across the London airport system is projected to reach 90% of the available runway capacity by 2030. This rises to more than 96% in the carbon capped, capacity unconstrained forecast (3), in which passenger choices are not restricted by the limitations of existing runways or other infrastructure. These rates of utilisation are at or above the point at which high levels of reliability would no longer be able to be maintained – particularly on a system-wide basis.

- 4.20** With carbon capped but capacity unconstrained, demand in the London airport system would continue to grow such that it would exceed the theoretical maximum capacity by around 14% by 2050. In contrast, there is projected to be significant spare capacity available at airports elsewhere in the country. The scope to redistribute excess demand to airports outside London and the South East is discussed later in this chapter.
- 4.21** Even with a carbon cap and a projected increase in aircraft sizes and loadings, by 2030 demand across the London airport system would be reaching the absolute limits of what could feasibly be accommodated. By 2050, the gap between demand and capacity equates to some 170-200,000 ATMs.
- 4.22** On the basis that a single runway could accommodate some 200,000 movements or more, this suggests that one net additional runway would be able to accommodate forecast demand growth in London and the South East between 2030 and 2050 in this scenario. By the end of that period the system would once again be approaching the limits of its capacity, suggesting that there may be a case for a second additional runway by around 2050.
- 4.23** Excess demand in the London airport system is forecast to be concentrated particularly on Heathrow, which remains full across all the demand scenarios considered. This does not mean, however, that the correct approach to addressing any capacity gap would necessarily be to expand Heathrow. The UK's aviation market is evolving, and the London airport sector is uniquely competitive. As this evolution continues, new options for meeting passenger needs and effectively addressing the forecast gap between supply and demand presented here may develop. Furthermore, final decisions on options for new capacity will also need to take into account wider factors including cost, deliverability and impacts, both positive and negative, on local communities and the environment.
- 4.24** The timeline in **Figure 4.4** shows the Commission's estimate of when London and South East airports will reach the limits of their current capacity in a carbon capped scenario. Even with the much higher modelled carbon price in the carbon capped, capacity constrained forecast, the London airport system is still projected to fill up by the early 2040s. During peak times some airports will be at capacity earlier than shown here.

Figure 4.4: Without additional capacity, major London and South East airports will be full by the 2040s, even with a carbon cap in place

Projected years when London and South East airports become full, in the carbon capped, capacity constrained forecast



- 4.25** It should be noted that 100% utilisation of the theoretical maximum runway capacity across the whole of the London airport system is unlikely to be either desirable or feasible. It would require investment in new terminal capacity and would create significant airspace challenges.
- 4.26** Perhaps more importantly, it would entirely remove any scope to manage periods of severe weather or other incidents, and would be likely to increase the levels of unreliability and delay experienced by passengers across all major London and South East airports. Therefore, the gap between demand and capacity indicated in the analysis above may be an underestimate of actual capacity need.
- 4.27** The Commission has also considered the potential implications of its carbon traded forecast. In this case, a greater level of overall demand growth is seen, as emissions can rise above the level consistent with current plans to meet UK climate targets. However the difference between the forecasts is relatively modest, with unconstrained passenger numbers only 18% higher than in the carbon capped scenario and ATMs roughly 16% higher.
- 4.28** The broad implications of this forecast, therefore, are in line with those from the carbon capped forecast, except that capacity constraints would bite slightly earlier. In this case, the median forecast shows unconstrained demand is estimated to outstrip available capacity across the major London and South East airports between 2025 and 2030, and one net additional runway would provide sufficient capacity to accommodate demand growth until the mid-2040s, with a further runway likely to be needed before 2050 for capacity as well as resilience reasons.
- 4.29** In reality, neither the carbon capped, nor the carbon traded forecast is likely to provide a 'correct' picture of future demand. Nonetheless, the level of consistency between them regarding overall demand pressures in the London airport system provides a particularly helpful guide for policy makers, indicating that the *scale* of

demand growth and capacity needed is broadly similar across a range of potential carbon futures, albeit with some difference in terms of *timing*.

- 4.30** These forecasts also show broadly similar results in relation to how future demand growth might be allocated across market segments. Significant growth between 2011 and 2050 is seen in all four scenarios modelled across most of the sectors of the aviation market (defined as domestic, short-haul business and leisure, long-haul business and leisure, UK transfer and international transfer). The exceptions to this are UK and international transfer passengers, which are forecast to decline by more than three quarters by 2050 when capacity is constrained in both the carbon traded and the carbon capped scenarios.
- 4.31** The main difference of this type between the scenarios relates to the effect of relaxing capacity constraints. In the carbon traded scenario, when capacity is unconstrained, growth rates are the same or higher than in the capacity constrained forecast across all sectors (including both transfer and origin and destination). In the carbon capped scenario, however, the limit on carbon emissions by 2050 means that as numbers of transfer passengers – both UK and international – rise in the unconstrained scenario, these have to be offset by lower growth rates in other sectors of the market. This effect is most pronounced in relation to short-haul leisure travel, which sees the level of growth forecast between 2011 and 2050 drop from 87% in the constrained scenario to 60% in the unconstrained scenario. The reductions seen in the business sector are significantly smaller, with the growth rate for long-haul business travel changing by less than 2%.
- 4.32** In reality, whatever capacity constraints may or may not be in place, future aviation demand will be shaped by market forces and not by the outputs of a model. While transfer passengers play an important role in supporting high levels of connectivity at hub airports, for example, they are also highly price sensitive and in many cases will effectively pay a similar or lower fare for two journeys to get to their destination as a direct passenger pays for one. Therefore, airlines may endeavour to prioritise direct passengers over transfer in allocating capacity. But this effect is not captured in demand modelling.

Key uncertainties and sensitivities

- 4.33** The Commission's carbon capped forecasts use carbon prices to constrain aviation emissions, and hence aviation demand, to a level consistent with current plans to meet UK climate targets. This is a proxy for a range of potential measures to control emissions, which could include international cap-and-trade schemes, domestic carbon taxes or some combination of these, and does not constitute a policy

recommendation. It is ultimately for Government, with advice from the CCC, to determine the appropriate framework for controlling aviation emissions.

- 4.34** For the purpose of producing the carbon capped, capacity unconstrained forecasts, the Commission assumed a carbon price of up to £600 per tonne of CO₂. This price is significantly in excess of the DECC central carbon values of around £200 per tonne of CO₂ and the current carbon price of around £3 per tonne of CO₂.¹⁰⁸ In 2050, the average modelled short-haul fare increase in this scenario is £43, taking the average fare from £103 to £146. The average modelled long-haul fare increase is £205, taking the average fare from £397 to £602.
- 4.35** The very high modelled carbon price could be seen to imply that the proposed level of emissions reductions within the aviation sector would not be the most cost-effective option for achieving the UK's overall carbon targets. As the CCC notes in its advice to the Commission, "it is of course possible that there may be scope to reduce emissions more in other sectors", which would allow aviation demand to grow by more than currently assumed. However, the CCC cautions that planned reductions in other sectors are "at the limit of what is feasible, with limited confidence about the scope for going beyond this".¹⁰⁹
- 4.36** New engine and airframe technologies could reduce the carbon intensity of future air travel. If progress on this front is greater than currently expected, this would also increase the level of demand that could be accommodated within the UK's currently legislated climate targets. A further uncertainty is around the future uptake and potential carbon savings from aviation biofuels.
- 4.37** The Commission has reviewed key assumptions regarding aircraft efficiency and biofuels. Estimated future fuel-efficiency savings used by the DfT are broadly in line with those used by industry. There are a wide range of assumptions around future biofuels uptake and potential carbon savings, with the DfT assumptions on the conservative side. On this basis, the DfT approach has been retained, although this remains an area of uncertainty. The assumptions in the CCC's 'likely' scenario, for example, are more optimistic overall in relation to biofuels.
- 4.38** Set against this, national and international policy frameworks do not currently include the most significant non-CO₂ emissions from aviation (see **Box 4a**). As scientific understanding of these emissions develops, policy may need to evolve to address their climate impacts. Should this require additional emissions

¹⁰⁸ Based on The Times reported carbon price on 22/11/13 of approximately £4 per tonne of CO₂, rebased to 2008 prices for consistency

¹⁰⁹ Available at http://www.theccc.org.uk/wp-content/uploads/2013/07/CCC_letter_aviation_commission.pdf

reductions within the aviation sector beyond what is currently planned, this constitutes a downside risk to the forecasts set out above.

Box 4a: Non-CO₂ emissions from aviation

In addition to CO₂, combustion of aviation fuel produces a range of emissions including water vapour (forming contrails), soot (black carbon) and oxides of nitrogen (NO_x). While many national and international climate policies, including the UK Climate Change Act, cover some non-CO₂ emissions (NCEs) through the concept of CO₂-equivalent emissions (CO₂e), they do not include the most significant NCEs from aviation.

Unlike CO₂, the climate effects of aviation NCEs depend on the location and time of the emissions, and can exert both warming and cooling influences. Compared to CO₂, the effects are also generally more regional and shorter lived in nature. This makes it difficult to compare the effects of NCEs with those of CO₂, although a number of methods have been developed to enable a comparison of some aspects.

'Radiative forcing' is one method for doing this. Other approaches include the 'Global Warming Potential' (GWP) and 'Global Temperature-change Potential' (GTP). Despite significant progress in quantifying climate effects for NCEs, climate metrics for these emissions remain more uncertain than for CO₂.

As scientific understanding in this area continues to improve, climate policies may need to evolve to take better account of NCEs. However, the implications of this for specific sectors, such as aviation, are not yet clear.

4.39 The CCC's recommendation to the Commission, taking account of all these uncertainties, is that the target of constraining CO₂ emissions from UK aviation to 2005 levels by 2050, consistent with current plans to meet the economy-wide climate target, remains the most appropriate basis for planning future airport capacity.¹¹⁰

4.40 Forecasts of air passenger demand also need to take into account the development of alternatives to aviation, such as high-speed rail and videoconferencing. **Box 4b** discusses the potential impacts on aviation forecasts of High Speed 2 (HS2). It should be noted, however, that in carbon capped scenarios, the use of alternatives to aviation is unlikely to reduce aviation demand overall. This is because in these scenarios the carbon cap is the constraining factor on aviation demand.

110 *Ibid*

The effect of aviation demand shifting to other transport modes is likely to be to create additional headroom within the carbon cap for other air passengers.

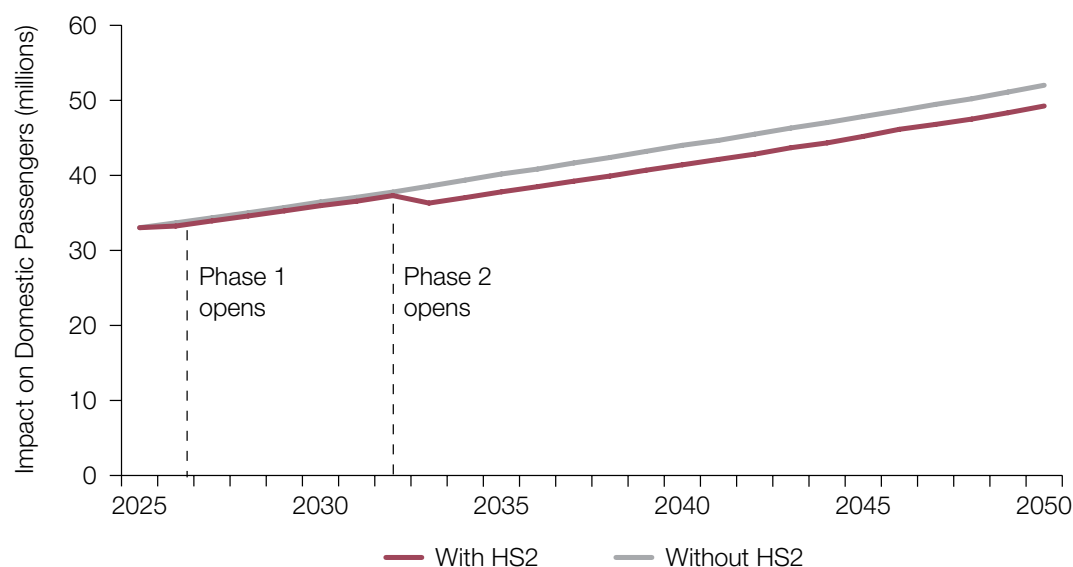
Box 4b: Could high-speed rail solve the airport capacity problem in London and the South East?

A number of stakeholders have argued that aviation demand could be met within existing capacity by shifting domestic and short-haul journeys onto rail, especially if HS2 adds capacity to the network.

An air-to-rail shift based on HS2 is included in the Commission's forecasts, and as **Figure 4.5** shows there is a relatively small reduction in domestic demand as some passengers switch onto HS2. There will also be an increase in the number of passengers flying from the UK to international destinations as HS2 increases the catchment area of UK airports.

Figure 4.5: There is a small reduction in domestic demand as a result of HS2, particularly from 2033 when phase 2 opens

Domestic passenger demand with and without HS2, 2025 – 2050



The scope for further rail growth on short-haul European routes is limited by some clear constraints, including rail line and tunnel capacity out of the UK – there is only one railway link that connects the UK with continental Europe – and by the availability of feasible destinations. For instance, the only additional destination planned since the opening of Eurotunnel is Amsterdam, and this is not yet operational.

Step 3: How far can excess demand be redistributed to other airports?

- 4.41** While demand at airports in London and the South East is expected to exceed available capacity by 2050, even with policies in place to meet UK climate targets, there is likely to be a high level of unused capacity at many regional airports. The Commission therefore considered whether it would be possible to solve the capacity problem in London and the South East by incentivising, or requiring, airlines to make greater use of under utilised capacity elsewhere.
- 4.42** This approach has been put to the Commission by various stakeholders, including environmental organisations, local groups and regional airports, in two different contexts. Some proposed it as a short or medium term measure to maintain and enhance the UK's connectivity before any new capacity can be utilised. Others suggested that the level of unused capacity, and the potential to make more use of it, was such that there was no need to provide any additional airport capacity in the longer-term.
- 4.43** The Richmond Heathrow Campaign's submission on how to increase airport capacity in the long-term was one of the most comprehensive proposals received by the Airports Commission for how rising demand could be accommodated without the need for new infrastructure, and is summarised in **Box 4c**.

Box 4c: Richmond Heathrow Campaign's long-term proposals for meeting future airport demand

The four elements of this proposal are set out below, together with an explanation of why the Commission does not consider that they would meet the UK's aviation capacity and connectivity needs.

Increasing the rate of aviation taxation to slow the rate of growth in passenger demand

The Commission has considered the implications of a significant increase in the cost of flying through its carbon capped forecasts, which can be considered a proxy for increasing aviation taxes. Even with such a price increase in place, there remains a need for additional capacity in the London and South East airport system.

Revising the forecast distribution of demand between the South East region and the rest of the UK

The Richmond Heathrow Campaign argues that forecasts should reflect the higher rates of demand growth that have been seen over recent decades outside of the South East. The Commission's forecasts indicate, however, that these higher rates of growth may be a consequence of the long-standing capacity constraints in the South East system, and the pattern of growth would be likely to change if those constraints were alleviated.

Expanding terminal capacity at South East airports to accommodate a higher average number of passengers per flight

The Commission's forecasts incorporate revised assumptions about plane sizes, which see more passengers per flight than in previous DfT forecasts. Despite this, significant excess demand over capacity is still forecast in the South East by 2050.

Redistributing services between the major South East airports to make better use of existing capacity

As set out in this chapter, the levers available to redistribute traffic are limited and the historical precedents are not encouraging. The Richmond Heathrow Campaign proposes that the removal of market disincentives would enable the segmentation of traffic between airports, but industry experience indicates that a highly interventionist approach would in practice be needed.

4.44 To assess the scope for redistributing traffic, the Commission considered four potential policy levers:

- taxation;
- changes to the slots regime;
- Traffic Distribution Rules; and,
- restrictions on aircraft and services at congested airports.

Taxation

4.45 The UK's main aviation tax, APD, is levied on airline passengers beginning their journeys at a UK airport. Rates of APD vary depending on the distance of the journey and the class in which the passenger travels. Since its introduction in 1994, rates of APD have more than doubled and the rate structure has been changed so as to allow more granular banding of destinations by distance. APD does not apply to passengers transferring flights via a UK airport while en route between two other countries (unless they stop over in the UK for more than 24 hours) or to passengers flying on an aircraft with a weight of less than 5.7 tonnes.

4.46 The UK is not alone in levying an APD-style tax on flying. Within Europe, Austria, France, Germany, Ireland and Italy have similar taxes. While all these taxes affect demand for aviation, this is especially the case in the UK, where the tax rate levied on passengers is much higher than the rate applied by other countries. This report does not review arguments surrounding the overall yield from APD and its economic impact, as this is not within the Commission's remit.

4.47 The Commission did consider the potential to vary APD on a revenue-neutral basis according to levels of congestion at airports – an APD congestion charge. This would provide an incentive for airlines to make greater use of less-congested airports. Whilst stakeholders proposed two alternative ways of using APD to achieve the same overall objective – devolving APD and varying it by region – these options would be less well-targeted than the APD congestion charge.

4.48 Devolving APD would do little to incentivise better use of existing capacity at regional airports in England, and could potentially distort competition between proximate airports on either side of a border, such as Bristol and Cardiff, or Newcastle and Edinburgh. Regional variations in APD could potentially give rise to perverse incentives, for example to not use spare capacity in London and the South East, as currently exists at Stansted and Luton.

4.49 As a result, the Commission analysed the impact of a 10% APD surcharge at airports above 90% of their maximum capacity, with approximately revenue neutral decreases in APD at other airports. The results of this analysis are set out in **Box 4d**. Broadly, this shows that an APD congestion charge is not a promising solution to the capacity problem in London and the South East because:

- **It does not increase overall seat capacity.** The policy would be likely to result in a minor reduction of long-haul seats available from the UK, with a negligible impact on overall seat capacity.
- **It does not maintain or improve long-haul connectivity.** The policy is likely to lead to a minor fall in the number of destinations directly accessible from the UK, as congested airports like Heathrow lose routes, and the new routes developed at less congested airports largely duplicate those already available from Heathrow.
- **It is carbon inefficient.** The policy would result in a reduction in average plane sizes on long-haul routes, as these routes are displaced from airports with high traffic volumes, such as Heathrow, to airports with smaller traffic volumes, like Luton. This increases emissions relative to the core forecasts.
- **The effects of the policy diminish over time.** In the long-term, the measure becomes less effective as currently less congested airports begin to hit the 90% capacity limit, and no longer benefit from the lower rate.

4.50 While a congestion based charge might have some short-term benefits for less congested airports, its net effect on the UK's national connectivity and capacity is mildly negative. The measure does not represent a suitable long-term strategy for meeting the Commission's remit of maintaining the UK's international hub status.

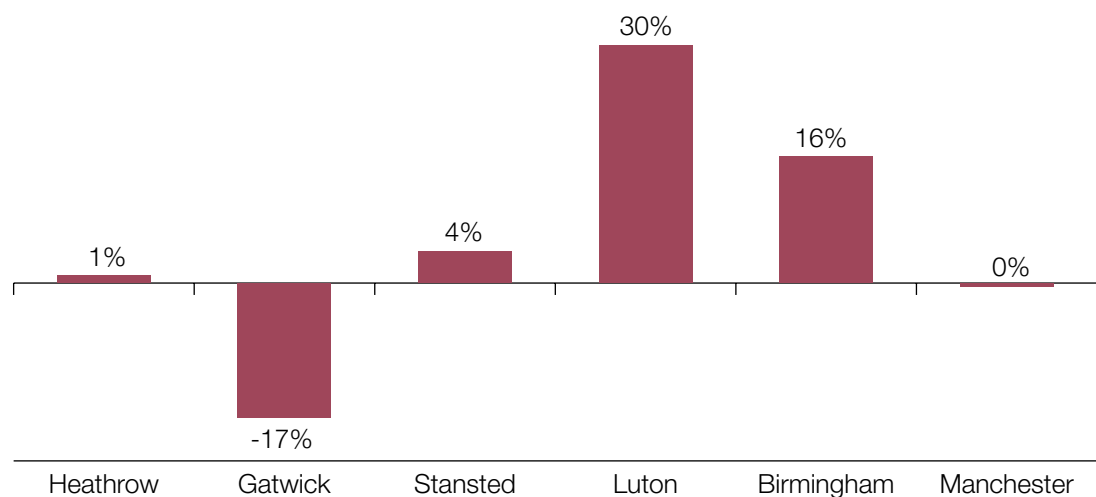
Box 4d: Could a congestion charge on the UK's busiest airports incentivise airlines to use currently under utilised capacity?

The Commission's analysis focused on an APD congestion charge whereby a 10% surcharge is levied at airports operating above 90% of their maximum capacity. These were accompanied by decreases in APD at other, less congested airports, making the policy as a whole approximately revenue neutral. A 90% ratio of demand to capacity was chosen as resilience problems would be expected to increase significantly beyond this level of capacity utilisation. The policy was modelled from 2015 onwards.

The analysis suggested that a congestion charge would result in an overall increase in the number of flights out of regional airports. **As Figure 4.6** shows, Birmingham, Luton and Stansted would be the main beneficiaries of this policy. Manchester would not benefit to the same extent, as newly energised regional competitors would draw traffic away from it.

Figure 4.6: Luton, Birmingham and Stansted see the largest increase in ATMs and Gatwick sees the biggest fall

Percentage change in ATMs as a result of 10% APD congestion charge relative to carbon capped base case, 2020



The new routes developed at regional airports, however, would to a large extent duplicate long-haul routes already available from large airports like Heathrow, Gatwick and Manchester, as **Table 4.1** shows.

Box 4d: Continued

Table 4.1: By 2020 there would be a small reduction in the number of destinations offered

Change in destinations served daily in 2020 as a result of 10% congestion charge (carbon capped)

	Long-haul	Short-haul	Total
London	-6	1	-5
Other UK	3	-1	2
UK Total	-6	0	-6

Note the UK total is not the sum of London and non-London figures. Taking long-haul as an example, of the 6 destinations London loses none are picked up by non-London airports, giving an overall UK loss of 6 destinations. The 3 additional destinations served by non-London airports are already served by London, so there is no gain to UK connectivity.

In terms of capacity, the model predicts that while there would be little change in terms of overall seat capacity, there would be close to a million fewer long-haul seats available from the UK, as shown in **Table 4.2**. The fall mainly occurs due to a shift towards using smaller aircraft for long-haul routes as demand for these routes would be more dispersed in the airport system than currently. This shift means that a congestion charge would also lead to an increase in carbon emissions of around 1–2% by 2030, relative to the core forecasts.

Table 4.2: By 2020 there would be a small increase in short-haul seat capacity, which is more than offset by the reduction in long-haul seat capacity

Change in available seats in 2020 as a result of 10% congestion charge (carbon capped)

	Long-haul	Short-haul	Total
London	7.3m	+1m	-6.3m
Other UK	+6.4m	-0.3m	+6.1m
All UK	-0.9m	+0.7m	-0.2m

Finally, the rate at which currently less congested airports fill up would be accelerated, bringing forward the point at which they would hit the 90% capacity limit required to benefit from the lower rate of APD, meaning that the effects of the policy would diminish over time.

Changes to the slots regime

4.51 The Commission also considered whether changes to the slots regime could enable better use of existing airport capacity. Here the system of international treaties and legal obligations surrounding the allocation of slots raises a number of points that must be taken into consideration:

- EU law, based on older international (IATA) precedents, requires slot allocation to be independent of Government control. In the UK this is done by the UK's slots coordinator, Airport Coordination Limited.
- The allocation of slots is the sole responsibility of independent airport coordinators. Coordinators are assisted in certain respects by 'coordination committees' (but these must not affect the independence of the coordinator).
- Primary allocation of slots (from the coordinator to the airline) does not involve a fee for the slot. Secondary trading markets, whereby airlines (in essence) purchase slots from each other, are permitted. In theory, these are not financial trades, but rather an exchange of one slot for another. In practice, the exchange of slots is normally accompanied by a payment by the party acquiring the more valuable slot.
- Once an airline has operated a slot for a year it obtains 'grandfather rights' on that slot.
- After two years, the airline may change the destination to which the slot operates without forfeiting 'grandfather rights'.
- When new capacity is created at an airport, 50% of it is reserved for new entrants, i.e. airlines currently holding four or fewer daily slots at the airport in question.
- It is not part of the role of coordinators to make judgements about how slots should best be allocated or used in the public interest, or to achieve economic policy or competition objectives.

4.52 Several stakeholders have raised the question of whether the slots regime should be changed, either to ensure that capacity within the current system is managed in the national interest, or to ensure that any new capacity added increases the UK's connections to the most economically important markets.

4.53 Unilateral changes to the slot allocation regime would constitute a breach of the UK's EU Treaty obligations and could provoke retaliatory action by other states. The agreement of changes to slot allocation regimes at the European or

international level would therefore be necessary if the UK were to seek to change the slot allocation system. The Commission has seen no evidence that such agreement is likely to be possible; indeed, the general direction of travel has been towards further liberalisation.

- 4.54** Some proposals to the Commission have suggested that governments should have the ability to direct airlines to fly particular routes and that the slots mechanism could be utilised as a means to achieve this. However, the Commission finds it difficult to conceive of any policy levers, short of state ownership, which could compel airlines to fly routes that are not commercially viable.
- 4.55** Moreover, unless there were infinite capacity at UK airports, giving priority to certain routes or destinations at a particular airport necessarily means constraining the capacity available there for other routes and destinations. It is highly likely that moves to deprive particular routes of their access into the most desirable UK airports would trigger retaliatory measures. Responses to the Commission's publication of short and medium-term options emphasised this message, with airlines and airline alliances making their opposition particularly clear, underlining the difficulty of securing the required international agreement.
- 4.56** Similar considerations apply to measures which would reserve a portion of any newly created capacity for specific destinations or markets, above and beyond the existing requirement that 50% of new capacity be reserved for new entrants.

Traffic Distribution Rules

- 4.57** As an alternative to changes to the slot regime, some stakeholders have proposed managing the use of existing or new capacity in the national interest through increased use of Traffic Distribution Rules (TDRs). These are a means of allocating traffic between different airports in the UK system, and were revised in 1991. The changes were largely to reflect European law, which requires that TDRs do not discriminate among destinations inside the EU, or on grounds of nationality or identity of air carriers.
- 4.58** Prior to these changes, the London Air TDRs were introduced in 1978, which were designed to achieve a better distribution of traffic between Heathrow and Gatwick, to meet Government policy objectives of the time (i.e. to encourage greater use of Gatwick). The rules were embodied in the 1977 US-UK Bermuda II bilateral air services agreement, whereby all new routes between the USA and London had to operate from Gatwick.

- 4.59** These TDRs proved unpopular with airlines, particularly US airlines. In 1991 the then Secretary of State, at the CAA's recommendation, removed the rules on passenger flights to London, while maintaining the rules on cargo, business and general aviation flights. The 1991 TDRs banning all new cargo flights from Heathrow and Gatwick remain in place today.
- 4.60** At around the time the 1978 rules were adopted, the Government also announced that all scheduled services between London and Canada, and between London and the Iberian Peninsula, would be transferred from Heathrow to Gatwick by 1 April 1979. However, in response to strong resistance, the UK Government withdrew the proposed TDRs, and the services to Canada and the Iberian Peninsula remained at Heathrow.
- 4.61** Under the current system, the 1991 TDRs grant the Secretary of State the ability to allocate certain types of traffic (particularly freight and charter) between Heathrow, Gatwick and Stansted.
- 4.62** In reality, while TDRs can prevent certain services from operating from a given airport, they cannot compel airlines to use specific airports for prescribed classes of traffic. For example, airlines may consider the service pattern required by a TDR to be commercially unattractive and, as a result, could choose to move their air service operations elsewhere, where such rules did not apply.

Restrictions on aircraft and services permitted at congested airports

- 4.63** A number of proposals have suggested prohibiting certain types of flights from Heathrow (and in some cases Gatwick). In particular, stakeholders have suggested prohibitions on the following types of flight:
- charter flights,
 - freight-only flights,
 - business jets,
 - general aviation,
 - small aircraft on scheduled services,
 - domestic flights.
- 4.64** In theory, as outlined above, the TDRs do provide Government with some levers through which this measure might be implemented. However, a combination of existing TDRs, restrictions placed by the airport itself through its conditions of use,

and market forces have already served to constrain the quantity of flights in most of the above categories using Heathrow.

- 4.65** In particular, the relatively high landing charges and congestion at Heathrow already render it largely unattractive for charter flights, dedicated freighters (most freight at Heathrow is carried in the bellyhold of passenger aircraft), business and general aviation. Moreover, as slots at Heathrow bring higher yields per passenger when they are used for international rather than domestic routes, domestic routes are relatively unattractive as well – over time the number of domestic routes into Heathrow has fallen to just eight in 2012.
- 4.66** The Commission noted that charter flights, freighters, business and general aviation flights were prohibited from entry into Heathrow for the period of the London Olympics and recognises these measures as a sensible response to a period of exceptional demand. However, recognising that those charter, business, general aviation and freight users who choose to use Heathrow do so despite high landing charges, the Commission does not believe that the case for a more restrictive regime coming into permanent operation has been made.
- 4.67** While levels of charter traffic and, to a lesser extent, business and general aviation are higher at Gatwick, there is a reasonable expectation that the same market forces, which have operated to reduce this traffic at Heathrow, will come into effect at Gatwick as the airport's remaining spare capacity comes into use over the next few years.
- 4.68** Constraining the use of smaller aircraft for scheduled flights is likely to remove important 'feeder' traffic for long-haul routes, and could also make it harder for airlines to experiment with new routes where a large plane may not initially be justified. Furthermore, the high price of slots via secondary trading and high landing charges at Heathrow already provide an incentive for airlines to use the largest aircraft commercially viable on a given route.
- 4.69** Similarly, domestic connections at Heathrow and other London airports are of economic significance for both London and the regions. The regions benefit both from access to the capital's economy and from the long-haul connectivity they can access via Heathrow. London benefits from the contribution that those regional passengers make to enhance the business case for its long-haul routes. Undermining this system by banning domestic flights from Heathrow would not be beneficial for the UK.

Summary: Scale, location, and timing of need for additional airport capacity

4.70 In summary, the Airports Commission's analysis suggests that:

- A. aviation demand is likely to increase significantly between now and 2050, even when 2050 carbon emissions are capped at a level which is consistent with the UK meeting its legislated climate commitments;
- B. this demand growth is likely to be concentrated in the South East, with sufficient demand to utilise 90% or more of available capacity across London and South East airports by around 2030;
- C. demand is predicted to exceed capacity in London and the South East by 2040 or earlier in all core scenarios, with the gap between capacity and demand rising to approximately 170-200,000 ATMs by 2050 even in the carbon capped forecast; and,
- D. there is relatively little scope to redistribute demand away from London and the South East to less heavily utilised capacity elsewhere in the country.

4.71 Taken together, these conclusions point to the need for additional capacity to be provided in London and the South East, to alleviate the impacts of tightening capacity constraints on operational reliability in the period to 2030, and to accommodate additional demand growth over the period to 2050.

4.72 There is a clear case for at least one net additional runway by 2030 across a range of scenarios, including where the UK is meeting its climate change targets. This scale of additional capacity is compatible with a number of airport expansion proposals that have been put to the Commission and views held by some of the major airline stakeholders in the UK, notably BA.¹¹¹

4.73 The Commission's forecasts suggest that there is also likely to be a demand case for a second additional runway to be operational by 2050, or, in some scenarios, earlier. Even if there is a demand case, however, it does not necessarily follow that there would be a strong economic or commercial case for a second net additional runway.

4.74 The Commission will carry out further analysis in the second phase of its work programme as to when, how and by whom the case for a second net additional runway might most appropriately be considered. This analysis may include consideration of how UK and international economic forecasts may develop, and the implications for long-term aviation demand; progress in agreeing measures to

¹¹¹ <https://www.gov.uk/government/publications/public-evidence-sessions-transcripts-airports-commission-discussion-papers>

reduce carbon emissions from aviation; the long-term development of the aviation industry and related technologies; and the implications for any future capacity expansion of each of the new runway options shortlisted for detailed consideration.

What sort of airport capacity does the UK need?

- 4.75** In terms of the nature of the additional capacity that is needed, the Commission does not believe there is a binary choice between providing additional hub capacity or additional point-to-point capacity. Instead, the optimal approach is to continue to invest in an airport system that caters for a range of airline business models. This is particularly important in a competitive airports system like London, where airlines can choose how to use the available capacity, and the market can be expected to respond dynamically to the provision of new infrastructure.

Stakeholder views on the nature of capacity needed

- 4.76** Several stakeholders addressed the nature of the capacity needed in their consultation responses, and reached very different views. Their conclusions were driven to a large extent by contrasting assumptions around how the aviation sector will develop. This can be illustrated by comparing the analyses submitted by the Mayor of London¹¹² and Gatwick Airport Limited.¹¹³
- 4.77** The Mayor of London's analysis focuses on connectivity outcomes. It points to a 4-runway hub airport as the option providing London and the South East with the best connectivity, compared to a 'do nothing' option or a '2-2-2' airport system where Gatwick and Stansted are expanded into two-runway airports to compete with Heathrow. The outputs of this analysis are summarised below.

Table 4.3: The Mayor's analysis of different capacity expansion options point to a four-runway hub solution

Destinations served and frequencies under different capacity options by 2050				
	No capacity change (2013)	No capacity change (2050)	2-2-2 (2050)	4-runway hub (2050)
Number of destinations	385	322	358	435
Frequencies	10,133	12,201	15,598	16,576

Source: Mayor of London's submission to the Airport Operational Models discussion paper.

- 4.78** Gatwick Airport's work, on the other hand, focuses on the additional capacity that would be delivered by different options. It suggests that in 2030 a third runway at

¹¹² <http://www.tfl.gov.uk/corporate/projectsandschemes/27598.aspx>

¹¹³ <http://www.gatwickairport.com/business-community/developing-gatwick/a-new-runway/>

Heathrow would add 22 million passengers to the system while a second runway at Gatwick would add 17 million. Gatwick's analysis also includes the development of viable route networks for each scenario considered as a means of identifying the potential connectivity effects (using the IATA methodology discussed in **Chapter 3**). The submission argues that after 2030 airlines would continue to add services to the route network at Gatwick and that passengers would also benefit from competition between the two airports.

Table 4.4: Gatwick's analysis suggests an additional runway at Gatwick would add less traffic than an additional runway at Heathrow, but would further enhance the benefits of airport competition

Comparison of passenger numbers at Heathrow and Gatwick with additional runway by 2030			
	No capacity change (2030)	Third runway added to LHR (2030)	Second runway added to Gatwick (2030)
Number of passengers	120 million	142 million	137 million

Source: Gatwick's long-term options submission

- 4.79** The differences between the Mayor of London's conclusions and Gatwick Airport's conclusions are partly due to the different methodologies adopted by the two studies, but are largely driven by different assumptions on the developments in the airline sector and future passenger behaviour. The differences in assumptions are summarised in **Table 4.5**.

Table 4.5: To forecast the future connectivity of various airport models the Mayor of London and Gatwick Airport made different assumptions on airline economic

Comparison of the Mayor of London and Gatwick Airport's forecasting assumptions		
	Mayor of London	Gatwick
Transfer passengers	Self-connecting has limited potential to substitute for transferring within one airline alliance	Self-connecting will be more popular in the future as the market share of new more price sensitive passengers increases
Market for long-haul routes	Legacy carriers will maintain competitive advantage in the long-haul market	New more-efficient types of aircraft will enable low-cost carriers to compete with legacy carriers on long-haul routes
Alliances moving away from LHR	No alliance will move to a second-tier airport, the only possible move is to a more attractive hub	One scenario of expanding Gatwick assumes one alliance moves from LHR to Gatwick. A second scenario assumes no move to an expanded Gatwick.

Source: Mayor of London's submission to the Airport Operational Models discussion paper and Gatwick's long-term options submission

- 4.80** The Mayor assumes a future in which hubs and fewer, stronger airlines grow their market share and global route networks become reinforced. Conversely, Gatwick Airport believes that the future will see a relative decline in the importance of hubs and alliances as low-cost airlines take over a significant share of the long-haul market and price-sensitive passengers prefer to travel to second-tier airports. The airport also argues that competition may drive further improvements, and potentially incentivise an alliance to move its base to Gatwick were sufficient capacity available.

Airports Commission modelling results

- 4.81** The Airports Commission has tested the potential connectivity outcomes for two possible future airport operational models. These two models were constructed through adding capacity to the London airport system. In the first case – concentrated – hub capacity is concentrated at one London airport (which has unlimited capacity), while all the other airports focus on facilitating point-to-point traffic. In the other case – dispersed – hub capacity is spread over two two-runway airports that independently act as hubs for connecting traffic. Details of the assumptions used in the model and the results are included in *Appendix 3: Technical Appendix*.
- 4.82** **Table 4.6** illustrates that the London airport system is likely to deliver slightly better connectivity outcomes under a concentrated model, in terms of the number of destinations served. However, the difference is not as marked in London as it would be for many cities globally as London has the biggest origin and destination market in the world,¹¹⁴ theoretically big enough to sustain two independent hub airports.
- 4.83** A concentrated system also serves more passengers in London and the South East: by 2050 there are between 66,000 and 127,000 more ATMs under a concentrated system. This model facilitates higher route densities through bringing more passengers together than under a dispersed system.

¹¹⁴ PwC analysis of Sabre ADI

Table 4.6: The Commission's forecasts of destinations served, passenger numbers and ATMs in the two London airport system scenarios are broadly similar

Passengers, ATMs and destinations served under dispersed and concentrated systems, carbon traded and capped, 2030, 2040 and 2050

Daily threshold	2030		2040		2050	
	CO ₂ traded	CO ₂ capped	CO ₂ traded	CO ₂ capped	CO ₂ traded	CO ₂ capped
Passengers (millions)						
Dispersed	149	142	173	161	205	183
Concentrated	164	153	194	172	223	198
Difference	15	11	21	11	18	15
ATMs (000s)						
Dispersed	1044	1003	1163	1094	1344	1,225
Concentrated	1133	1071	1306	1161	1471	1,291
Difference	89	68	143	67	127	66
Number of destinations served						
Dispersed	211	206	228	221	248	240
Concentrated	217	216	235	229	249	244
Difference	6	10	7	8	1	4

4.84 This analysis has been carried out using the Commission's updated version of the DfT model. This derives its forecasts from historic trends and does not currently incorporate the possibility of a step-change in capacity or connectivity at any particular airport (for example, through the development of a substantial low-cost long-haul network). The Commission intends to look in more detail in the next phase of its work programme at the plausibility of such step-changes and their potential impacts.

4.85 The analysis above also needs to be put into a wider societal and business context. Whilst it demonstrates that a concentrated model may have some degree of connectivity advantage in terms of the number of routes and frequencies offered, connectivity may have other important dimensions – such as affordability and accessibility. Taking a view on long-term expansion options also requires scrutinising both the potential benefits, such as connectivity and agglomeration benefits, and the potential costs, such as pollution, noise, congestion, on roads around the airport and public transport.

- 4.86** This modelling cannot fully account for airlines' commercial behaviour. IAG (a key member of oneworld alliance), SkyTeam and Star Alliance argue that they would not move away from Heathrow to a different hub. Such a potential move would result in foregoing substantial expenditure by all three alliances on Heathrow's terminals and other infrastructure and facing uncertainty around the attractiveness to passengers of a relatively unknown airport. Also, although alliances do not mention this point specifically, one alliance freeing up slots at Heathrow could benefit its competitors.
- 4.87** The Commission will examine these questions further in the next phase of its work. On the one hand, airlines are truly global in nature and many of them may have a high degree of flexibility when it comes to locating their bases. This point may be especially relevant for Europe, where distances between major airports are not as great as on other continents and, as a result, competition for international-to-international transfer passengers may be higher. On the other hand, London as a global city provides airlines based there with access to currently the biggest OD market in the world.

Implications of the Commission's scenarios

- 4.88** The Commission has also used the scenarios set out in Chapter 2 to test how conclusions on the nature of capacity needed vary according to key assumptions around the future development of the aviation sector. The key modelling assumptions for each scenario, and their implications for UK airports, are set out in **Table 4.7**.

Table 4.7: Four scenarios have been used to inform sensitivity tests around the baseline forecasts

Scenario	Modelling assumptions changed (relative to baseline)	Key results and implications for UK airports
A: Global Growth	● GDP of newly industrialised and less developed countries rises 2% per annum above the baseline. ● Passenger demand growth of 70% between 2005 and 2050, due to the introduction of more fuel-efficient aircraft. ● 1% per annum growth of international-to-international transfer passenger demand above the baseline.	● All London airports except Stansted are full by 2030 ● All London airports, plus Birmingham and Southampton, are full by 2050 ● Hub capacity particularly in demand

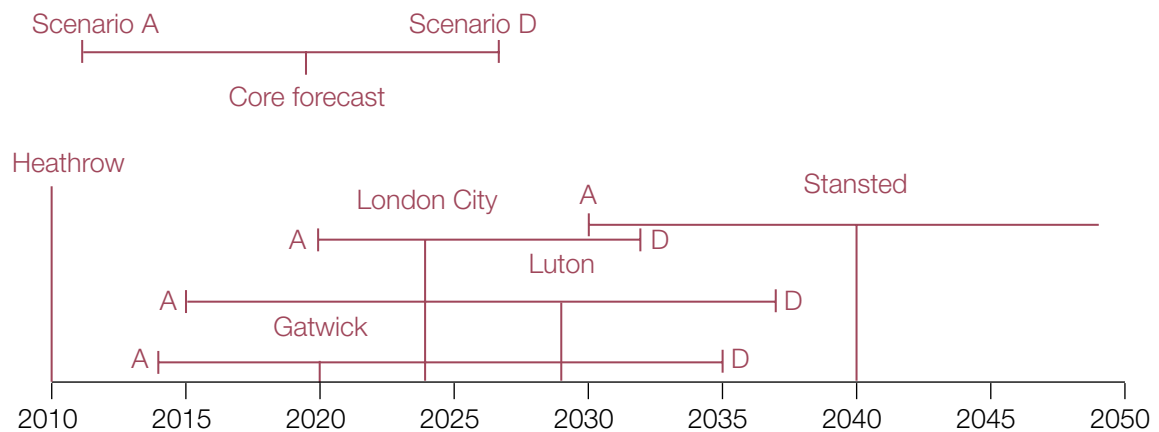
Table 4.7: Four scenarios have been used to inform sensitivity tests around the baseline forecasts

Scenario	Modelling assumptions changed (relative to baseline)	Key results and implications for UK airports
B: Relative decline of Europe	● 1% per annum reduction in I-I transfer passenger demand relative to the baseline ● LCCs operate a new generation of twin-aisle aircraft which accommodate up to 220 passengers ● Very large aircraft operated by network carriers (Boeing 747, A380) are replaced by smaller, more fuel-efficient aircraft like B787 and A350 ● Larger twin-engine aircraft (e.g. B777) continue to operate	● The number of terminal passengers at UK airports would be slightly lower than in the baseline ● Heathrow and Gatwick still full by 2020 ● Dubai International has grown at the expense of European hubs, with about 20 million more terminal passengers relative to the baseline
C: Low-cost is King	● 1% per annum reduction in I-I passengers relative to the baseline ● Higher share of traffic is assumed to be low-cost carriers and charter ● A proportion of A380s have been replaced with smaller aircraft like B787 and A350	● Low-cost and charter airlines capture over 50% of the market ● Reduced passenger numbers at all EU hubs, with second tier airports growing in strength ● Total terminal passengers at UK airports are broadly in line with baseline forecasts ● There has been a switch in demand from Heathrow to Gatwick, which offers cheaper landing charges and has invested in facilities to enable self-connecting
D: Global Fragmentation	● UK GDP grows more slowly (by about 0.5% per annum in the longer-term relative to the baseline); GDP of all the other economies declines by 1% per annum relative to the baseline ● Carbon traded ● Numbers of I-I passengers held constant at 2011 baseline levels ● The relative attractiveness of Dubai decreases over time	● Hub capacity has declined in importance as low-cost carriers capture a large market share ● Reduced terminal passenger numbers compared to baseline, although all London airports except Stansted are still full by 2040

4.89 There are two clear conclusions to draw from these scenarios:

- i. **The case for capacity expansion in London and the South East stands up in all the scenarios modelled.** As **Figure 4.7** demonstrates, even in Scenario D, which is an extremely pessimistic scenario from the perspective of terminal passengers at UK airports, all London airports are full by 2040 except for Stansted (where 77% of capacity is utilised by 2050).
- ii. **The balance of capacity needed in each scenario is different.** Scenarios A and B point towards hub capacity, whereas in scenarios C and D prioritising non-hub capacity would appear more important.

Figure 4.7: Even in scenario D, all London airports except for Stansted are full by 2040



4.90 Taken together, these separate pieces of analysis show that different assumptions about the future of the aviation sector can lead to different conclusions around the nature of airport capacity needed in the UK. The Commission will watch closely how the market evolves between now and its final report. But given the lack of consensus around the way the sector will develop, it will be important for the Commission's final recommendation to be one whose economic and commercial case is robust in a range of different future scenarios.

Conclusions

4.91 The analysis presented in this chapter points to the need for some additional airport capacity to be provided to address demand growth in London and the South East, to alleviate the impacts of tightening capacity constraints on operational reliability in the period to 2030, and to accommodate additional demand growth over the period to 2050.

- 4.92** The analysis shows that there is a clear case for at least one net additional runway by 2030 across a range of scenarios, including where the UK is meeting its climate change targets. This is compatible with a number of specific airport expansion proposals that have been put to the Commission.
- 4.93** The Commission's forecasts indicate that there would be likely to be a demand case for a second additional runway in operation by 2050 or, in some scenarios, slightly earlier. The Commission will carry out further analysis in the second phase of its work programme, including looking at the implications for any future capacity expansion of each of the new runway options shortlisted for detailed consideration, in order to be able to make recommendations to Government in its final report as to when, how and by whom the case for a second new runway should be considered.
- 4.94** **Chapter 6** sets out the Commission's assessment of the various proposals for addressing the UK's airport capacity gap, in light of the analysis set out in this chapter. **Chapter 5**, sets out the Commission's recommendations for making best use of existing airport capacity in the period before any new infrastructure comes on line.

Chapter 5:

Making best use of existing capacity

SUMMARY

The emerging problems for UK airports cannot be addressed without some new infrastructure, but there are opportunities to make better use of existing capacity in the short-term.

The Commission recommends:

- An 'Optimisation Strategy' to improve the operational efficiency of UK airports and airspace, including:
 - Airport Collaborative Decision Making;
 - airspace changes supporting performance based navigation;
 - enhanced en-route traffic management to drive tighter adherence to schedules;
 - Time Based Separation.
- Trials at Heathrow of measures to smooth the early morning arrival schedule to minimise stacking and delays and to provide more predictable respite for local people.
- The establishment of a Senior Delivery Group to drive forward the implementation of the Future Airspace Strategy and the delivery of the Commission's recommendations.
- The creation of an Independent Aviation Noise Authority to provide expert and impartial advice about the noise impacts of aviation and to facilitate the delivery of future improvements to airspace operations.
- A package of surface transport improvements to make airports with spare capacity more attractive to airlines and passengers, including:
 - the enhancement of Gatwick Airport Station;
 - further work to develop a strategy for enhancing Gatwick's Road and Rail Access;

- work on developing proposals to improve the rail link between London and Stansted;
- work to provide rail access into Heathrow from the South; and,
- the provision of smart ticketing facilities at airport stations.

These measures are worthwhile on their own terms, but none of them provides a long-term solution to the UK's airport capacity problem.

The Chair of the Commission wrote to the Chancellor of the Exchequer on 26 November about the surface transport recommendations. HM Treasury's National Infrastructure Plan, published on 4 December, began the process of implementing them. The Commission welcomes this, and encourages the Government to continue to work on the delivery of the surface transport improvements.

5.1 In the short-term, the most significant effect of capacity constraints at UK airports is reduced airport resilience. At Heathrow, this is already causing delays for passengers. It is also causing unnecessary disruption for communities around airports, whose exposure to aircraft noise is exacerbated and rendered less predictable by the effects of delay on airport operations. The environmental impacts of delay go wider still, as delays and airborne holding result in unnecessary emissions.

5.2 As this report has argued, these problems can only be resolved in the longer-term by adding new capacity. But the Commission's remit also requires it to look at how to make best use of existing airport infrastructure, before new capacity becomes operational. This is not a new issue – it is one the aviation industry grapples with every day. The Commission's call for proposals therefore generated a wide range of responses. Three key themes emerged:

- **Theme 1:** that the aviation industry has itself recognised many of the specific technical, operational and behavioural changes that would promote more effective operations at UK airports and within UK airspace – particularly at the most congested airports within the London area – but that progress on implementing these changes has been slow and more momentum is required;
- **Theme 2:** that there are opportunities for Government to encourage airlines to use spare capacity in the UK's airport system more effectively, through a combination of incentives and facilitating measures. Through measures such as

improvements to surface access, the Government can help to shape industry behaviours; and,

- **Theme 3:** that there are more far-reaching changes that might be implemented in respect of current capacity, but that these cannot be considered in isolation from the longer-term options for adding additional airport capacity and recommendations on them will therefore need to wait for the final report.

5.3 In reaching its recommendations, the Commission has followed an open process with opportunities for public and stakeholder engagement. The details of this process are described in **Appendix 1**. The Commission has sought to take a balanced and integrated approach, considering measures not only in terms of their impacts on the aviation sector, but also wider environmental and community impacts.

5.4 The Commission recommends a range of short-term measures to improve the efficiency of the UK's current aviation system. Properly implemented, these actions will produce substantial benefits for the UK. They will also provide a basis upon which any future long-term strategy for new capacity, along with its supporting transitional arrangements, can be built.

5.5 The main proposals are:

- An Optimisation Strategy consisting of a range of improvements designed to increase the capacity and efficiency of the UK's airspace. The measures are highly dependent on each other and to produce the most benefit must be implemented together. They include:
 - Airport Collaborative Decision Making;
 - airspace changes supporting performance based navigation;
 - enhanced en-route traffic management to drive tighter adherence to schedule; and,
 - Time Based Separation.
- Trials at Heathrow of measures to smooth the early morning arrival schedule to minimise delays and provide more predictable respite for local communities as part of a range of measures to increase the flexibility of runway use at Heathrow.
- The establishment of a Senior Delivery Group to drive forward the implementation of the Future Airspace Strategy – the most significant development in improving the UK's aviation efficiency for over 40 years – and the delivery of the

Commission's recommendations, showing strong leadership and accountability for delivery.

- The creation of an Independent Aviation Noise Authority to provide expert and impartial advice about the noise impacts of aviation and facilitate the delivery of future improvements to airspace operations.
- A package of surface transport improvements to make airports with spare capacity more attractive to airlines and passengers, including:
 - the enhancement of Gatwick Airport Station;
 - further work to develop a strategy for enhancing Gatwick's Road and Rail Access;
 - work on developing proposals to improve the rail link between London and Stansted;
 - work to provide rail access into Heathrow from the south; and,
 - the provision of smart ticketing facilities at airport stations.

5.6 The detail and rationale behind each of these proposals is described further in this Chapter, while a full list of the components of the Commission's strategy can be found in **Appendix 1**.

5.7 The benefits of implementing the Optimisation Strategy are significant. Every cancelled business meeting or shortened leisure trip has a consequent impact on the economy.

5.8 The Commission's analysis indicates economic benefits between 2014 and 2030 from the Optimisation Strategy, with a net present value in the region of £2.3 billion.¹¹⁵ The benefits of the surface access measures are more difficult to quantify, but in light of the length of time until new capacity can be brought online, it is important that we make the most effective use of the capacity we currently have in the interim. Improving surface access can help to achieve that.

¹¹⁵ The net present value has been calculated by the Commission's technical consultants for details of their methodology please refer to the 'Short term options: technical report'

Theme 1: More effective operations of UK airports and airspace

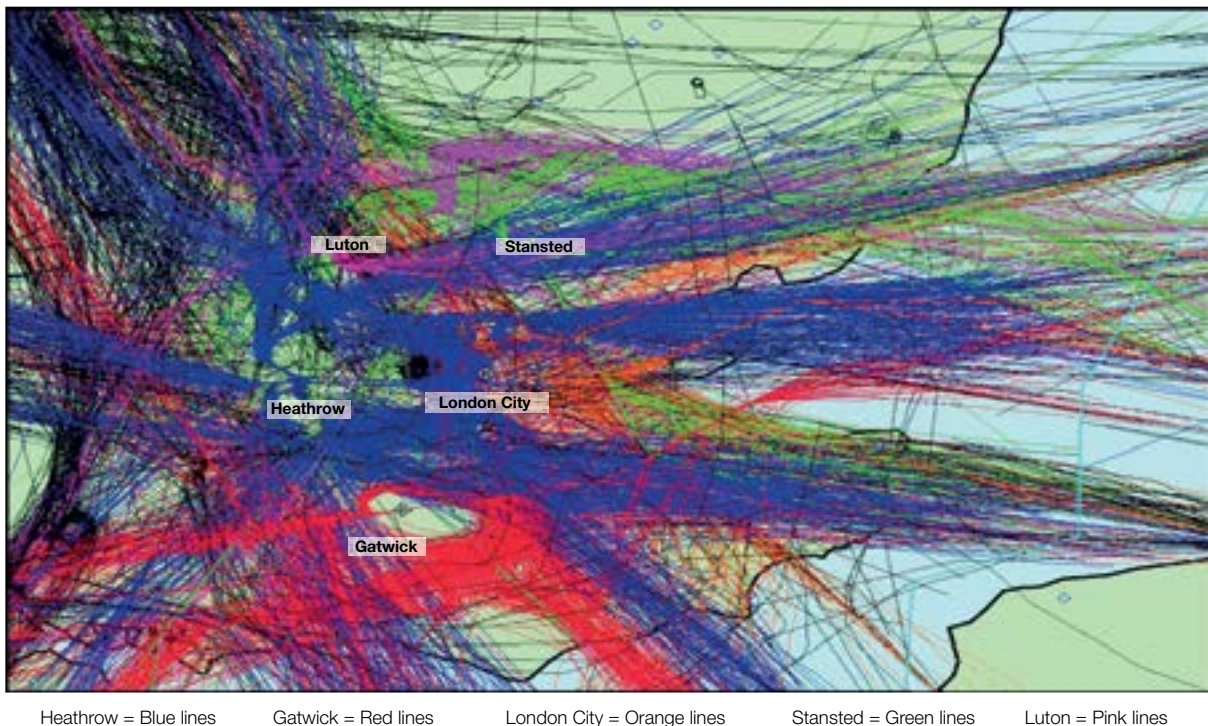
- 5.9** NATS – the UK’s provider of en-route air traffic control – has described the routes within our airspace as the motorways of the sky. These motorways now need to be optimised to support a more efficient and resilient aviation sector by allowing aircraft to climb faster and to fly more direct routes into and out of our airports, reducing their noise and emissions.
- 5.10** London terminal airspace is one of the busiest and most complex systems in the world supporting the five London airport arrival and departure routes. According to Eurocontrol,¹¹⁶ the number of flights arriving and departing London’s airports per day, was around 3,386, averaged over 2012. It is difficult to compare this directly with other European cities as airspace is structured differently across Europe, however this average can be roughly compared to the lower airspace over the Netherlands – including Amsterdam Schiphol – which experiences around 1,393 aircraft movements per day averaged over 2012. Perhaps the most directly comparable airspace system to London is New York’s which in its lower airspace experiences around 5,100 aircraft movements per day averaged over 2012.¹¹⁷
- 5.11** **Figure 5.1** shows the routes flown into and out of the London area converging to support the five main civilian airports at or below 25,000ft on a daily basis. The routes overlap in large part, demonstrating the complexity of the system whereby air traffic control are required to maintain safe distances between aircraft arriving and departing from different airports in the same area with aircraft passing above and below each other to reach their destination. **Figure 5.1** also shows there are few parts of London which are not over flown by aircraft.

¹¹⁶ Eurocontrol, Performance Review Report, 2012

¹¹⁷ FAA OPSNET

Figure 5.1: London airspace is highly complex and congested¹¹⁸

The different coloured routes represent the arrival and departure routes for the five London airports. The lighter shades are the arrival routes and the darker ones the departure routes.



- 5.12** The current airspace structure has evolved over the last forty years in a piecemeal approach as airports have expanded and demand for air travel has increased. This has led to conflicts between arrival and departure routes to the various airports leading to inefficiencies in the routes aircraft fly, increasing their fuel burn, carbon emissions and in some cases noise. Airspace and the routes within it have not been optimised in line with advances in aircraft and navigational technology.
- 5.13** At present, to maximise the number of aircraft that can land at an airport, and to manage delays on arrival, aircraft are either held at their departure airports or in the air in ‘holding stacks’ where aircraft fly in a circle until they are given clearance to start their final approach to the airport. This approach to holding stacks is environmentally inefficient as it leads to indirect flight routes causing increased levels of fuel burn and carbon emissions, adds to journey time and increases the level of intervention needed from air traffic control.
- 5.14** The South East Airport Taskforce report¹¹⁹ on punctuality, delay and resilience estimated that London Terminal Airspace causes approximately three minutes of

¹¹⁸ NATS reconstruction of London airspace and the routes within it below 25,000ft

¹¹⁹ <http://assets.dft.gov.uk/publications/south-east-airports-taskforce-report/south-east-airports-taskforce-sub-group-report.pdf>

delay per flight over Europe¹²⁰ due to the high level of demand. This is exacerbated by the lack of spare capacity – particularly at Heathrow – to mitigate and recover from the impacts of disruption. In addition, the report suggested that tactical measures imposed at Heathrow and Gatwick due to constraints on departures through London Terminal Airspace contribute to start up delays of up to six minutes on average per flight at Heathrow and four minutes on average per flight at Gatwick, though as these are average figures, actual delays can be significantly higher.

- 5.15** Delays are also caused by poor weather conditions such as low visibility and strong winds, which impact all airports. The Eurocontrol Central Office for Delay Analysis¹²¹ reported that in 2012 Heathrow suffered delays due to poor weather conditions ranging from low visibility through to high winds and thunderstorms in 11 months of the year. These weather conditions are just one of a range of reasons for a loss of resilience which include delays caused by passengers; late arrival of aircraft; and incidents at airports to name but a few. Heathrow's segregated mode of operations, whereby one runway is used for arrivals and one for departures, also contributes to its difficulty in recovering from delay.
- 5.16** The extent of demand for access to the London terminal airspace is not the only cause of delays; the high levels of airport capacity utilisation are also to blame. For example, as explained in the South East Airport Taskforce report, the high utilisation of Heathrow Airport entails considerable queuing for use of the runways. This manifests itself in holding delays – of an average of 15 minutes per flight for arrivals and an average of 20 minutes per flight for departures. These delays vary through the day. At Gatwick, as the runway utilisation is a little more variable than at Heathrow, this translates to moderate queues at peak times with up to 10 minutes on average per flight for arrivals and up to 15 minutes on average per flight for departures.
- 5.17** While some delays are inevitable – for example, those caused by the most severe weather events such as heavy snow – the optimisation of the interactions between airspace and airport operations could improve the system's resilience and ability to respond to disruption, reducing delays and cancellations currently associated with high winds for example. The Commission has identified an Optimisation Strategy for making the best use of existing capacity, with a particular focus on Heathrow.

¹²⁰ The circa three minutes of delay per flight refers to holding delays on the ground at the departure airport imposed by the European network manager (Eurocontrol) that are attributed to the London Terminal Airspace (also referred to as the London Terminal Manoeuvring Area). This type of holding delay – where aircraft are held at the departure airport – is known as 'air traffic flow management (ATFM)'

¹²¹ Eurocontrol Central Office for Delay Analysis, CODA Digest, 'Delays to Air Transport in Europe', Annual 2012

Optimisation strategy

- 5.18** The approach to aircraft holding observed today is partly a consequence of the lack of sharing of real time information about when aircraft are going to arrive in London airspace. Sharing operational information will allow all those involved in processing arriving aircraft to prepare in advance, increasing the predictability and speed of the aircraft turnaround process.

Airport Collaborative Decision Making

- 5.19** Heathrow and Gatwick have invested heavily in a system called Airport Collaborative Decision Making (ACDM) which provides access to accurate and timely flight information. This is expected to start delivering improvements in terms of reduced delays on the ground; reduced costs to airlines, ground handlers and other stakeholders; more flexibility for air traffic control in how they prioritise and sequence departures; and the optimisation of the use of the airport's capacity, for example through the allocation of aircraft stands and gates, allowing for greater use of the runway. ACDM has allowed Gatwick to increase the number of movements it can process per hour at the airport from 50 to 55 movements at peak times.
- 5.20** The industry should implement ACDM quickly and seize the opportunity it provides to make use of the data collected by the system to help inform the definition of airport schedules and to monitor compliance against these.
- 5.21** Further benefits can be derived if more UK airports put departure information into the system so that air traffic control both in the UK and in Europe can receive real time information about target take off times. Airports with 30,000 movements per year and above should invest in this Departure Planning Information (DPI) functionality by April 2015 to ensure the most efficient use of airspace over the UK in support of the implementation of the Future Airspace Strategy.

Airspace improvements

- 5.22** The complex nature of the London terminal airspace will remain a limiting factor on airport capacity unless much needed improvements to its design are implemented. This is particularly the case when delays have built up.
- 5.23** At present aircraft depart along 'Standard Instrument Departure routes' (SIDs). These follow the centreline of 'Noise Preferential Routes' (NPRs), which were designed in the 1960s to avoid overflying built up areas where possible. By redesigning SIDs in line with the capability of modern aircraft it may be possible to reduce the separation between departures and increase runway capacity. Modern

aircraft with performance based navigation capability are able to follow much more accurate tracks providing confidence in their ability to avoid deviating from them.

5.24 Reducing separation between departure routes does not translate into an increase in the airport's overall capacity due to constraints elsewhere in the system relating to arriving traffic and ground infrastructure. But it would allow for easier recovery from disruption, which at present has a tendency to accumulate due to the constraints of airspace operations.

5.25 The Government should facilitate moves by industry to redesign airspace within the London area to a performance based navigation standard allowing for closer spaced departure routes where possible. Airports should also work closely with NATS to consider the feasibility and implementation of alternating arrival and departure routes to offer respite for local communities living under these aircraft paths.

Arrival management

5.26 NATS is establishing systems to manage the arrival of aircraft more effectively than at present, including through 'linear holding', reducing the requirement to stack. Air traffic control will be able to request aircraft to absorb delays en-route, reducing fuel burn and CO₂ caused by the stack, while also allowing air traffic control to sequence arrival traffic in a way which makes the best use of runway capacity. This is particularly relevant now with an increasing number of A380s flying into Heathrow which require larger separations between them and the following aircraft and more time to vacate the runway which could have a detrimental impact on the airport's capacity.

5.27 NATS should continue to drive this concept forward to reduce the use of holding stacks. The Commission recommends that NATS encourage greater adherence to schedule by airlines through stricter enforcement of aircraft required time of arrival at fixed points en-route.

Time based separation

5.28 As aircraft begin to descend, air traffic controllers currently separate them by fixed distances based on the aircraft sequence on the approach. However, the current distance based separation does not take account of the effect of wind on the aircraft's speed. For example, during periods of strong headwinds, aircraft generally travel at slower speeds relative to the ground which means that the separation between successive arrivals increases. This means that fewer aircraft land per hour, increasing delays at the airport and potentially leading to cancellations.

- 5.29** The use of time based separation would enable air traffic control to apply the same time spacing between aircraft irrespective of wind conditions. This would result in a much more consistent approach to aircraft separation in a much wider range of wind conditions. NATS estimates that given prevailing wind conditions at Heathrow, and the currently observed traffic mix, time based separation could recover up to five movements per hour on windy days. Those movements would otherwise be delayed or cancelled.
- 5.30** A typical landing rate at Heathrow is 42-44 aircraft per hour. On high wind days this can drop to 36 per hour. On 11 March 2013 there was a high wind day so a 36 aircraft per hour flow rate was applied for most of the day at Heathrow which resulted in 11,249 minutes of delay. NATS estimates that the use of Time Based Separation could have reduced this delay figure by 32%.
- 5.31** Time Based Separation has not yet been introduced anywhere else in the world and would therefore require a stringent safety case to be undertaken by the Civil Aviation Authority (CAA). That work should be taken forward urgently with a view to implementation at Heathrow by 2015 followed by implementation at Gatwick.

Flexible use of runways

- 5.32** The intensity with which Heathrow and Gatwick's capacity is used means that it is difficult for the airports to recover quickly from delays. The airports require increased flexibility to enable them to:
- improve the airport's resilience by increasing its ability to react to disruption through the advanced planning of its response;
 - increase flexibility to amend operations in response to delay build up; and,
 - be more flexible in the use of runways to manage noise impacts.
- 5.33** A range of proposals were received which met the objectives set out above. The majority related to Heathrow.

Operation of an optimised, daily service plan

- 5.34** With the increase in information available through ACDM, linear holding and weather forecasting, airports should be able to generate a strategic plan for delivery of the schedule one day in advance to identify where there will be pinch points in the schedule or where it will not be met. This would allow for preventative action to be taken in advance where necessary, and for cancellations to be managed in a controlled way with passengers being informed in advance.

Tactical management of arrivals throughout the day

- 5.35** To recover from arrival delay, Heathrow can use both its runways to land aircraft, disrupting the departure flow temporarily. This is known as Tactically Enhanced Arrival Management (TEAM). TEAM is enacted when a set of trigger conditions are met, most notably a 20 minute delay on arrival. Its use is limited to six arrivals on the departure runway per hour.
- 5.36** Heathrow airport recently undertook a trial to test the impact of changing the trigger conditions for the use of TEAM so that it could be enacted if there was a 10 minute delay on arrival and the number of arrivals using TEAM per hour was increased to twelve arrivals per hour. The trial demonstrated that the use of this enhanced TEAM supported effective and increased flexibility when compared to the pre-existing TEAM availability. It also demonstrated that there was a fine balance between arrivals and departures meaning that if too many arrivals were landed using both runways, this would result in a reduction in the number of departures possible. Therefore, the use of enhanced TEAM was self regulating. With this in mind, the ability to respond to delays that are mounting at an early stage instead of waiting until a trigger point of 20 minutes appears to introduce more operational flexibility into Heathrow's ability to manage arrival delay.
- 5.37** Following consultation, Heathrow should continue to operate enhanced TEAM to allow delays to be tackled as they start building up, taking advantage of more accurate schedule information so as to balance demand for arrivals and departures.
- 5.38** The number of A380s using Heathrow is set to increase over the coming years – projected to increase from 21 daily arrivals in 2014 to 62 daily arrivals by 2030. In the short-term, the airport should have the operational flexibility to land A380s on the departure runway if this is necessary to retain the high levels of runway throughput required to meet the schedule. Heathrow should also have the flexibility to land arrivals for Terminal Four on the departure runway if this is the closest runway for the terminal to avoid the aircraft having to cross the runway if delays are occurring.

Departure management

- 5.39** The airspace structures around Heathrow do not support simultaneous departures from both runways in the same way as they support TEAM, so if there is a build up of delay on departure, there are few tools available.
- 5.40** Heathrow has trialled the use of early vectoring which allowed air traffic control to direct aircraft to turn off SIDs earlier than normal. This meant that air traffic control

could reduce the separation between departures, thereby increasing the departure rate. Whilst these early vectors were only trialled using two SIDs, they provided some flexibility for air traffic control in managing departure delay and disruption. Early vectoring also redistributed the noise footprint within and near to the edge of the affected NPRs meaning that more people were impacted by aircraft noise in a given hour without the predictability of normal operations where aircraft would normally follow the centre line of the departure route. The integration of early vectoring practices into normal Heathrow operations as part of a permanent airspace change would increase the operational flexibility available to air traffic control whilst increasing the predictability and information about where aircraft are likely to overfly.

- 5.41** The early vectoring approach should be introduced as a permanent feature of Heathrow operations so long as it forms part of a permanent airspace structure. The Government should therefore support the airport in its efforts to expedite the re-definition of its departure routes both to mitigate noise impacts and to enable increased departure flow rates when necessary.

Alternation

- 5.42** Heathrow's runways are oriented east-west and, as the prevailing wind is predominantly westerly, the airport operates mainly with arrivals and departures to the west, so as to fly into the wind. This is supplemented by a so-called 'westerly preference' during daytime operations, which means that the airport continues to operate in a westerly direction until any tailwind exceeds five knots. This means that for approximately 75% of the time, flights operate to the west; approaching over London and departing over Windsor. The westerly preference was introduced in the 1960s to reduce numbers of aircraft taking off in an easterly direction over London as it was considered then that departure noise was louder than arrivals. However, developments in aircraft technology have changed this balance over time. For this reason, the Government should review the need for a westerly preference with a view to introducing a 'no preference' policy.
- 5.43** During westerly operations one runway is used for arrivals and the other for departures, with the arrival and departure runways being swapped (alternated) at 15:00 hours each day to give those living under the flight paths respite from noise. For historical reasons, when the airport is operating in an easterly direction, the northern runway can only be used for arrivals and the southern runway for departures. This was to protect the village of Cranford, situated to the east of the northern runway, from departure noise. The agreement that supported this operational decision was rescinded by the previous Government and this decision

was confirmed in 2010 by the current Government. A planning application is currently underway for the infrastructure required to support the alterations to the airfield required to implement this decision.

- 5.44** Runway alternation should be enabled as rapidly as possible for easterly operations. This will provide respite for those, particularly in Windsor, who do not currently benefit from alternation.

Early morning smoothing

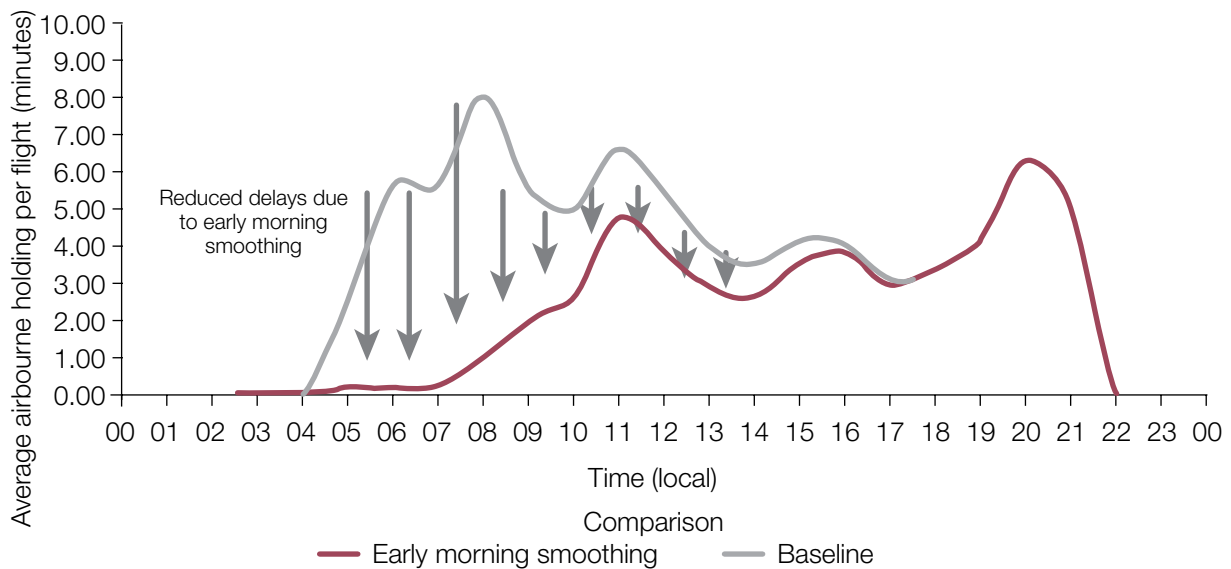
- 5.45** Delay often starts building at Heathrow from 06:00. The number of movements before this – during the night period (23:00 and 05:59) – is strictly regulated as part of the Department for Transport's night noise regime with an average of 15 movements scheduled in this period.
- 5.46** Currently there are no flights scheduled at Heathrow between 06:00 and 06:20. This is to ensure that no flights other than those allowed as part of the night noise regime can arrive before 06:00, which would infringe the current night flight regime. In practice, flights can land from 06:00 as they are technically classed as having arrived 'on-slot' (at their scheduled time) even if they are 20 minutes early. The airport is, therefore, effectively closed, opening for normal business at 06:00. This creates a bunching effect immediately before 06:00 resulting in holding delays at the start of the day which can knock-on to affect flights during the rest of the day.
- 5.47** To counter this delay, the airport routinely enacts TEAM (see paragraphs 5.35 – 5.38). In the 2012 summer season and 2012/13 winter season, TEAM was used almost every day to manage arrival queues. This reduces respite for those living under the departure runway who would not be expecting to be overflowed on that morning. It can also lead to further negative impacts for local communities as delays build throughout the day and flights end up having to depart after 23:30 to recover.
- 5.48** The loss or reduction of respite is a key issue for the local community living around Heathrow.
- 5.49** Smoothing the early morning arrivals to allow for more flights between the 05:00 to 05:59 period should reduce the peak of arrivals in the 06:00 hour and, as a result, limit the use of both runways for arrivals to those days when the most significant delays are experienced. This would therefore provide more certainty for those not expecting to be overflowed as part of their half day respite arrangements.

5.50 Using the CAA's Runway Resilience study of 2008,¹²² the effect of this proposal was modelled to understand its impact on airborne holding. **Figures 5.2 and 5.3** demonstrate the potential impact of early morning smoothing on airborne holding using the summer (April to October 2008) and winter (November 2007 to March 2008) seasons as the baseline. It shows that in summer it could:

- eliminate airborne holding in the first two hours (05:00 to 06:59);
- reduce airborne holding thereafter with decreasing magnitude until late afternoon; and,
- reduce overall average holding from 4.6 minutes per flight to 2.9 minutes per flight.

Figure 5.2: Early morning smoothing would be expected to reduce average delays per flight

Impact of early morning smoothing on airborne holding in the summer season (April to October) 2008 as a baseline.



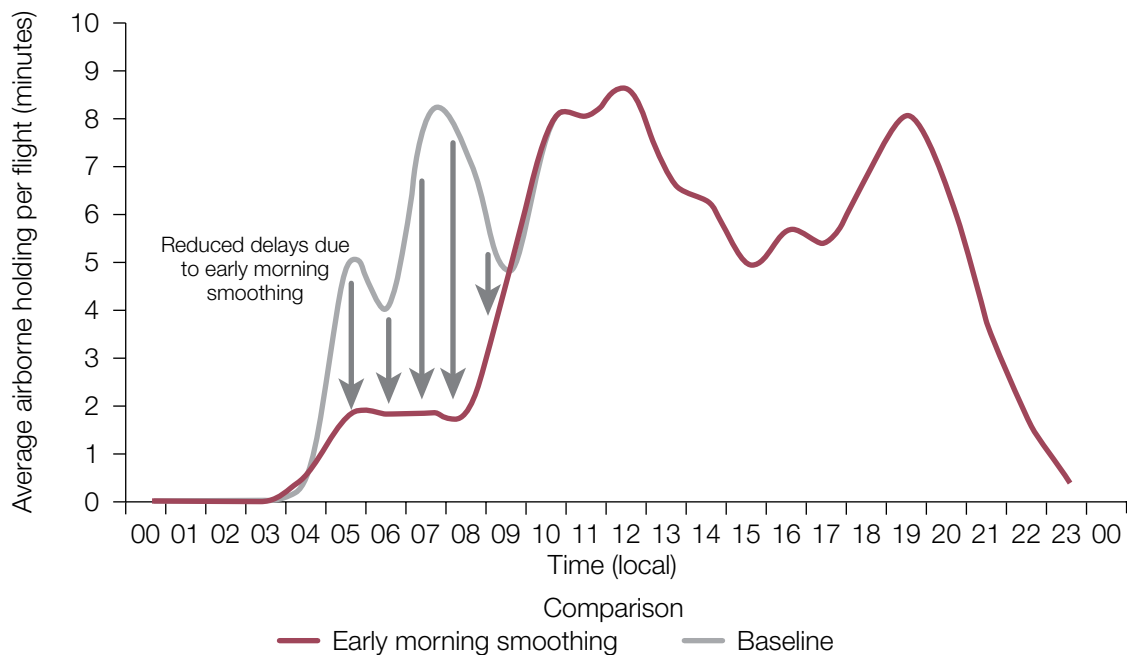
5.51 As weather conditions are generally worse in the winter, which often impact the airport's operations from first thing in the morning, the benefits are reduced to some degree. Nonetheless, as well as helping maintain respite for local communities, the smoothing proposal would:

- reduce airborne holding from 05:00 to 09:00 (the impact is less long-lived than in summer); and,
- reduce overall average holding from 6.2 minutes per flight to 5.4 minutes per flight.

¹²² Analysis undertaken using baseline data, methods and techniques used for the CAA Runway Resilience study, 2008

Figure 5.3: Early morning smoothing would be expected to reduce average delays per flight

Impact of early morning smoothing on airborne holding in the winter season (November 2007 to March 2008) as the baseline.



5.52 Taken over the year, this proposal could reduce CO₂ emissions by 84,000 tonnes per year.

5.53 Heathrow airport should progress a trial of this proposal with a view to implementing the change permanently if the trial demonstrates a reduction in airborne holding and a reduction in the use of TEAM on a regular basis. The trial should be undertaken by 2015 at the latest once all stakeholders have been appropriately consulted and dispensation has been sought from the night noise regime from the Secretary of State for Transport.

5.54 In taking forward such a trial, the following safeguards should be put in place:

- The increase in number of flights between 05:00 and 05:59 should be met by a reduction later in the day so that the planning cap of 480,000 movements per annum is not breached.
- Assurances must be given to the local community that TEAM will only be used in exceptional circumstances before 07:00, to protect respite as far as possible.
- Those flights that are brought forward to land between 05:00 and 05:59 must use aircraft with a QC1 or better noise profile.
- The airport must work with the local community to keep them informed of the outcomes of the trial.

Delivery

- 5.55** Many of the concepts discussed above form part of the CAA led Future Airspace Strategy (FAS). FAS is potentially the most significant development in improving the UK's aviation efficiency for over 40 years and is the key enabler of a number of the recommendations forming part of the optimisation strategy. The FAS is described in more detail in **Box 5a**.
- 5.56** The delivery of components of the Optimisation Strategy, particularly those connected to the FAS, is dependent on a complete re-design of the airspace around London. This is already being led by NATS through the London Airspace Management Programme (LAMP) to provide more efficient operations to all the airports in a manner that reflects advances in aircraft capabilities.
- 5.57** The LAMP project will bring significant operational and environmental benefits, increasing capacity and performance efficiency, whilst improving safety – for example, by removing current conflicts between arrival and departure routes at the London airports so that more efficient routings to and from airports can be delivered and carbon emissions reduced.

Box 5a: Future airspace strategy

The CAA led Future Airspace Strategy (FAS) contributes to the implementation of the objectives of the Single European Sky (SES) and in particular, supports the delivery of the technological and procedural solutions that form part of the technological element of the SES with a view to modernising and optimising the future European ATM network.

The FAS is intended to deal with inefficiencies in the system in three ways:

- complex and congested airspace;
- regular arrival delays; and,
- under-utilisation of performance-based navigation.

The FAS deployment plan includes:

- implementing a fundamentally more efficient route network in the busy terminal environment;
- removing fixed structures in the upper airspace enabling more direct routes;
- streaming traffic through speed control and improving arrival punctuality to manage queuing and reduce stack holding;
- re-designing departure procedures to allow aircraft to climb continuously and increase runway throughput; and,
- connecting airports electronically into the network to share accurate information and better sequence departures and arrivals.

A number of the recommendations have been made earlier in the Chapter form part of the FAS including:

- the implementation of ACDM and DPI;
- queue management;
- re-designing of London terminal airspace to incorporate performance based navigation standards; and,
- Time Based Separation.

Box 5a: Continued

The first phase of work delivering the FAS is currently underway with a timescale of 2013 to 2020, with the plan having been developed in collaborating with airlines, airports, providers of air traffic control services, the military and regulators forming part of the FAS Industry Implementation Group (FASIIG).

Industry governance reform

- 5.58** Since the FAS is essential to the delivery of the wider Optimisation Strategy, the pace at which the industry is moving to deliver the substantial changes required to current operations is a cause for concern.
- 5.59** While collaboration is key to delivery, the lack of clear governance and responsibility for delivery of the components of the FAS is adding to the delivery timescales. The number of stakeholders involved does not facilitate swift decisions.
- 5.60** Overall leadership for the FAS and its component deliverables is lacking. The delivery of the measures identified as part of Theme 1 of this Chapter, particularly where they form part of the FAS and LAMP, requires the involvement of top level representatives from the most directly involved organisations. We therefore recommend the establishment of a Senior Delivery Group with Board level representatives from the CAA, NATS and the major airports in London and the South East with overall responsibility for the delivery of the FAS.
- 5.61** The Group should be chaired by the Chief Executive of one of the member organisations listed above and should report on a six monthly basis by means of a published progress report. The first report should provide industry with a detailed timetable for delivery with clear milestones and dependencies identified.
- 5.62** The Group should be responsible for holding individual airports to account for making sure that improvements to punctuality and scheduled performance driven by the FAS and the wider optimisation strategy are matched by appropriate changes to the airport's local operation models.
- 5.63** Changes as in the optimisation strategy inevitably affect populations subject to aircraft noise and so require the airport and air traffic control to consult with communities near airports. There is a balance to be struck between the interests of local communities and aviation users. The CAA has an active role in ensuring that this balance is maintained but final decisions on large scale airspace change

currently rest with Ministers at the Department for Transport, bringing a risk that decisions of this kind become politicised leading to delay or, at the extreme, failure.

- 5.64** It is right that local communities are involved in the decision making process for changes that will affect them. The outcomes of this consultation should be fully taken into account at the design stage governing any airspace change process, but the Government should not form part of this decision making process as there are organisations better placed to play this role in determining the balance of costs and benefits of every operational change proposed. Government should devolve its responsibility for airspace changes to the CAA, advised as appropriate by a newly-established Independent Aviation Noise Authority.

Independent Aviation Noise Authority

- 5.65** The governance changes outlined above are necessary but not sufficient to deliver the Optimisation Strategy. NPRs have not changed for many decades, despite the significant population shifts that have taken place in the interim. Similarly, previous attempts to restructure London's airspace have failed. This is not only a problem in terms of optimising the current system. It also suggests the scale of the challenge that exists in delivering the airspace change to support any longer-term options to provide new capacity.
- 5.66** A lack of trust between the aviation industry and local communities has played a large role in creating this impasse. If this situation is to change, then it is vital that any decisions made are recognised as impartial and evidence based, with the needs of all parties appropriately balanced.
- 5.67** In many cases, where decisions are made in respect of aircraft noise, the ultimate power rests either with the Secretary of State for Transport or the CAA. However objective either party is in its behaviour, a perception will always persist that the decisions of the former are driven by political considerations and that the latter is beholden to the industry that provides its funding. These perceptions may be unfair, but they persist.
- 5.68** An independent body with a statutory duty to provide advice and make recommendations on an impartial basis, drawing on the latest evidence, could play an important role.
- 5.69** The Commission's Aviation Noise Discussion Paper sought views on establishing an Independent Aviation Noise Authority. Respondents argued both for and against this idea. Those against noted that many of the powers and responsibilities that

might be associated with the role already reside with one or other regulatory body, including the CAA and the Secretary of State for Transport.

5.70 Other respondents saw merit in establishing an independent authority. They cited mistrust amongst local communities in relation to the fairness and transparency of current arrangements for reporting aircraft noise, and for the recording and handling of complaints from members of the public. Separately, bodies involved in delivering the FAS and LAMP noted the difficulties arising from the political clearances required for changes to NPRs and noted that an independent body with a role in providing advice could provide a means of overcoming them.

5.71 Independent bodies of this kind have been established in a number of countries. In Australia, complaints and enquiries about aircraft noise and operations from any airport in the country are submitted to the national body 'Airservices Australia', which processes this data through its Noise Complaints and Information Service (NCIS). NCIS reports are published quarterly, and the data is used to identify systemic problems, and to provide guidance for government in developing aviation policy. As a result of this interface, NCIS is well placed to:

- explain aircraft movements and flight paths to the public (primarily through WebTrak, an online system displaying information about where and how high aircraft fly over metropolitan areas);
- provide a one-stop shop for aviation noise information to the public, for example airport curfew arrangements, air traffic control arrangements and information on monitoring and noise abatement technologies;
- work with other aviation industry stakeholders to resolve issues raised; and,
- consider possible changes to air traffic management and advise if they are not possible, or refer them for further investigation.

5.72 NCIS also undertakes systematic monitoring of aircraft noise, collecting data from every aircraft travelling to or from the country's eight largest airports. In the UK, some of the larger airports have replicated some of these functions on a voluntary basis.

5.73 The French Noise Regulator, ACNUSA, undertakes a similar noise monitoring program. In addition, ACNUSA has the power to fine airlines which fail to comply with noise regulations.

5.74 An independent, national authority with a credible and authoritative voice on noise issues could be of significant value. It could provide comprehensive advice on

changes to NPRs, addressing some of the concerns described above in relation to the political obstacles to the delivery of FAS and LAMP. It could also act as a statutory consultee on other noise related issues, including involvement in planning inquiries which would have implications for populations affected by aircraft noise. Government and the regulator could be required to seek the authority's views on issues with implications for aircraft noise and, should either party decide not to act upon its recommendations, they could be required to publish in full the reasons for their decision.

5.75 The authority could also play a role in the delivery of longer-term plans for additional airport capacity. It could put a framework in place governing aircraft noise at sites affected by expansion and monitor the delivery and operation of the infrastructure and its associated airspace to ensure that it remained in compliance with this framework.

5.76 In addition, an Independent Aviation Noise Authority could be well-placed to undertake consistent and regular surveying of attitudes to aviation noise, including its impacts on health and well-being. The response to the Commission's discussion paper, from all sides of the industry, showed that further research into these effects is desirable and necessary. In particular, responses identified the need for regular surveying of attitudes over time (annual or bi-annual data collection), rather than sporadic and occasional surveying. The CAA noted that noise modelling has improved to such an extent that noise and annoyance studies could now be plotted with a greater degree of specificity than ever before.

5.77 The Authority could also have a broader role in leading research on aviation noise issues, although the time taken to establish such a body should not be a reason for Government or the industry to delay taking forward research more quickly where that would be of value. The Commission notes that respondents to its noise paper made some suggestions for further research priorities.

5.78 The Independent Aviation Noise Authority could also collect and publish information on airports' and airlines' progress on noise issues, giving it the ability to 'name and shame' the worst performers.

5.79 There is potential for airports to be subject to 'double jeopardy' should the Noise Authority have direct licensing and enforcement powers. Accordingly, the primary function of the Authority should be provision of accurate, impartial and published advice to those with whom formal decision making and enforcement powers rest. Where such parties departed from the advice provided, they could be required to explain their reasons for doing so.

5.80 The Commission therefore recommends that an independent body be established with a duty to provide statutory advice to the Government and CAA on issues relating to aircraft noise. The Government and the CAA should be required to publish their reasoning in any cases where their decisions diverge from the advice provided by the body.

5.81 Specifically, the body could:

- Provide statutory advice to the Secretary of State for Transport regarding proposed changes to Noise Preferential Routes.
- Provide statutory advice to the Secretary of State for Transport and the CAA in respect of the proper structure for noise compensation schemes.
- Provide statutory input to planning inquiries relating to airport infrastructure in respect of the appropriate controls that should apply in respect of aircraft noise.
- Work with the developers and operators of any new airport capacity, as well as communities affected by the development to define a noise envelope to create a balance between aviation growth and noise control.
- Conduct research into the best means of monitoring and reporting aircraft noise, as well as its association with annoyance and impacts upon human health and their possible mitigation.
- Publish comparative assessments of airlines' performance in reducing their noise impacts.
- Act as a statutory consultee in planning applications with respect to airport infrastructure or housing developments which would have an effect upon the population affected by airport noise.
- Mediate by request between airports and their local communities in disputes relating to noise monitoring, the functioning of airports' advisory committees, and airports' compliance with their noise action plans and, where appropriate, advising the CAA in respect of potential breaches of noise regulations.

5.82 The establishment of the Independent Aircraft Noise Authority would require primary legislation. In the meantime, industry should not wait for the establishment of this body before beginning the process of implementing the Optimisation Strategy or progressing the delivery of the FAS.

Theme 2: Promoting the use of under-utilised capacity

5.83 Many submissions on making the best use of existing capacity pointed to the level of unused capacity at many UK airports. Making more use of this capacity has been put forward as an alternative to the provision of new runway capacity. **Chapter 4** discussed means by which the Government might mandate or provide strong financial incentives for the redistribution of traffic around the UK's airport network. The conclusion was that mandatory measures were impractical and that strong financial incentives would have significant adverse consequences.

5.84 However, there are benefits to incentivising the use of existing capacity, where this can be done without harming the connectivity of the UK's busiest airports. Each of the long-term options outlined for further development in **Chapter 6** would require a substantial period of time for planning and delivery and the potential for Heathrow's connectivity to improve during this period is clearly limited.

5.85 The Commission therefore considered measures that would provide incentives for the use of under-utilised capacity, or remove obstacles to its use. These included:

- enhanced surface transport links to airports;
- encouragement of air-services agreements at less utilised airports;
- promotion of reliever airport facilities; and,
- financial incentives to open new routes.

Enhanced surface transport links

5.86 Passengers do not think of their journey only in terms of its airborne component. The length of time it takes them to reach the airport, the cost, quality, comfort and convenience of that journey and the likelihood that it will be subject to delay are all important considerations.

5.87 Not all passengers have the same expectations regarding their journey to or from the airport. A passenger on a short-haulflight using a low-cost carrier probably has different expectations to a passenger emerging from a long-haul overnight flight. Meeting passengers' needs in terms of surface transport often means offering a range of options, with a range of prices. Airlines respond to the needs of their customers; if passengers do not want to travel to an airport because of the quality of its surface transport, airlines will be less likely to schedule flights to or from it. Poor surface transport can send the message that an airport is 'second best' or 'not the city's main airport'. For long-haul passengers, particularly those with a choice of airlines, these are significant issues.

- 5.88** In many instances airport surface transport shares its infrastructure with commuter, intercity and leisure traffic that is vital to the wider economies of those cities. Congestion on that infrastructure – both road and rail – can force difficult decisions between the interests of airport users and other travellers. However, in light of the current severe capacity constraints within the UK system and the length of time until new capacity can be brought into operation. There is a strong case for attaching a greater strategic priority to transport investments which improve surface access to our airports.
- 5.89** The Chair of the Commission wrote to the Chancellor of the Exchequer on 26 November to make this point and to set out the Commission recommendations on surface access to airports. HM Treasury’s National Infrastructure Plan,¹²³ published on 4 December, began the process of implementing it. The Commission welcomes this, and encourages the Government to continue to work on the delivery of the surface transport improvements.

Gatwick

- The Government should work with Network Rail and Gatwick Airport to implement a significant enhancement of the airport station, with an emphasis on making the station more accessible to users with luggage (which should also enhance access for users with disabilities). The Government should pursue an ambitious (circa £180 million) option for enhancing the station through the construction of a new concourse and ticket hall with enhanced access to platforms, subject to the airport providing an appropriate contribution to the costs of the scheme.
- There is a need to improve the suitability of the Gatwick Express rolling stock to make it more suitable for airport users, for example by the provision of additional luggage space. The Government should take opportunities to enhance it through the franchising system.
- The Government should work with train operators to promote the introduction of paperless ticketing facilities for journeys to and from Gatwick Airport station.
- The Government and Network Rail should accelerate work to produce a detailed plan for the enhancement of the Brighton Main Line, with a particular emphasis upon enhancing capacity and reliability, so as to accommodate growth in both airport and commuter traffic. This could focus on the alleviation of particular pinch points (such as East Croydon).

¹²³ HM Treasury (2013), *National Infrastructure Plan*
<https://www.gov.uk/government/publications/national-infrastructure-plan-2013>

- The Government should work with the Highways Agency to develop a forward route strategy for the sections of the motorway network connecting to Gatwick Airport, with a particular emphasis on the connections between the M25, M23 and the airport itself. That strategy should consider options for expanding the slip-roads between the roads in question, which could become substantial congestion pinch points.

Stansted

- The Government should work with Network Rail and Transport for London on a detailed study of the route between London and Stansted Airport and serious consideration should be given to 4-tracking the line as far as Broxbourne Junction, subject to a robust business case being developed. This study should consider how enhancements to the route might benefit airport traffic, London commuters and Cambridge traffic, recognising that any steps to enhance the Stansted Express service through regularising or reducing journey times and improving reliability will help the airport to play an enhanced role in supporting London and the UK's international connectivity. The study should take full account of the Mayor's London Growth Strategy.
- The Government, Network Rail and Train Operators should work together on options to connect Stansted Airport to a wider range of London destinations, with a particular emphasis on making better use of the connection facilities available at Stratford domestic station.
- The Government should work with train operators to promote the introduction of paperless ticketing facilities for journeys to and from Stansted Airport station.
- The Government and the Highways Agency should monitor road congestion around Stansted Airport, with a view to making interventions should substantial congestion arise as traffic at the airport grows.

Heathrow

- Recognising the importance of encouraging modal shift towards more environmentally sustainable forms of transport at Heathrow, not only for supporting future expansion plans but also for optimising the airport's operations within its current capacity constraints, the Government should work with Network Rail to undertake a detailed study to find the best option for enhancing rail access into Heathrow from the south. Initial indications are that up to roughly 15% of Heathrow's passengers in the London and South East region could benefit from improved Southern Access.

Manchester

- The Government should continue its support for the Northern Hub and ensure that the project is completed in full.
- The Government and the Highways Agency should monitor road congestion around Manchester Airport, with a view to making interventions should substantial congestion arise.

Birmingham

- The Government should continue its support for the Birmingham Gateway project and ensure that the scheme is fully delivered.

Luton

- The Government and the Highways Agency should develop a comprehensive strategy for motorway access to Luton, with a particular view to examining the case for enhancements to M1 Junction 10A.

Glasgow

- There is a need for improved public transport access to Glasgow airport. In the short-term, the Commission recommends that the Scottish Executive develop enhanced bus links to the airport. However, looking beyond this, the Scottish Executive should work with Network Rail and other stakeholders to explore other options, including light-rail options.

Other airports

- The Commission's resources and remit mean that it is not the appropriate body to reach a view on many of the schemes proposed for improving access to smaller and regional airports. However, it is important that these airports can serve their local markets effectively, so central Government should work with Local Authorities and Local Enterprise Partnerships to ensure that proper consideration is given to the needs of airport users when prioritising local transport investment.

5.90 Taken as a whole, this package would need to be underpinned by more than £2 billion of investment. The most immediate package of works would entail cost of around £200 million. Many of the schemes will take some time to plan and deliver. Making an early start will maximise the benefits that can be achieved before new airport capacity comes online.

Encouragement of Air Services Agreements at less utilised airports

- 5.91** Air Services Agreements are negotiated between nations and determine bilateral rights around access to airports. Some parties proposed that promoting bilateral agreements – particularly fifth freedoms – in respect of less utilised airports could be an effective means of managing capacity.

Box 5b: Fifth freedoms

Fifth freedoms allow an airline permitted to operate a service between that airline's home country and the UK also to pick up passengers on the arrival of that service in the UK and carry them on to a third country (and on returning from that third country to drop off passengers whose destination is the UK before continuing on back to its home country). An example might be a flight which originated in Dubai, stopped at Manchester to pick up and drop off passengers and then continued to New York.

- 5.92** Current Government policy – as articulated in the 2013 Aviation Policy Framework – is liberal, supporting the granting of air services agreements at less congested airports. However, some have suggested Government should further relax its policy in this area, by reducing or removing the requirement for overseas airlines to demonstrate that they are not dependent upon state aid, or by removing the ability of competing airlines to object to applications.
- 5.93** The Commission sought legal advice on whether this would be possible. On the basis of this advice, the Commission has concluded that current Government policy represents the furthest point in the direction of liberalisation to which the Government might plausibly travel.
- 5.94** The Government is free to grant traffic rights despite objections (including where it determines that objections are driven only by commercial self-interest). However it would likely be inconsistent with the modern approach to ignore legitimate concerns regarding anti-competitive state aids. A UK based carrier without Government support would have a legitimate right to object to fifth freedoms being granted at its home base to an overseas carrier supported by direct Government subsidy, preferential loans or tax exemptions.
- 5.95** Accordingly, the Commission recommends that the Government continue to pursue its current policy of encouraging overseas airlines to apply for fifth freedom rights at

less congested UK airports, subject to the Government satisfying itself that the grant of such rights will not be likely to distort competition in the relevant market.

Reliever airports and support for business aviation

- 5.96** Several submissions drew the Commission's attention to the concept of 'reliever airports', with particular reference to its application within the New York airport system. Under this system, smaller airports and airfields in the vicinity of congested airports are designated to handle specific types of traffic, with a particular emphasis on business and general aviation, as well as smaller aircraft flying scheduled services.
- 5.97** The private, competitive nature of UK airports ownership means that a strict application of the New York system would not be possible in the London and South East area. Government would not be able to mandate the distribution of traffic to other airfields without running a high risk of creating an illegal distortion of competition.
- 5.98** However, a growth in scheduled traffic at airports with a large share of the current business jet market (Luton and Stansted in particular) may create pressures over time for business jet users, who depend upon access to airports being available at short notice, which is difficult at a congested airport. The Commission does not recommend mandating changes to the operation of the business aviation market (which generally appears to be functioning well), but it does note the need for flexibility within the system.
- 5.99** Government policy should promote the benefits of smaller airports in the London and South East system for accommodating business and general aviation.
- 5.100** Furthermore, while the opening hours and other conditions of use of these airports are often matters that should properly be dealt with between the airport and its local authority, the local authorities should support the development of smaller local airports and, alongside consideration of their environmental impacts, also give due consideration to the positive benefits they can bring to the local and regional economy.

RAF Northolt

- 5.101** One proposal to increase the level of traffic that can be accommodated within the Heathrow system is to use RAF Northolt for traffic that would otherwise use Heathrow, possibly as a means of providing additional flights to UK regional airports.

5.102 The Commission has considered options which would make use of the existing infrastructure for commercial flights and those which would extend and realign the runway to allow for more extensive use. The Commission's conclusion is that RAF Northolt does not provide a realistic option for managing capacity at Heathrow.

Box 5c: RAF Northolt

RAF Northolt is a single-runway military airfield, located approximately six miles (10km) north of Heathrow airport. The runway is just under 1,700m long and is on a south-south-west/north-north-east alignment (while Heathrow's runways are on a straight west/east alignment). The airfield is currently used for private flights (though not for commercial operations carrying fare-paying passengers), with the annual cap currently in the process of being raised from 7,000 to 12,000 per year.

There are two categories of proposal for the further use of Northolt:

- make additional use of the existing runway to accommodate civilian traffic, with an improved interface with the Heathrow system; or,
- realign and extend the runway to enable greater use of the airport, potentially allowing for it to be fully integrated into Heathrow as a "third runway".

Safety regulations governing the use of runways in proximity to busy roads means that the usable portion of Northolt's runway for routine use by civilian traffic is short (1,200m), significantly limiting the aircraft and routes that can operate. The runway's alignment means that its arrival routes for civilian traffic conflict with the routes for Heathrow's runways. Significant additional usage of Northolt would come at the expense of reduced Heathrow airspace capacity. Northolt's departure routes also conflict with Luton's. Rectifying this would require changes (and potentially delays) to the LAMP.

While Northolt is relatively well served for journeys into central London, road journeys between Northolt and Heathrow are subject to delay due to congestion, particularly at peak times. Minimum transfer times in scheduling term between Northolt and Heathrow would be high, while the built-up nature of much of the area between Northolt and Heathrow means that the cost of providing a dedicated surface transport link would be prohibitive.

Box 5c: Continued

In respect of proposals to realign and extend the runway, the local geography is not particularly well suited and substantial rebuilding of current roads would be required, along with a possible need for large-scale demolition of housing. The maximum possible length of a Northolt runway would be significantly less than those of other Heathrow third runway proposals, entailing a very significant delivery time, on a par with other third runways at Heathrow.

The Commission recognises the value of the role Northolt currently plays in respect of civilian traffic, but does not include significantly increased use of Northolt among its short or medium term recommendations.

Financial incentives for new routes

- 5.103** In addition to considering the potential to use variable APD to redistribute traffic around the UK's airport system (as discussed in **Chapter 4**), the Commission also considered proposals to use 'APD holidays' to encourage the development of routes to new destinations.
- 5.104** Under this proposal, new routes would benefit from an initial period (probably two years) during which they would be exempted from APD. This would enable new routes to develop their market and help to offset some of the commercial risks associated with opening them.
- 5.105** There are two potential pitfalls:
- If the proposal were non-discriminatory (in other words, if it applied to every new route equally) then there would be substantial potential to game the system, for example via airlines switching between airports in the same regions of their origin and destination countries to ensure that they would always benefit from the holiday. This behaviour would reduce the UK's tax income from APD without generating connectivity benefits.
 - If the proposal introduced measures to counter these perverse incentives, then it would run a substantial risk of being challenged on the basis that it was distorting competition by favouring particular routes in favour of others.
- 5.106** The Commission cannot, therefore, recommend the use of APD holidays, though UK airports might consider options available to them within their landing charge regimes to incentivise the development of new routes.

Theme 3: Medium-term options

5.107 There are other options for enhancing the use of existing capacity, but which make sense only as part of a longer-term scenario for adding new capacity. They include:

- mixed mode operations at Heathrow;
- the ‘noise envelope’ concept;
- changes to the system governing the economic regulation of airports;
- some major surface transport proposals; and,
- removal of physical or planning restrictions on making the maximum use of existing runway infrastructure.

5.108 Some of the key considerations around each of these areas are described below.

Mixed mode operations at Heathrow

5.109 Heathrow presently operates in segregated mode. Under this model, one runway is used for arrivals and the other for departures. Currently, on westerly operations, the runways alternate in the middle of the day, to allow for respite for people living under specific flight paths. While some of the measures recommended in this Chapter would allow for the tactical use of de-segregation in specific circumstances, the principle of segregation would remain.

5.110 Mixed mode operations would allow both runways to be used for arrivals or departures at the same time. This potentially allows for a significant increase in the number of scheduled flights at the airport above the current cap of 480,000 (certainly up to 520,000 ATMs and potentially as high as 540,000) – or alternatively, the increased operational flexibility could be used to enhance the resilience of the airport’s operations. However, this comes at a cost to people living around the airport. Mixed mode operations mean a loss of respite; aircraft noise could be present throughout the day, every day. The measure therefore attracts strong local opposition.

5.111 The Commission is not recommending the introduction of mixed mode operations at Heathrow as a short-term measure. There are three key factors behind this decision:

- The noise impacts of mixed mode operation are severe, as it would mean an end to the respite periods currently granted to communities around the airport as a result of runway alternation.

- Removing the current planning limitation in place at Heathrow which caps its annual ATMs at 480,000 would require a planning inquiry. Even with a more streamlined planning process, the Commission believes that the planning inquiry could still take a considerable period of time and there is no guarantee of success. Even if the planning cap were not to be lifted and mixed mode operations were used only to enhance resilience, infrastructure and airspace changes would be required, with a consequent need for extensive consultation.
- The implementation of mixed mode operations would need to be driven by the airport's owners, who have indicated they do not support this measure.¹²⁴

5.112 Taken together, the above factors present a strong case that the implementation of mixed mode is neither quick nor easy and would inevitably come at a significant cost to local communities.

5.113 However, the Commission's assessment of need has indicated that the aviation demand pressures in the London and South East system will continue to grow. Furthermore, the Commission has noted the range of possible delivery timescales associated with the long-term options under consideration. Should the delivery timescale for new runway capacity be towards the longer end of the anticipated spectrum, then the case for enabling mixed mode operations at Heathrow may be stronger.

5.114 Accordingly, while mixed mode operations do not form part of the Commission's short-term recommendations, it is conceivable that this issue may become material as part of a transition strategy to the preferred longer-term option. It is therefore possible that the Commission may need to give some further thought to this issue within Phase 2 of the process.

Noise mitigation measures including the 'noise envelope' concept

5.115 The Commission received a range of proposals both in response to its call for evidence on short and medium term options for making best use of existing capacity and in response to its noise discussion paper, on how industry and Government could tackle aviation's noise impacts further.

5.116 Government policy has been that, in most circumstances, it is desirable to concentrate aircraft along the smallest possible number of specified routes and that these routes should avoid densely populated areas as far as possible. A number of respondents noted that new aircraft navigational technology such as performance based navigation would allow for more accurate tracks to be flown. An extension of

¹²⁴ <http://mediacentre.heathrowairport.com/Media-library/Short-medium-term-options-submission-5b1.aspx>

this was the proposal to alternate the concentration of noise through the creation of multiple arrival and departure routes to performance based navigation standard to avoid the creation of ‘noise ghettos’. These concepts form part of the LAMP.

5.117 Other proposals may be categorised roughly into two categories; those relating to the management of noise and those relating to planning and compensation against noise.

5.118 In the first of these categories the Commission received representations seeking the establishment of an independent noise regulator – as discussed earlier in this chapter – and the development of a ‘noise envelope’ to create a balance between aviation growth and noise reduction with the objective of incentivising airlines to introduce quieter aircraft whilst giving local communities more certainty about the levels of noise they may expect in the future. There are three possible approaches to setting an envelope. They are:

- restricting the number of inputs through the introduction of a movement cap (as seen at Heathrow currently); a quota count system which would see aircraft types assigned a ‘noise factor’ according to their noise performance incentivising airlines to invest in quieter aircraft which conceivably could lead to more movements within a set cap (as seen with the DfT’s Night Noise Regime); and by setting passenger number limits;
- restricting noise exposure through the use of noise contours as a basis for setting restrictions associated with noise exposure; and,
- setting noise level caps by for example setting caps based on acceptable levels of noise as measured by noise monitors.

5.119 Of these approaches, the Commission received suggestions about extending the use of the quota count system currently in place during the night period (23:00–05:59) into full day operations with an agreed quota count limit. Others proposed the concept of introducing noise envelopes more generally.

5.120 The concept of noise envelopes will be considered further in Phase 2, taking account of the short-listed options under consideration. Noise envelopes could be an effective way of managing the noise impacts of any new airport or runway development.

5.121 In the second category of options, those relating to planning and compensation against noise, the Commission received a range of proposals suggesting that noise compensation arrangements should be reviewed alongside consideration of the proposals for new runway capacity. Representations were also received indicating

that there were no effective land use policies applied to the areas around Heathrow, Gatwick and Stansted, and that whilst the aviation industry was delivering quieter aircraft and the size of the 57L_{Aeq} contour around airports affected by noise is reducing, new domestic dwellings are continuing to be built therefore increasing the size of the population within the noise affected area.

- 5.122** Both these issues are important. The role of the proposed Independent Aviation Noise Authority should include responsibilities for advising the Secretary of State for Transport and the CAA in respect of appropriate noise compensation schemes. This body would also have a statutory role in providing input to planning inquiries relating to new housing developments in the vicinity of existing airports. The Commission expects to consider these issues further in the next phase of its work.

Changes to the system governing the economic regulation of airports

- 5.123** Many parties put proposals to the Commission for changes to the regulatory regime. These changes would require primary legislation (the framework was most recently updated by the Civil Aviation Act 2012).
- 5.124** The Commission considered these proposals but is not making recommendations in this area in its interim report. The long-term options discussed in **Chapter 6** present a range of different future scenarios in terms of the competitive environment within which the UK's airport industry might operate. The regulatory underpinnings required for a system in which a single airport would clearly dominate may be different for those in which two or more airports of broadly comparable size would compete for market share.
- 5.125** Furthermore, the regulatory framework, with its role in determining the rate of return for airport investors and the landing charges paid by airlines, has clear implications for the commercial viability of long-term options. The Commission will return to this issue in detail as part of its work ahead of the final report.

Major surface transport proposals

- 5.126** Paragraphs 5.86 to 5.90 discuss the Commission's immediate recommendations in terms of surface transport. In respect of each of those recommendations, there is a clear case to act on the basis of forecast demand at existing airports during the period until any new capacity could be brought online.

5.127 The Commission received many other proposals in respect of enhanced surface transport links to airports. In some cases, the Commission did not believe that there was ever likely to be a case for the proposal in question. In other cases, however, while current and short to medium term forecast demand would not justify a proposal, the proposal might nevertheless play a role in supporting the transition towards or operation of one or more of the long-term proposals taken forward for further consideration.

5.128 Proposals identified for this category had one or more of the following features:

- a very high cost, significantly outweighing benefits on the basis of current and short to medium term forecast demand;
- the potential for expenditure on building infrastructure that might not be used if one or more of the long-term options taken forward for further consideration should be selected;
- significant impacts on commuters and other users of surface transport networks that cannot be justified on the basis of current or short to medium term forecast; or,
- the potential to create significant planning blight, due to a requirement for land-take or substantial road or rail noise implications for existing communities.

5.129 Accordingly, a number of surface transport proposals were identified for further examination alongside the relevant long-term options ahead of the Commission's final report. They include:

- construction of new high speed rail lines or spurs from current or planned high speed rail lines, such as the HS2 spur to Heathrow;
- construction of new rail lines (as opposed to the enhancement of lines that form part of the existing network); and,
- significant changes to current infrastructure or service patterns which cannot be justified on the basis of existing airport traffic levels.

Removal of physical or planning restrictions on making the maximum use of existing runway infrastructure

5.130 The maximum permitted use of existing capacity at some airports, including Stansted and Luton, is constrained by planning restrictions and also by the availability of non-runway infrastructure such as terminal and stands able to handle higher than current numbers of passengers or air traffic movements.

- 5.131** Alongside its consideration of proposals for adding new runway capacity, the Commission may also examine as part of its Phase 2 work whether there is a case as part of its overall strategy for taking action to address any of these limitations in order to enable more effective use of existing capacity.
- 5.132** This work will be focused on those airports where no proposal for new runway infrastructure has been taken forward for further consideration.

Conclusions

- 5.133** Many of the actions required to optimise the UK's airspace and airport operations are well understood and it is inertia in industry and political processes that has inhibited their implementation. The Commission has already made clear the scale of the challenge that the UK faces in the period until new capacity can be brought online. It is imperative that all parties now work together to implement these recommendations as quickly as possible. Failure to deliver will result in missed opportunities for the UK's economy and its role in international markets.
- 5.134** Access to the benefits of the strategy outlined in this chapter is contingent upon the delivery of the entire package, which contains a number of measures with complicated interdependencies. Attempts to pick and choose between recommendations will, the Commission believes, substantially reduce the overall benefits.
- 5.135** While the measures described in this chapter will lead to real gains in the short and medium term, they are not a solution to the UK's longer-term capacity needs. **Chapter 6** describes the Commission's assessment of the options for addressing those needs.

Chapter 6:

Adding capacity in London and the South East

SUMMARY

The analysis in **Chapter 4** demonstrates a clear case for at least one net additional runway in London and the South East by 2030.

The Commission has looked at accommodating increasing demand through a variety of means. This includes through purely operational measures requiring no new runways, or through using surface transport improvements to replace the need for short-haul air movements or to enable more effective use of existing capacity. The Commission has concluded that none of these options could meet the capacity shortfall.

Several potential options for providing additional capacity have been considered, ranging from incremental increases of capacity at current airports to building several new runways at completely new airports. The Commission has considered the trade-offs and balances between these options and will come to a final decision in 2015.

The Commission has therefore identified two existing airports as credible locations for an additional runway. At one of these airports there are two potential sites for expansion:

- **Gatwick Airport:**

The Commission will take forward Gatwick Airport Ltd's proposal for one new runway to the south of the existing runway. This would be over 3,000m in length and the two runways would be spaced sufficiently apart to permit fully independent operation. Related new terminal facilities and linking taxiways would be built between the new and existing runways.

- **Heathrow Airport (two alternatives):**

- One new runway to the north west – as proposed by Heathrow Airport Ltd, alternatives a new 3,500m runway constructed to the north west of the existing airport spaced sufficiently to permit fully independent operation. Related new terminal facilities would be needed to the north and west of the existing northern runway and linking taxiways to the west.
- Extending the northern runway to the west – as proposed by Heathrow Hub Ltd, an extension of the existing northern runway to a length of at least 6,000m to allow the extended runway to operate as two independent runways: one for departures and one for arrivals.

There are still important issues to examine for each of the proposals, together with significant risks. The Commission will seek to address these as the options are developed and appraised in more detail in the next phase. That will involve close consultation with promoters and others. It will also be important to understand the needs of local communities.

In addition, the Commission intends to carry out further analysis of the feasibility and impacts of an Isle of Grain airport and reach a decision in the second half of 2014 as to whether this constitutes a credible option for detailed development and appraisal. If it concludes that it is, it will be subject to a similar process of appraisal and consultation as the existing short-listed options, prior to the Commission reaching the recommendations in its final report.

- 6.1** The analysis in **Chapter 4** demonstrates a clear case for at least one net additional runway in London and the South East by 2030.
- 6.2** Heathrow is already 98% full. By 2030, Gatwick, London City and Luton are all forecast to become full, across a range of scenarios. Although there will still be some unused capacity at Stansted, total capacity utilisation across the London airports system will be more than 90% – above the level at which resilient operations can normally be expected to be maintained. In some scenarios, demand would already exceed capacity. Only through the provision of an additional runway can resilience be maintained and demand growth accommodated in subsequent years.
- 6.3** Even with one additional runway in place, by 2050 demand in the carbon capped forecast is predicted to have risen once again to more than 95% of available capacity. In the carbon traded forecast, demand is estimated to exceed capacity to

the same timescale by up to 150,000 ATMs. On this basis, the Commission's forecasts indicate that there is likely to be a demand case for a second additional runway to be in operation by 2050 or, in some scenarios, earlier.

- 6.4** One of the aims of this *Interim Report* is to identify credible long-term options meriting further detailed consideration. The Commission's assessment has identified a small number of options with a credible prospect of being deliverable within the required timescale, meeting the UK's international connectivity needs and being commercially attractive to airlines.
- 6.5** In addition, for reasons outlined below, the Commission will continue to investigate the option of a potential new hub airport located in the Thames Estuary. This additional work will be undertaken in the first half of 2014 with a view to deciding in the second half of that year whether such a proposal should be considered alongside the short-list. If a decision is reached that it should, it will be subject to similar appraisal and consultation processes as the short-listed options, although not necessarily to the same timescale.

How did the Commission reach its shortlist?

- 6.6** The Commission invited interested parties to submit proposals for long-term aviation capacity options by 19 July 2013. Some 52 proposals were received. These were published on the Commission's website and stakeholders were invited to submit views and additional evidence.
- 6.7** The submitted proposals were assessed against the Commission's sift criteria, alongside a small number of additional options developed directly by the Commission to give a suite of possible options for further analysis. Further details of how the Commission reached its shortlist – the process undertaken, the analysis, evidence and materials considered – are available on the Commission's website.¹²⁵
- 6.8** An initial sift identified a number of options which were not taken forward for further consideration, on the basis that they either:
- presented fundamental challenges that could not credibly be overcome, for example regarding safety, legality or deliverability;
 - were very similar in scope to more credible, well developed options; or
 - were inconsistent with the Commission's remit.

¹²⁵ <https://www.gov.uk/government/organisations/airports-commission>

- 6.9** The remaining options could be split into three groups:
- a. proposals advocating alternatives to additional runway infrastructure e.g. new surface transport or operational measures to enable more effective use of existing capacity;
 - b. proposals for a new hub airport with four or more runways, either through major expansion of an existing airport or at a completely new site; and,
 - c. proposals for the incremental provision of an additional runway at an existing airport.

Alternatives to new runway infrastructure

- 6.10** The Commission received a number of submissions arguing that the UK's aviation capacity and connectivity needs could be met without the provision of new runway infrastructure. **Chapter 4** sets out the Commission's consideration of the options for fiscal or regulatory measures to enable more effective use of existing capacity, and why these have been rejected.
- 6.11** In addition, the Commission received a number of proposals for major investment in surface transport infrastructure as an alternative to new runways. Its assessment of these options is set out in text **Box 6a**. On the basis of this assessment, the Commission concluded that none of these options was a credible candidate for short-listing.
- 6.12** The remainder of the Commission's short-listing process focused on options for new aviation infrastructure, whether through the incremental expansion of an existing airport or the creation of a new hub airport. To inform its consideration of these options, and to enable comparisons on a broadly consistent basis, the Commission's technical advisers carried out independent assessments across a range of factors covered by the sift criteria. These included noise and other environmental effects, cost, surface access and deliverability.
- 6.13** On the basis of these assessments and other relevant evidence, the Commission reduced the number of options under consideration. Removing options which are judged highly unlikely to be credible by assessing them against our sift criteria has enabled the Commission to avoid unnecessary impacts on those who live near the sites in question. A process of the type undertaken by the Commission is bound to affect local communities; in reaching its short-list the Commission's intention has been to minimise these impacts as far as is consistent with a rigorous assessment process.

Box 6a: Surface transport alternatives

Following the Commission's initial sift process, the surface transport options were grouped into the following categories:

- high speed rail networks to replace domestic air journeys and so free up slots/capacity at constrained airports;
- direct orbital connections between London's airports e.g. fly in to Heathrow and connect via train to an outbound flight departing Gatwick; and,
- a new hub or terminal in central London to encourage similar interchange possibilities, or promotion of the city as a hub itself.

For each category an overall assessment was carried out, drawing on elements from the range of proposals submitted, to consider whether the approach could offer a credible means of meeting the UK's aviation capacity and connectivity needs.

Given the scale of required aviation capacity identified, simply replacing domestic flights to London airports with high speed rail journeys would not liberate enough slots. Without removing all other options it is unlikely all travellers would choose the train over domestic flights. In addition, faced with such a choice many may choose to transfer via an alternative European airport. Finally, the release of a domestic slot may not necessarily result in a corresponding international flight as safety rules require greater separation between larger long-haul aircraft than for smaller aircraft typically used for domestic flights.

The other two categories did not offer an increase in aviation capacity, but rather fuller utilisation of existing capacity in a bid to tackle the current constraints at Heathrow. In these cases it was found that building surface transport infrastructure, capable of delivering flight connection times consistent with current passenger expectations, was either impossible or prohibitively expensive, especially when compared with options for additional runways.

Options for new hub airports

- 6.14** The option of constructing a new hub airport offers the attractive prospect of providing a potentially significant increase in capacity while at the same time

delivering a very substantial reduction in noise impact. In some cases, where aligned with wider regional development strategies, such options may also make a positive contribution to the delivery of wider economic development and regeneration objectives.

- 6.15** A new hub airport would effectively relocate Heathrow's operations and infrastructure to another site and further increase capacity through provision of additional runways; moving the aircraft noise associated with the UK's largest airport from the heavily populated environs of west London to more sparsely inhabited areas. Although some people in these areas would be affected by noise for the first time as a result, the difference in the total scale of impacts could be transformational. Approximately a quarter of a million people around Heathrow currently experience noise levels in excess of $57L_{Aeq}$. Depending on the option under consideration, the replacement of Heathrow with a new airport could see this cut to a few thousand by 2030.
- 6.16** By building a completely new airport many of the legacy issues associated with incremental development at existing sites could be avoided. It would be possible for example to use land use planning to stop new residential and public infrastructure (e.g. schools) from being built in the higher levels of the noise contour, safeguarding the fundamental reduction in noise nuisance into the future.
- 6.17** Such options also, however, present significant challenges. A project of this kind would be of a different scale to the incremental expansion of an existing airport and the associated costs and delivery challenges could be commensurately higher. Despite their potential noise benefits, many of these options would have other negative environmental impacts which need to be taken into account. They would require extensive additional surface transport infrastructure, which would have cost, deliverability and environmental challenges of its own. The complexity of incorporating a major new airport of this size into London's congested airspace could also restrict the level of capacity increase which is achievable in practice.
- 6.18** A broad range of proposals of this kind were considered by the Commission, all of which would require the closure of Heathrow to enable them to attract the investment and traffic necessary to operate at the scale envisaged. These included options for:
- new airports in and around the Thames Estuary;
 - new airports at a number of inland locations in the South East where no commercial airport currently exists; and,

- options for major expansion at existing airports, including for four runways at Luton or up to five runways at Stansted.

6.19 Additional challenges would be associated with the closure of Heathrow airport. First, this would likely increase further the costs associated with a new hub airport. Although it is very difficult to quantify how much value could be realised from the Heathrow site, it is clear that with the need to remediate the site (decontamination and preparation for redevelopment etc) and then release the land in a manner that did not flood the market, it would be decades after acquisition before the full value of the site could be realised. In addition there would be a high degree of risk associated with any redevelopment of this size (broadly equivalent to a medium-sized town such as Maidenhead). In light of these factors it seems a safe assumption that for the purposes of this study the acquisition of Heathrow should be considered a net cost in 2030, with an uncertain prospect for full recovery of these costs by 2050.

6.20 Second, while the potential value of the Heathrow site for addressing housing shortages in the capital should not be underestimated, it cannot be assumed that the overall economic impact of closure would be positive. Analysis carried out for the Commission of these impacts, although noting that much employment may be replicated at the new airport site, indicates that the impacts in the local area could be significant, with the airport being associated with 8-10% of employment in the four closest boroughs. Easy access to an international airport is an important consideration for firms locating in the Thames Valley corridor, and the closure of the airport would be expected to reduce both the area's attractiveness to new businesses and its ability to retain the firms currently located there.¹²⁶

6.21 Finally, there are important uncertainties about how the aviation industry would respond to a decision to construct a major new hub airport to the east of London. As set out in **Chapter 2** the aviation industry is in a state of constant evolution. Investment in a new airport of this kind would require a high level of certainty that the hub-and-spoke model would continue to play a dominant role in providing international connectivity, and that airlines would bear the cost and risk of locating to a new airport.

6.22 In public and in their submissions to the Commission, a number of airlines and alliances have been unenthusiastic about moving from Heathrow and the establishment of an effective hub capability at any new airport cannot be guaranteed. Airlines will always need access to London's origin and destination

¹²⁶ Leigh Fisher (2013), "Economic and operational impacts of closure of Heathrow Airport", available on the Commission's website

market, but that need not be through a new, untested airport, and they may choose to locate other elements of their networks elsewhere.

- 6.23** During the assessment process the Commission identified the two most interesting options as the construction of a new four runway airport in the Thames Estuary and the expansion of Stansted Airport into a five runway hub. These are discussed in more detail below.

A Thames Estuary hub airport

- 6.24** Among the most imaginative options submitted were those for a new hub airport in or around the Thames Estuary. The options presented to the Commission ranged from floating islands constructed some distance offshore to airports located at a number of locations on the foreshore, from Foulness Island to the Cliffe marshes. The proposals from the London Mayor and others to build a four runway airport on the Isle of Grain are good examples of the latter. As set out in **Appendix 2**, the Commission's view was that they were likely to represent the most viable of the options for development in the Estuary. The more remote options presented cost, feasibility and distance obstacles which made them less attractive in a number of respects.
- 6.25** The assessment of an inner Estuary airport on the Isle of Grain has been based on an option developed by the Commission itself, which draws upon elements from a number of the proposals submitted and seeks to achieve the most effective balance of impacts.
- 6.26** In order to limit noise impacts, while also reducing or avoiding any consequences for the Liquefied Natural Gas (LNG) facility nearby, a north-easterly location on the Isle of Grain was used. Options further to the west would increase the size of population affected by noise, and locations further to the west or south could potentially require the relocation of the LNG facility. To minimise the costs associated with land reclamation from the Estuary whilst still providing a significant increase in capacity, a configuration of two independent sets of dependent runways was used. It was not possible, however, to avoid affecting internationally designated environments without reducing the additional capacity provided to less than that required by the Commission's assessment of need, due to the extent of the designated areas.
- 6.27** The key potential advantages of an option of this kind are:
- It would deliver the most significant reduction in overall noise impacts of any of the options considered other than an island airport. The Commission's analysis

suggests the population within the 57L_{Aeq} contour surrounding an Isle of Grain airport could be as low as 1,400 people by 2030 – compared to around 150,000 around Heathrow to the same timescale as currently configured. The proposal would also offer other environmental benefits in comparison to other options, particularly in relation to air quality for which the impacts would be particularly low.

- It could make a significant contribution to local regeneration. The local authority areas immediately surrounding the site experience comparatively high average levels of deprivation for the south east of England and higher levels than at the vast majority of sites considered by the Commission. A new airport could be a substantial generator of economic activity in the region and provide significant new employment opportunities – around 100,000 jobs¹²⁷ at the airport alone in the 2030s, plus additional related wider employment.
- It would be well-aligned with the wider economic development of London. London is forecast to see a significant increase in population and economic activity over the coming decades – with population rising to over 10 million by 2036 and the labour market growing by around 850,000 jobs over the same period.¹²⁸ The most significant proportion of this growth is expected to be seen in the east of the city. A Thames Estuary airport could be well-located to support the strategies for development set out in the Mayor's London Plan. In addition, the closure of Heathrow could offer a very substantial site for redevelopment, with on some estimates scope to provide homes by 2050 for around 150,000 people.
- It would provide a significant increase in hub airport capacity which would likely be subject to fewer operational limitations than Heathrow. In particular, its very low noise impacts would offer the opportunity to operate 24 hours a day, increasing its flexibility.

6.28 These benefits could be significant. In some cases, however, they are complex to assess. Whereas the Commission has been able to model the potential noise impacts to a reasonable degree of accuracy, economic development and regeneration benefits are far harder to quantify. While the Commission has taken appropriate account of these factors in its short-listing process, balanced against the costs and risks of an approach of this kind, a full assessment would require more detailed analysis than has been undertaken to date.

¹²⁷ Calculated on the basis that each 1 million passengers at an airport supports roughly 1,000 jobs

¹²⁸ Mayor of London (2013), "A new hub Airport for London and the UK: Isle of Grain", para 3.6, <http://www.tfl.gov.uk/assets/downloads/corporate/new-hub-airport-isle-of-grain-mayor-of-london.pdf>

6.29 An Isle of Grain airport, however, would also present significant challenges and risks. A key risk associated with an Isle of Grain airport relates to its environmental impacts. While the noise and air quality effects of such a scheme would be low in comparison to other options, building such an airport would have a substantial impact on several large areas of nationally and internationally recognised environment, as shown in **Figure 6.1** below. These are areas designated under British, European and international legislation as being important to certain protected species.

Figure 6.1: The Estuary has many areas of protected habitat and flood risk

GIS plot of key environment, flood and heritage sites with possible airport outline in red.



Source: Jacobs

6.30 To impact on such designated areas would likely require proof that there was no alternative option and the demonstration of an overriding public interest. If these requirements could be met, it would still be necessary to show that large areas of compensatory habitat for lost land and marine environments could be provided elsewhere, in a manner that performs the same function as the impacted site. This is explained further in **Box 6b**.

Box 6b: Development impacting the Natura 2000 network

Natura 2000 is an EU wide network of nature protection areas aiming to assure the long-term survival of Europe's most valuable and threatened species and habitats. It comprises Special Areas of Conservation (SAC) designated by Member States under the Habitats Directive, and also incorporates Special Protection Areas (SPAs) designated under the 1979 Birds Directive.

Direct impacts on the Natura 2000 network would likely mean development can only take place in these areas when no alternative is shown to exist. The bar for the alternatives test is high due to the potential for many other locations to meet the objectives for the expansion which would not have such adverse effects. If there are no feasible alternatives, then there must also be 'imperative reasons of overriding public interest' (IROPI) that justify the plan or project despite the environmental damage it will cause.

Where a plan or project will negatively affect a 'priority' habitat or species, only reasons relating to human health, public safety, or beneficial consequences of primary importance to the environment can be considered. Other imperative reasons of overriding public interest can only be considered having obtained and had regard to the opinion of the European Commission.

Finally, the proposal would also need to demonstrate how it could provide compensatory measures which maintain the integrity of the Natura 2000 sites affected. Where possible the impact of this compensation should be secured before consent is granted. Given the need to ensure adequate compensation a suggested target compensatory habitat would be between a 2:1 and 3:1 ratio. However, the actual test is that the compensatory habitat is functionally equivalent and maintains the Natura 2000 site integrity.

- 6.31** The Commission's view is that these issues present significant delivery risks for an Isle of Grain airport. None of the proposals submitted to the Commission for an Isle of Grain airport has provided clear evidence that the impacts on these designated sites could feasibly be addressed or compensatory habitats provided, though some do point to previous projects in which these issues have been managed. Even if it is assumed that an appropriate solution can be identified, this would remain an area of major legal risk, given the stringency of the regulations governing development at such sites. The need to overcome these issues is a further reason why the timescales for delivery of a new Estuary airport may be prolonged.

- 6.32** There is also a potential flood risk at the proposed Isle of Grain site, which is on the coastal area of a considerable flood plain and built out into an estuary. While other new hub airport options also have flood risk issues to be addressed, the problems for an Estuary site are of a different order of magnitude. Furthermore, developing an airport at the Isle of Grain, on the Commission's analysis, would likely cause the loss of around 1,600 homes and require the relocation of at least one entire community, as well as directly affecting five scheduled monuments and seven listed buildings (including two Grade I and one Grade II* listed churches).
- 6.33** An Isle of Grain Airport would be some 33 miles from central London (compared to 15 for Heathrow and 25 for Gatwick) with no direct surface access links in place. Its easterly location makes it less convenient than Heathrow for the majority of UK travellers. The Commission's analysis suggests that a number of major transport enhancements would be required to support an Isle of Grain airport, including new high speed links to central London, extensions to Crossrail and local conventional rail lines and a range of road improvements. Securing planning permission for and delivering surface transport investment of this scale to support an airport opening date prior to 2030 would be extremely challenging, particularly given the overlap with the construction period for HS2.
- 6.34** These surface transport enhancements would also be very costly (estimated at more than £24 billion before any adjustment for risk or optimism bias) and would present their own planning, delivery and environmental challenges. They may, however, provide additional benefits through increasing transport capacity for other users in Kent and East London. Even with these improvements in place the population likely to be living within 45, 60 and 120 minutes' travel of the airport would be lower than around Heathrow and broadly similar to Gatwick.
- 6.35** The overall costs of an Isle of Grain airport would be extremely high. The Commission's independent assessment suggests that they could total as much as £82-112 billion by 2030, including surface access costs and allowances for risk and optimism bias. This is around five times the estimated cost of a new runway at Heathrow, and does not include any costs related to the acquisition or closure of Heathrow.
- 6.36** The Commission's cost estimates are higher than those put forward by the promoters of Thames Estuary schemes, due in large part to the treatment of risk and optimism bias. The same allowances, however, have been used for all schemes under consideration, and the difference between the estimated base and risk adjusted costs (roughly 100%) is broadly in line with the difference between the

original base cost estimate for the HS2 network and the current risk adjusted total.¹²⁹

Box 6c: Assessing the costs and financeability of new airport infrastructure

The costs associated with any new infrastructure proposal include many elements. For the airport they will include the cost of constructing the runway, the associated airport infrastructure such as terminals and baggage handling facilities, and potentially any environmental elements such as flood protection and mitigation. Any proposal for additional capacity will also need to ensure sufficient surface transport is available to bring passengers and goods to and from the site. Where this is additional to current confirmed transport schemes this is arguably a necessary additional cost to enable full realisation of the proposal.

Finally there may also be other ancillary costs necessary to bring the project into being, such as wider environmental mitigation or protection measures, or the acquisition of other airports to ensure their closure or compensation for any reduction in capacity.

Many proposals considered some or all of these costs, but different methodologies, approaches to risk and apportionment of costs were used in each case. To ensure consistent comparison the Commission generated its own cost estimates for all elements necessary to deliver the project. These estimates included allowances of 40% for risk and a further 50% for optimism bias.

The question of who pays for which elements of a new airport is ultimately a political judgement. In many cases the most expensive element of a proposal is the associated surface access improvements. In some cases these may offer wider benefits to society than to just airport users, although dedicated airport express links would be less likely to do so.

¹²⁹ The HS2 Y network was estimated in January 2012 to have a construction cost of £33 billion, including allowances for risk and optimism bias of approximately 65%. This indicates a base cost of roughly £20 billion compared to a current risk-adjusted cost estimate of £43 billion

Box 6c: Continued

The Commission analysed various approaches to public sector support for the options under consideration. It assessed the level of public sector support necessary to allow the airport to finance the required debt from within its current charging scheme. It also looked at the increase in airport charges necessary to finance the required debt both with and without surface transport costs and with and without an allowance for indexation of revenues.

The broad conclusion was that any significant expansion in airport capacity would likely be beyond the capability of the private sector to achieve alone. All the options considered therefore would be expected to require some level of public support, be that Government guarantees for finance or the construction of associated public transport infrastructure to reduce the risk sufficiently to encourage private investment.

- 6.37** These high costs would present very significant challenges in terms of financeability. In order to repay the debt required to finance the project, aeronautical charges would need to be set around three times the Heathrow Q6 level set by the CAA.¹³⁰ This would have a major effect on the attractiveness of this option to airlines. In order to finance the project without such an increase in charges an estimated £64 billion in public subsidy would be required.
- 6.38** The interaction of any Isle of Grain airport with the wider London airspace system would also be challenging. As a result, although such an airport would represent a significant increase over Heathrow's current capacity, the increase would not be as great at a system wide level. In particular, it would be very challenging to manage the interactions between arrivals and departures at the new airport and those at London City, suggesting the latter would have to close. An Isle of Grain airport would also be likely to require the closure of Southend Airport, reducing the options available to low cost carriers in the south east of England.
- 6.39** These interactions would limit the net capacity gain within the London system, as well as reducing the level of competition and diversity within the London aviation market. For these reasons, despite its higher costs, it is estimated that the net capacity gain in the London system from an Isle of Grain airport would be broadly

¹³⁰ The financing figures in this chapter assume no direct Government subsidy and include the cost of surface access improvements unless otherwise stated. For these figures some level of Government guarantee or other intervention may, however, be required to secure affordable financing. For further details of the assumptions and methodology behind these figures please refer to the "High-Level Commercial/Financial Assessment of Selected Potential Schemes" paper on the Commission's website

comparable to that from a single additional runway at Heathrow or Gatwick.

Box 6d describes in more detail how the Commission has assessed the airspace implications of the options that it has considered.

- 6.40** The impacts of a scheme of this kind on the point-to-point aviation market would also need careful consideration. If some legacy carriers' services were attracted to such an airport from other parts of the London system, it could release additional capacity for growth in the point-to-point and low cost sectors. However, the likely closures of London City and Southend airports should an Estuary airport be taken forward, could offset these benefits and reduce variety and competition within the aviation market. Further work would be required to understand fully the effects of an airport of this kind on the aviation industry.
- 6.41** Overall, the proposals put forward for a new hub airport in the Estuary show great imagination and ambition. Following 60 years of debate about how best to accommodate aviation growth in the South East, the next step will mark a watershed in the UK's approach. The prospect of a new hub airport that fundamentally alters the current relationship between airport operations and local noise impacts is bound to seem attractive, particularly for the many thousands affected by noise around Heathrow. Supporting the shift of London's economic centre of gravity eastwards to allow for further expected population growth, combined with a major redevelopment opportunity of the Heathrow site, is an alluring prospect, which could have a major impact on the economic geography of the South East.
- 6.42** Conversely, the costs and risks attached to such plans are so high that they present serious challenges to the credibility of these options. The scale of road and rail investment and construction activity needed is daunting, at a time when HS2 is also under way. They present serious environmental challenges and planning risks, due to their impacts on important protected sites. These problems are not necessarily insuperable, but no complete solutions to them have been presented and it is clear, in any case, that they would take many years to overcome. The risks to the timescales set out by the Commission for addressing the identified capacity gap would be significant.
- 6.43** The Commission's view therefore, is that no proposal for an Estuary airport advanced so far has presented a sufficiently powerful case for it to be recommended as a credible option for further detailed assessment at this stage.
- 6.44** But neither does the Commission consider that a firm conclusion can yet be reached that an Isle of Grain airport option would have no prospect of success. The

scale of benefits associated with such a proposal is potentially greater than for any of the other options that the Commission has considered. As noted above, substantial further work is required to evaluate these fully. The delivery challenges posed need detailed and careful consideration. The analytical difficulties are of a different order from those associated with expansion at an existing airport site, particularly in relation to its local and regional economic impacts. It has not been possible to undertake this analysis in the time available for the publication of this report.

6.45 For these reasons, the Commission believes that it is appropriate to continue to analyse the feasibility and impacts of such an airport in addition to the further development of its short-listed options. Therefore, in the first half of 2014, it intends to carry out further analysis of a number of the key issues presented by an Isle of Grain airport. This may include consideration of:

- the surface access measures needed to support such a development, together with their costs and benefits (including wider impacts for users of the South East transport network);
- the feasibility of meeting the tests required for development affecting Natura 2000 sites, including in particular of delivering effective compensatory habitats; and
- the potential socio-economic impacts of a major airport development on the Isle of Grain, including the consequential impacts in respect of the Heathrow and London City sites.

6.46 The Commission will aim to complete this work in time to enable it to reach a decision in the second half of 2014 on whether an Isle of Grain option constitutes a credible option. If so, it will subject it to the same process of appraisal and consultation as the other three short-listed options, although not necessarily to the same timescale, so as to reach a firm recommendation in its final report in the summer of 2015.

A hub airport at Stansted

6.47 Two options for a new hub airport were proposed at Stansted: a four runway and a five runway airport. The Commission's analysis focused on the five runway option. This is because a four runway airport at this location would not deliver the necessary overall increase in capacity across the London system. It would add three runways at the Stansted site, but would require the closure of Heathrow and a significant scaling back of operations at Luton due to airspace constraints. As a

result, the additional capacity provided would be significantly below the requirement identified by the Commission.

- 6.48** The Commission's consideration of the new hub option at Stansted has therefore focused on a five runway option, broadly as proposed by the Mayor of London. This would clearly address some of the issues presented by a new hub on the Isle of Grain. It would have no direct impacts on any internationally designated sites, for example, and the number of properties requiring demolition would be significantly smaller.
- 6.49** It would be less costly than the Estuary option, though still significantly more expensive than options for incremental expansion, at £59-80 billion. This, combined with the higher number of passengers able to use an airport of this scale, means that the costs of operation would be noticeably lower: with no allowance for indexation, aeronautical charges would need to be more double than the level in the Heathrow Q6 settlement, as opposed to over three times more for the Estuary.
- 6.50** In other ways, however, a five runway Stansted hub does not offer as compelling a proposal as an Isle of Grain airport. It would not offer the same potential to address noise impacts in the south east of England, with almost ten times as many people affected by this option as by a Thames Estuary hub. It would be located in an affluent area of the country, offering fewer regeneration opportunities, and although broadly aligned with the development corridor along the Lea Valley would not support London's economic development objectives to the same extent.
- 6.51** Despite its advantages in relation to designated sites, it would also have significant environmental and heritage impacts of its own. More than 150 listed buildings fall within the proposed footprint for the site, including two Grade I and seven Grade II* buildings, as well as four Scheduled Monuments and one Registered Park and Garden. Its impacts on cultural heritage are greater than for any other option considered. It would also involve the loss of more than 2,000 hectares of high quality agricultural land and up to six villages. As with other hub options, it would require major new surface access infrastructure which would present environmental and deliverability challenges of its own.
- 6.52** Finally, there would be significant risks associated with the level of additional capacity which might be provided by this option. As described in **Box 6d**, the system wide capacity impacts of building four or more runways in one location need to be considered carefully. If a five runway Stansted Hub proves capable of delivering gross capacity of 1,250,000 ATMs the net increase for the London airport system could be more than 300,000 movements, even allowing for the

closure of Heathrow and a substantial reduction in the scale of operations at Luton and London City.

- 6.53** There may, however, be an upper limit to the total number of air transport movements possible at one site. NATS advise that in the London context it may be difficult to achieve much more than one million movements at any one site which would almost eliminate the capacity gain provided. By way of comparison, Atlanta – the busiest airport in the world – currently manages to handle 950,000 movements off five parallel runways with no other significant airports within 200 miles.

Box 6d: Air traffic management and system capacity

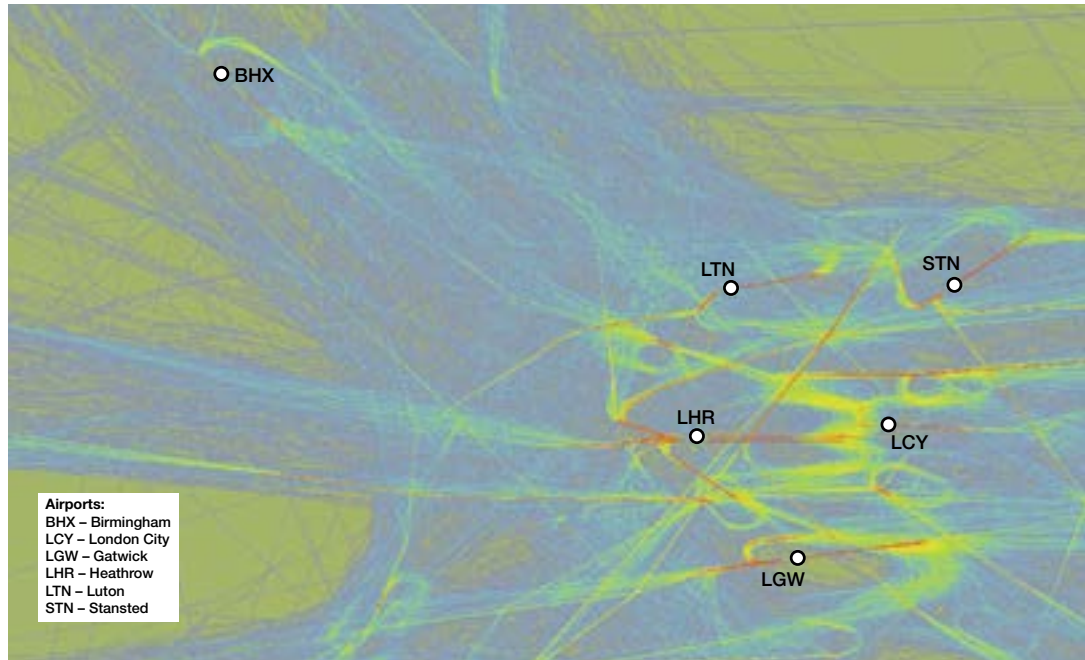
Capacity needs to be considered both in terms of the individual airport and also in terms of net impact on the capacity of the London air traffic system. Managing air traffic is a complex multidimensional task. It is predicated on keeping planes safely separated until they converge at an airport. It requires careful planning and management, whose complexity increases the closer together airports are located and the more traffic that uses them.

Figure 5.1 in **Chapter 5** gives a sense of the complexity of the London air traffic management system; in **Figure 6.2** below the same traffic is depicted using red to indicate the densest flows of traffic and grey the least dense. From this it is possible to see the elliptical swirls of the holding stacks where arriving planes circle while waiting for an available slot at an airport, and the approach paths extending for several miles along the centreline of each runway e.g. the two approach paths to the east of Heathrow extending all the way to London City. It is also possible to see the interaction of different streams of traffic for the different airports – in particular Heathrow with London City and Luton with Stansted.

Box 6d: Continued

Figure 6.2: London air space is complex with many interactions between the traffic streams for the various airports

Density plot of all traffic below 25,000ft (arrivals and departures) for a day in August 2012 for airports displayed – westerly operations.



Source: NATS

Given the proximity of London's airports and the current volumes of traffic, it is likely that building additional capacity at one airport may mean that it is not possible to utilise fully the runway of another. This is particularly true where the centrelines of runways converge at some point proximate to the airport e.g. as is the case with Luton and Stansted.

New hub airports, therefore, often lead to greater airspace interaction problems than incremental expansion at existing sites as their provision of large amounts of additional capacity in one place has greater potential to perturb the system. For these reasons the Commission's analysis found that the majority of new hub airports did not offer net additional system capacity far in excess of demand forecasts. Indeed once the closure of Heathrow for commercial reasons was factored into the calculation, the majority offered broadly the same or even less capacity than an additional runway at an existing airport. **Table 6.1** gives a broad indication of this.

Box 6d: Continued**Table 6.1: New runways may have impacts on system capacity****Potential airspace impacts of proposals on London and SE airport capacity¹³¹**

Expansion options	Impact on other airports				
	LHR	LGW	STN	LTN	LCY
Heathrow 3rd runway					
Gatwick 2nd runway					
Stansted 2nd runway					
Isle of Grain Hub					
Stansted Hub					

Source: NATS

6.54 In light of these factors the Commission does not consider that a five runway hub at Stansted would offer a credible option to be taken forward for further detailed development in the next phase of its work programme.

Options to build incremental capacity at existing airports

6.55 The Commission also considered a range of options to build an additional runway at existing airport sites. These included Birmingham, Gatwick, Heathrow and Stansted and it is from this group that the shortlisted options have been drawn. This category of options generally met the identified capacity requirement at a lower cost than building a completely new airport and presented fewer delivery risks.

6.56 The Commission did not consider that there was a strong demand case for expansion at Stansted. The airport is currently operating at roughly half its permitted

¹³¹ Given the complicated multidimensional nature of airspace management, it is not possible to say what the precise impacts of an airport proposal will be. In the absence of Fast Time Simulation modelling, the table gives an indication of the expected nature of the impact on airspace grounds i.e. increase in current capacity, continuation of current capacity, reduction of current potential capacity or closure of airport. Redesigning the London airspace system and incorporation of new technology may also offer opportunities to 'design out' some of these interactions and further increase the potential of the system, thus the above table represents the impact on the system's current architecture. The table above does not take into account the commercial impacts of opening another airport and it is worth noting in this context that proposals for a Stansted Hub are likely to require the closure of Heathrow for commercial reasons

capacity and could accommodate an additional 130,000 ATMs per year. It is not forecast to reach capacity until approximately 2040, even with other London airports remaining constrained. It is therefore uncertain that it would provide an effective solution to wider emerging capacity constraints.

- 6.57** Its wider costs and benefits would not outweigh these disadvantages. A second runway at Stansted would not be significantly cheaper than one at Gatwick, and its 45 and 60 minute catchment areas would be noticeably smaller than at Gatwick and Heathrow (although its 120 minute catchment area would be larger than for Gatwick). It would increase noise impacts in 2030 at the local level, although its noise impacts across the London system would be broadly neutral. Its other environmental impacts would be mixed – for example, it would have comparatively limited impacts on air quality and designated sites, but would require the loss of a high number of listed buildings and the largest area of greenfield land of any of the main single runway options.
- 6.58** For these reasons, the Commission did not consider that a second runway at Stansted should be shortlisted as a credible option for further development and appraisal. The airport is, however, currently prevented from operating to its absolute maximum capacity due to planning restrictions, and the Commission will consider in the next phase of its work whether there is a case for lifting these as part of its overall strategy for optimising aviation capacity in the London system.
- 6.59** It is likely also that a new runway at Stansted should be reconsidered as part of any future review of options for a second additional runway, which will be able to take into account the long-term effects of competition resulting from its sale by BAA Ltd.
- 6.60** The case for a second runway at Birmingham Airport is predicated heavily on the improvements in surface access which will be enabled by the construction of HS2. The airport argues that these will make it significantly more accessible from a large part of the UK and capable of servicing the London market as well as its existing catchment.
- 6.61** The Commission's forecasts, however, have incorporated the changes to surface accessibility that would be enabled by HS2 and even on this basis the airport is not forecast to be operating at capacity until the mid-2040s, even with other airports remaining constrained. This reflects both the fact that the airport's catchment has a lower propensity to fly than that of airports in the South East region and that HS2 will improve access to other airports (notably Manchester and Heathrow) from the West Midlands just as much as it will enable easier access to Birmingham Airport from other

areas of the country. This is before consideration is given as to whether HS2 is able to provide an effective 'shuttle' service between the airport and central London.

- 6.62** Noise impacts from an expanded Birmingham Airport would be relatively high in comparison to alternative options (other than at Heathrow) for expansion at an existing airport. There would, however, be comparatively minor impacts on listed buildings and designated sites. Likely costs would be lower than for Heathrow options but broadly comparable with other potential sites for a single new runway.
- 6.63** On balance, the Commission's view was that there was not a strong case for expansion at Birmingham Airport, and that it should not be shortlisted as a credible option for further development and appraisal. As with Stansted Airport, however, this option may merit reconsideration as part of any future assessment of options for a second new runway, particularly as the long term impacts of HS2 on patterns of travel and aviation demand become clearer.
- 6.64** At Heathrow, in addition to the runway options shortlisted, the Commission considered options for new runways to the north and to the south west of the existing runway. The northern option was less costly than the shortlisted north west option, but had more severe noise impacts, while providing less capacity and requiring the loss of significantly more residential properties. The south western option would have a direct impact on an internationally designated site, as well as potential effects on London's water supply through the loss of a reservoir which could not easily be mitigated.
- 6.65** The full list of options of this kind considered by the Commission is set out in **Appendix 2**.

The shortlisted options

- 6.66** From a long list of over 50 possible options the Commission selected two potential sites for further analysis and assessment which:
- delivered the capacity needed in line with the estimated capacity requirement;
 - were sufficiently flexible to cope with uncertainty around the future development of the industry; and,
 - performed well across a balanced assessment of various factors identified in the sift criteria.
- 6.67** These two sites, and the credible runway options in each case, are considered in detail below with an explanation of the Commission's rationale for the proposed option being shortlisted. The two sites are:

- **Gatwick Airport:** At this site the Commission's analysis will be based on a new runway over 3,000m in length spaced sufficiently south of the existing runway to permit fully independent operation.
- **Heathrow Airport:** At this site the Commission's analysis will consider two potential runway options:
 - A new 3,500m runway constructed to the north west of the existing airport, as proposed by Heathrow Airport Ltd, and spaced sufficiently to permit fully independent operation.
 - An extension of the existing northern runway to the west, as proposed by Heathrow Hub Ltd, lengthening it to at least 6,000m and enabling it to be operated as two separate runways: one for departures and one for arrivals.

6.68 In the next phase of its work, the Commission will subject the short-listed proposals to a more rigorous assessment, including consideration of their economic, social and environmental impacts, to develop as comprehensive a picture as possible of the risks and opportunities within each of the proposals, and to prepare the background evidence needed for the delivery of a final recommendation. There will be consultation on the design and appraisal of each shortlisted option in the autumn of 2014.

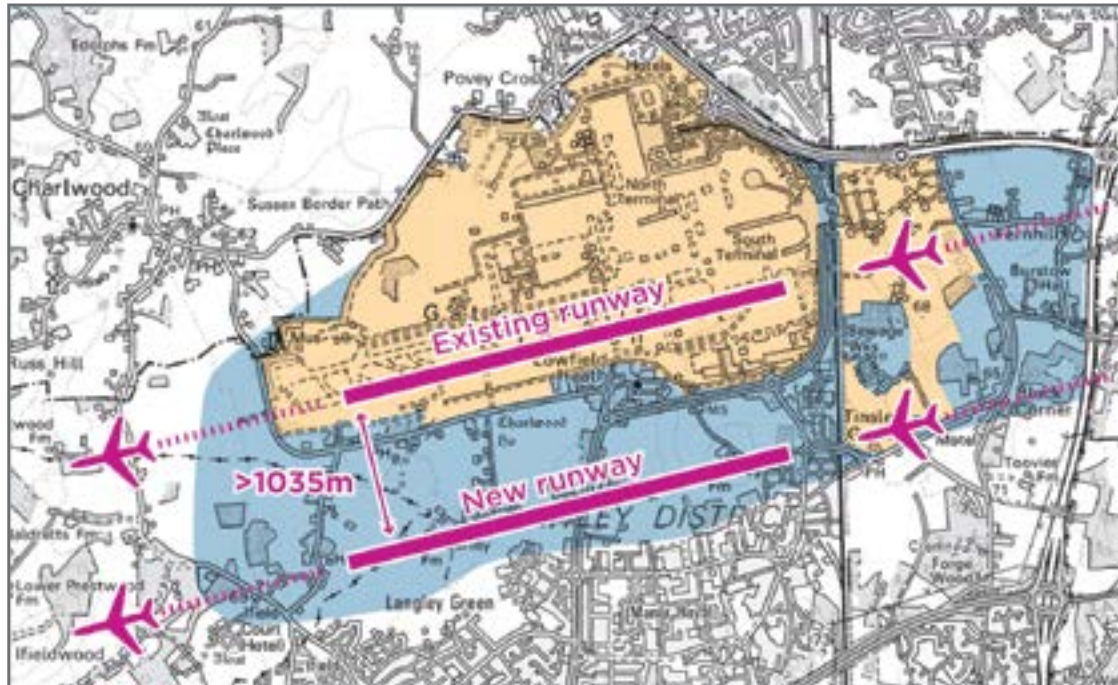
Site 1 – Gatwick Airport

- 6.69** As discussed in **Chapter 3**, since it was purchased by its current owners in October 2009 Gatwick Airport has sought to position itself as a competitor to Heathrow, as well as to enhance its position as a key airport for low-cost and point-to-point services.
- 6.70** The airport has attracted a number of new carriers, including airlines operating to Far Eastern destinations (China, Vietnam and from next year Indonesia), which might previously have been expected to operate only from a more established hub airport. It has also introduced its Gatwick Connect service to support travellers using the airport to self-connect between services, and from 2014 it will accommodate the UK's first low-cost long-haul services.
- 6.71** Expanding capacity at Gatwick Airport could support growth in the point-to-point market by allowing established carriers at the airport to increase the scale of their operations and attracting new ones. But it could also help to support and enhance the UK's hub status, perhaps by attracting one of the major alliances to move from Heathrow, incentivised by greater scope for growth or the opportunity to build a dominant position at the airport. It might equally be through the continuing growth

of self-connecting at the airport, through new partnerships between short- and long-haul airlines operating there or through some combination of the two.

- 6.72** These are not mutually exclusive scenarios. Growth in point-to-point traffic, for example, could over time provide an increasing feed market for any potential network carrier at the airport, strengthening the incentives to move from Heathrow. In addition, the enhanced competition for Heathrow which might be offered by an expanded Gatwick Airport could potentially lead to further benefits for passengers and freight users.
- 6.73** Gatwick's single current runway is already operating at a high level of utilisation and the Commission's demand forecasts estimate that it will reach capacity within less than ten years. This suggests that any new runway would likely be well-utilised, with the Commission's forecasts indicating an expanded Gatwick could operate at 70% capacity in 2030 rising to over 95% by 2050.
- 6.74** Gatwick Airport Ltd has proposed that a new runway should be constructed south of the existing one. It has identified three options: close-spaced, wide-spaced/dependent operation and wide-spaced/independent operation. The Commission's assessment has focused on the last – a runway over 3,000m in length spaced sufficiently south of the existing runway (at least 1,035m) to permit fully independent operation. This offers the greatest increase in capacity while still having relatively low environmental and noise impacts compared with some other potential sites. The Commission will, however, keep this under review as it takes forward more detailed development and appraisal. The proposal also includes related new terminal facilities and taxiways between the new and existing runways.

A new runway over 3,000m in length, as proposed by Gatwick Airport Ltd, spaced sufficiently south of the existing runway to permit fully independent operation. Related new terminal facilities and linking taxiways would be built in between the new and existing runways



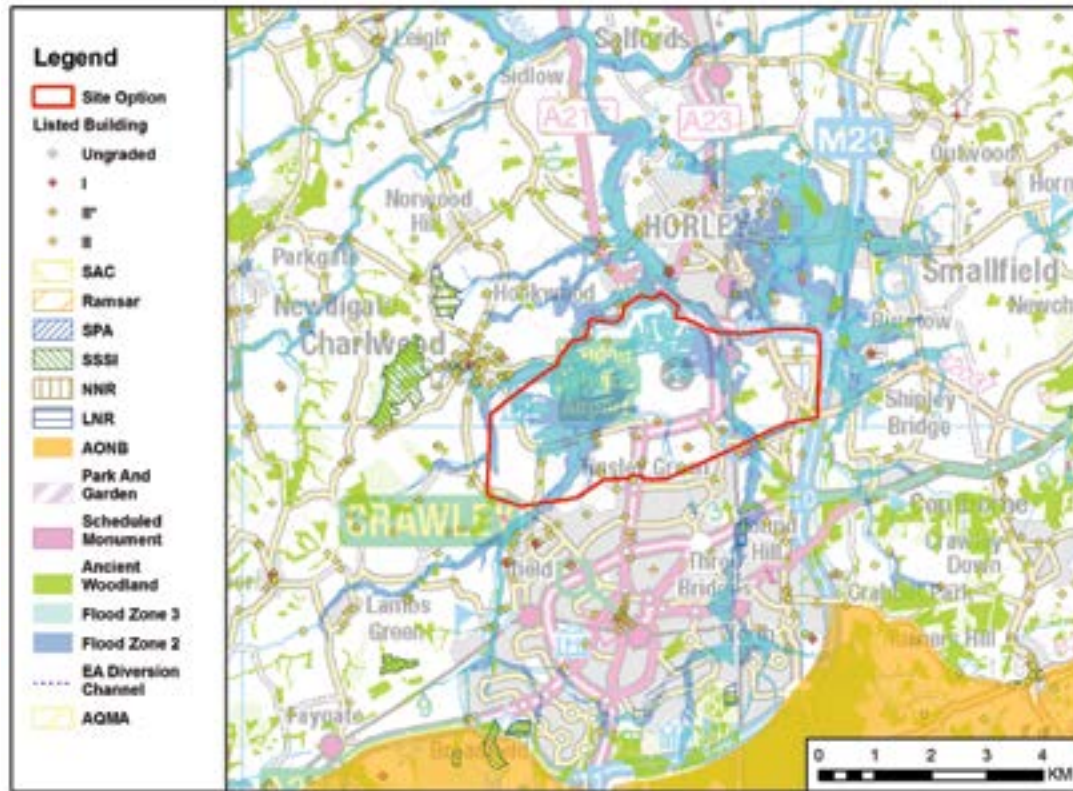
6.75 The costs of expansion at Gatwick, while substantial (estimated to be between £10-13 billion over the period to 2030, once the costs of surface access improvements are taken into account, and with allowances for risk and optimism bias), are lower than those of expansion at Heathrow and significantly lower than those of any new hub airport.

6.76 The relatively strong forecast demand at Gatwick suggests that these costs could credibly be financed. With no direct Government subsidy and including surface access costs, the Commission estimates that this would require aeronautical yields per passenger to be about a third more than the level of the proposed Heathrow Q6 settlement at Heathrow. Given the scale of the project, some level of Government involvement may be required to secure financing at an attractive rate, but that applies to all options under consideration.

6.77 Gatwick's demand catchment is comparatively strong. There are reasonably fast rail connections to Victoria and London Bridge, with the Thameslink connection providing a link to two other London terminals and suburban destinations to the north of the capital, as well as to HS1 and in due course to Crossrail. Access to the airport is also good from a range of towns and cities to the south of London.

The expansion of the airport, however, would place additional pressure on transport links, although that will be mitigated to some degree by improvements already committed.

Figure 6.4: Environmental impacts of a new runway at Gatwick



Source: Jacobs

- 6.78** The land required for this proposal has previously been safeguarded by Gatwick so the need for property demolitions is small, with roughly 200 homes estimated to be lost – fewer than for most other proposals.¹³²
- 6.79** As can be seen in **Figure 6.4**, the impacts on protected sites, landscape and heritage of this proposal are also limited. There is no loss of greenbelt land and no sites with the most important international environmental designations are affected, although there may be indirect impacts on nearby Sites of Special Scientific Interest, Conservation Areas and Scheduled Monuments. These impacts are lower than for many other schemes considered. Up to 15 listed buildings are located within the safeguarded area and could potentially be lost (five of which are Grade II*, but none

¹³² By way of comparison Gatwick Airport Ltd stated that this option would likely impact 100 residential and 120 commercial properties. The Commission's analysis used area data from GIS sources to provide average population densities for the affected sites. The analysis was consistent across all options analysed but does not represent local on site survey data which may or may not underpin some of the figures quoted by proposers. Further information on the methods used to compile the data are available in the *Approaches and Assumptions* paper on the Commission's website. This is an area for further work in Phase 2

of which are Grade 1), with some other nearby buildings at risk. The proposals would require the development of some 900 hectares of greenfield site (not including road schemes), but this is limited in comparison to some of the larger schemes.

- 6.80** Local noise impacts at Gatwick are currently much lower than at Heathrow, with the modelled population within the $57L_{Aeq}$ contour totalling approximately 3,200. If the proposed expansion were implemented this would be estimated to rise by 2030 to around 6,300 (compared to a 2030 baseline of 1,900 taking account of expected background reductions in aviation noise due to technological and operational improvements). This compares to a modelled 2030 baseline of more than 150,000 at Heathrow. While the proposal does not offer the same potential to reduce overall noise impacts as a new hub airport, the numbers of people affected by noise in the Gatwick area remain relatively low.¹³³
- 6.81** Noise performance against a $57L_{Aeq}$ contour at a London airport system-wide level is slightly worse than the north western runway option at Heathrow but better than the extended northern runway. There is a much better modelled performance at noise contours that measure a wider area, frequency of impact, or at night, (i.e. $55L_{Den}$, $50L_{Night}$ and N70) due to the airport's more sparsely populated hinterland. The numbers of people expected to be affected by noise in 2030 who were not impacted in 2012 is low. The scope to reduce noise impacts further through airspace and operational design will be explored as part of detailed development.
- 6.82** The area immediately surrounding the airport is relatively affluent so a second runway at Gatwick would be unlikely to promote significant regeneration, but there is still potential for economic and employment benefits in the region.
- 6.83** On the basis of its analysis, the Commission's view is that on balance this is a credible option for future expansion which should be developed and appraised in detail in the next phase of the Commission's work programme.

¹³³ For comparison the modelled population in the CAA $57L_{Aeq}$ contour for 2012 was 3,650 at Gatwick. The Commission used a different modelling approach (INM) to that of the CAA (ANCON) to allow for consistent comparison across all options (including those where no historic data was available e.g. new sites). This approach has not taken account of noise preferential routes assuming straight in and out operations, and so the results differ from those of the CAA modelling. The key factor is the relative difference between the modelled results rather than the absolute numbers. Given the uncertainties associated with modelling, only where differences greater than a few thousand is there a strong likelihood that reality will reflect the same relative performance. Further information on the approach taken by the Commission to modelling of noise is available in the Approaches and Assumptions paper on the Commission's website

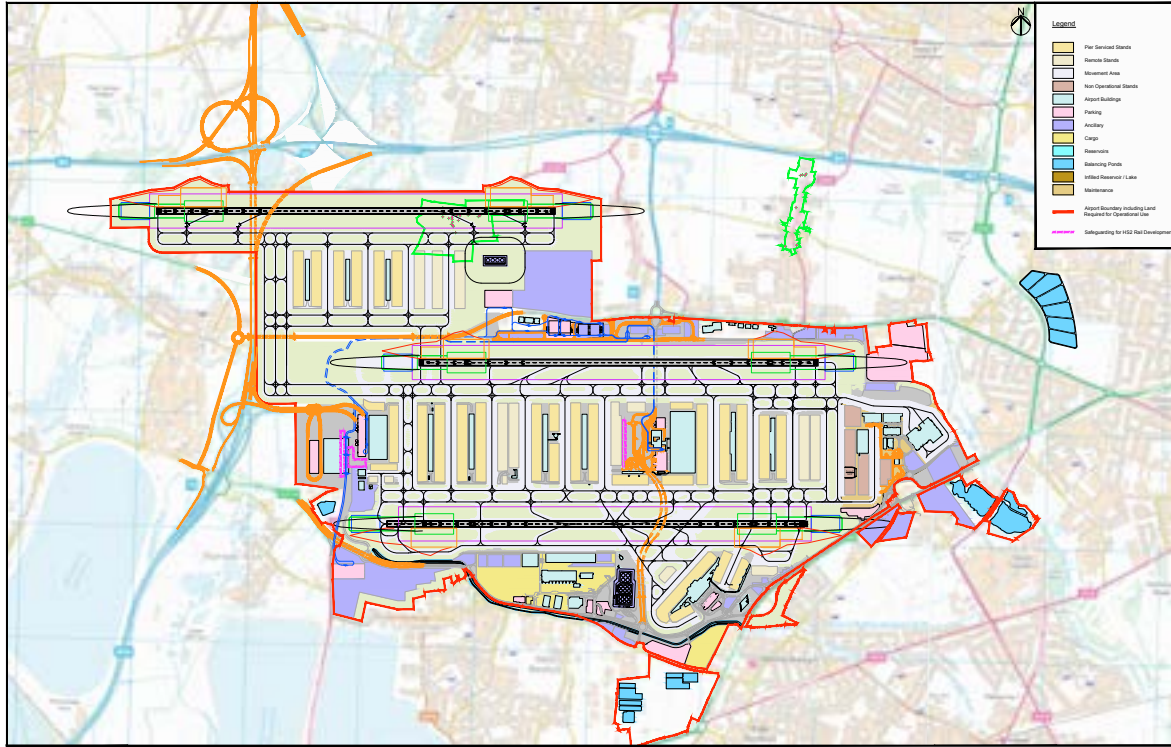
Site 2 – Heathrow Airport

- 6.84** Heathrow Airport is the UK's largest airport and has a well-established role as its major aviation hub. While passenger numbers continue to rise, it has operated for some time at the limits of its runway capacity with no scope for further growth in air transport movements.
- 6.85** As the analysis in **Chapter 3** sets out, the impacts of this are already perceptible in: high levels of delays and unreliability; the consequent restrictions on growth in the number of destinations served; and impacts on local communities through unpredictability of respite. The Commission's modelling has indicated that the impact on connectivity could potentially become more severe over time as fewer transfer passengers use the airport and its route network declines as a result.
- 6.86** Expansion at Heathrow could alleviate these impacts, providing greater scope for airlines to open new routes and services and enabling more resilient and hence predictable operations.
- 6.87** It would be likely to support the maintenance and improvement of the UK's hub status, as it would open up the potential for growth at one of the world's most important aviation hubs. It could also enable growth in the point-to-point market both by enabling point-to-point carriers to increase their presence or establish new footholds at Heathrow; and by creating space for growth at other congested airports as and when services operated by network carriers migrate to Heathrow.
- 6.88** The Commission's forecasts indicate that a new runway at Heathrow would be very well-used, with the expanded airport operating at around 80-90% of capacity by 2030 and at maximum capacity by 2050.
- 6.89** A wide range of options for new runways at Heathrow was submitted to the Commission. In reviewing them, the Commission has taken careful account of their environmental implications, alongside other factors such as cost and deliverability. A key environmental issue was noise, given the high numbers of people affected by the airport currently, but other issues including air quality, impacts on protected sites and London's water supply were also relevant.

- 6.90** The Commission's detailed assessment of the case for a new runway at Heathrow will focus on two possible options as shown in **Figures 6.5** and **6.6** opposite:
- 6.91** Many of the features and impacts of these options are broadly the same. The costs for each would be higher than those for most single runway options considered at other sites, although less than those for the south west runway option at Heathrow. Estimated as costing £13-18 billion by 2030 they are, however, much lower than most options with four or more runways, in many cases by several orders of magnitude.
- 6.92** The Commission has carried out the same financing analysis as for other options. This suggests that the costs for both could credibly be financed, given the strength of forecast demand for any expanded capacity, with the airport's aeronautical yields rising as a result to roughly one and a half times the level in the proposed Q6 settlement.
- 6.93** Heathrow offers the closest location to central London of any of the potential sites considered – providing good connection times to important origin and destination markets. The completion of Crossrail and the western link to Heathrow from the Great Western Main Line will improve this further. For these reasons, and taking into account the additional transport investment, Heathrow benefits from larger 45, 60 and 120 minute catchments than the majority of the options under consideration.
- 6.94** Given the extensive existing and planned transport connections to the airport, additional surface access requirements are limited but include improved rail access to the south and incremental road improvements. A high speed rail spur from the main HS2 line to the airport is not included in the cost estimate, but the Commission will consider the case for this as part of its review of surface access options. It will not, however, consider the case for any re-routing of the main HS2 line.
- 6.95** It appears reasonable to assume that background increases in traffic over the period to 2030 will already push the heavily congested local motorway network beyond capacity and therefore action will need to be taken with or without expansion at the airport. For this reason, more significant motorway enhancement costs are not included in the Commission's cost estimate, however, these assumptions will need further consideration.

Figure 6.5: Site 2 Option (a) one new runway to the northwest

New 3,500m runway, as proposed by Heathrow Airport Ltd, constructed to the northwest of the existing airport and spaced sufficiently to permit fully independent operation. Related new terminal facilities to the north and west of the existing northern runway and linking taxiways to the west would be needed.



Source: Heathrow Airport Ltd.

Figure 6.6: Site 2 Option (b) Extending the northern runway to the west

Extension of the existing Northern runway, as proposed by Heathrow Hub Ltd, to a length of over 6,000m to allow the lengthened runway to operate independently as two separate runways. One would be used for departures and one for arrivals.



Source: Heathrow Hub Ltd.

- 6.96** Heathrow Hub Ltd has also proposed the construction of a new transport hub, located on the Great Western Mainline to the north of the airport, with secure baggage and passenger connections to terminal facilities at the refurbished terminal buildings. A transport hub of this kind could widen the catchment area of the airport, potentially increasing the proportion of passengers reaching the airport by public transport, and could support either of the runway options shortlisted. The Commission will give it consideration as part of its overall analysis of surface access issues in Phase 2.
- 6.97** The local authority areas around the Heathrow site have higher than average levels of deprivation than at many other proposed expansion sites, with the exception of the areas around a potential Estuary airport on the Isle of Grain. The economic effects of expansion at the airport could therefore offer valuable opportunities for employment in these areas.
- 6.98** Expansion at the current site would also continue to support the existing agglomeration impacts of the Thames Valley/M4 corridor and allow a greater selection of long-haul destinations and frequencies, as well as the opportunity for greater connectivity to the UK's regions and European destinations.
- 6.99** Heathrow is located in the southern part of the Hillingdon Air Quality Management Area. The Commission has noted the potential mitigation plans put forward by proposers, and will investigate air quality impacts in more detail as part of its future work programme.

The different runway options

- 6.100** In addition to the common features and impacts listed above, each runway option will also have specific impacts which are looked at below.

Option (a) – One new runway to the north west

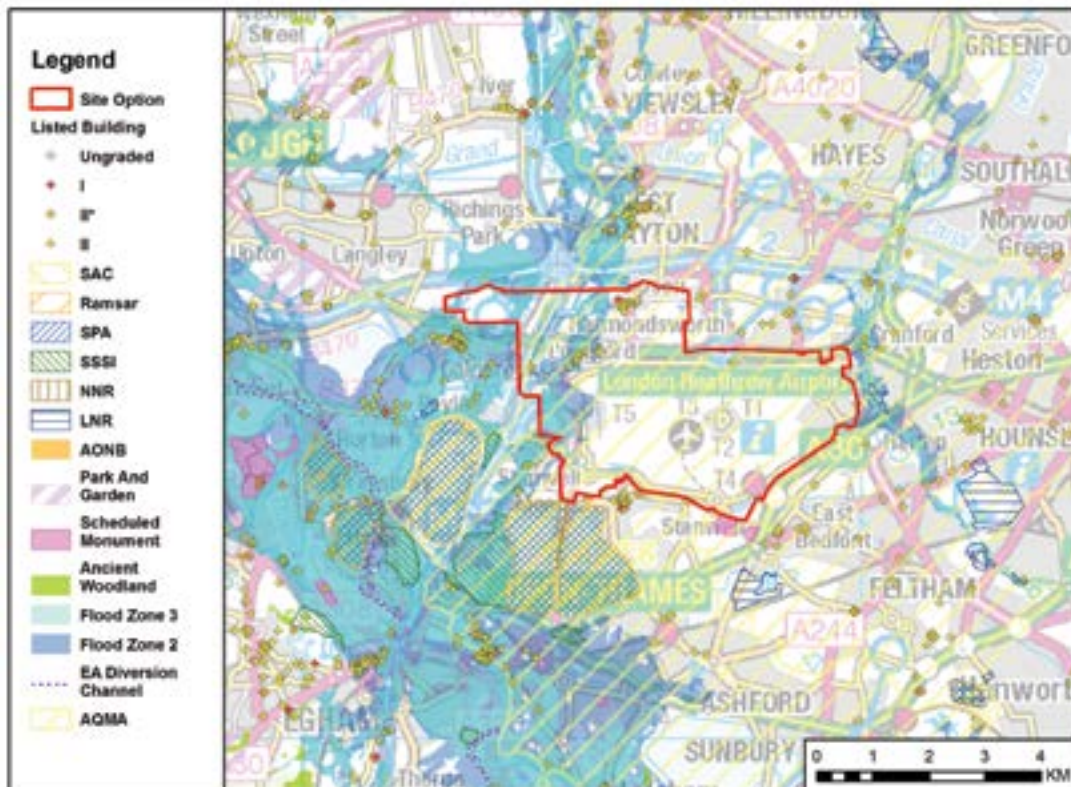
- 6.101** A new runway in this location would provide a significant increase in capacity of up to 260,000 ATMs a year.
- 6.102** The number of people affected by noise around Heathrow is higher than at any other European airport, with a population of roughly 240,000 currently living within the 57L_{Aeq} contour.¹³⁴ By 2030, this is forecast to fall to roughly 150,000 due to improvements in technology and operations. The impact of the construction and operation of the proposed third runway is estimated to be roughly neutral possibly even offering a further reduction over the expected baseline. That is because the

¹³⁴ See previous footnote on noise with regards to Gatwick. The CAA analysis gives a figure of 239,600 population in the 57L_{Aeq} contour in 2012

new runway would allow a portion of the airport's traffic to land and take off further to the west than the existing configuration of runways, which sees those aircraft flying at a higher altitude over the most densely populated areas. That is sufficient to offset the noise impacts from the additional air services accommodated, on the $57L_{Aeq}$ noise metric.

- 6.103** The use of the additional runway would also spread the noise impact over a larger area, meaning that some people would be newly brought within the $57L_{Aeq}$ contour, although they are estimated to be roughly balanced by those removed from the contour area as a result of the operational changes described above. There would likely be some reduction in respite under this option, although this is unlikely to be as significant as for the extended northern runway considered in option (b) below.
- 6.104** The north western runway option performs more strongly than the extended northern runway in respect of the $57L_{Aeq}$ noise contour and the N70 noise contour (this offers an alternative to average noise contours and identifies those properties experiencing more than 50 events per day whose maximum noise level is 70 decibels or above). In respect of other metrics, however, the extended northern runway option has the lower impact. This is described in more detail below.

Figure 6.7: Environmental impacts of Option (a) – one new runway to the northwest



Source: Jacobs

- 6.105** As shown in **Figure 6.7**, no internationally designated sites are directly impacted by the proposal. The South West London Waterbodies SPA/Ramsar site would, however, lie within 2km of the expanded airport site, with the potential for some indirect impacts. Further analysis would be needed, but the current close proximity of the existing airport boundary gives cause to believe any impact may not be significant.
- 6.106** This proposal would also require a significant number of demolitions, totalling approximately 1,500 houses and including the loss of the village of Harmondsworth, much of which is a conservation area.¹³⁵ A second conservation area in Longworth would also lose listed buildings. Around 30 listed buildings would be lost, including the Grade I listed Great Tithe Barn and the Grade II* listed St Mary's Church. While Heathrow Airport Ltd has indicated that it will continue to examine the potential to avoid the most severe of these heritage impacts, it is difficult to see currently how this may be achieved other than by relocating the barn and church.

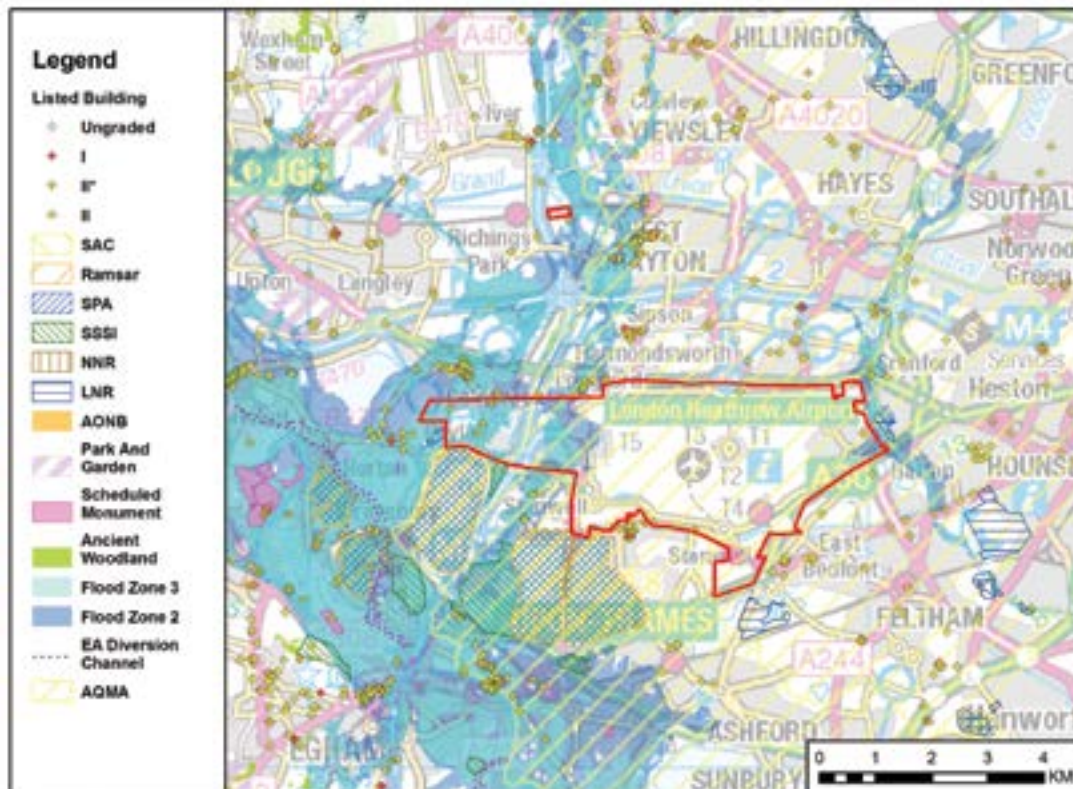
Option (b) – Extending the northern runway to the west

- 6.107** The extended northern runway option would not be capable of operating independently from the existing runways, and therefore the level of net additional capacity achieved would not be as great. The Commission estimates that the maximum additional capacity achievable under this option would be 190,000 air transport movements, compared to 260,000 for the north western runway. The novel nature of the proposal also means that further work to develop an acceptable safety case would be required to understand fully the capacity benefits, although the Commission has not seen any evidence to suggest that such a safety case could not be put into place.
- 6.108** The potential noise impacts also vary significantly between the two proposals. As set out above, the north western runway performs more strongly than this option in respect of a 57L_{Aeq} contour. On this measure, the population within the contour would increase by approximately 30,000 in comparison to the forecast 2030 baseline. This option also offers less scope to maintain significant periods of respite, as it relies on the simultaneous use of two runways for arrivals or departures for substantial periods of the day, though this effect is mitigated if not operating at full capacity. Further investigation of the issues surrounding respite for both options will be needed in Phase 2.
- 6.109** Conversely, the extended northern runway proposal would offer significantly greater benefits in reducing noise at night. The runway configuration would allow all night

¹³⁵ For comparison Heathrow Airport Ltd estimate a total of 950 residential properties lost

flights to use the western portion of the extended runway, shifting these movements noticeably further to the west than with the north western option. As a result, the population falling within the 55 L_{Den} contour, which measures average noise levels across day, evening and night, placing greater weight on the latter two, is more than 20,000 lower than for the north western runway. The difference in respect of night noise alone is even greater.

Figure 6.8: Environmental impacts of Option (b) – Extending the northern runway to the west



Source: Jacobs

- 6.110** This option is situated closer to the boundary of the South West London Waterbodies SPA/Ramsar site and could potentially encroach upon it. Therefore, the risk of direct impacts cannot be ruled out, and any indirect impacts may be greater than for the north western runway. Nonetheless, as for the north western runway, the current close proximity of the airport's existing boundary suggests that they may not be significant.
- 6.111** This option's impacts on properties and local cultural heritage, however, are noticeably lower than for the north west runway proposal, with direct effects on just 8 listed buildings (none Grade I or Grade II*) and only indirect effects on the Colnbrook Conservation Area. It also requires the demolition of the fewest

properties out of all options considered at Heathrow, with a probable total of 720 properties estimated to be lost.¹³⁶

- 6.112** On the basis of its analysis, the Commission's view is that on balance both the north western runway and the extended northern runway at Heathrow are credible options for future expansion which should be developed and appraised in detail in the next phase of the Commission's work programme.

Conclusion

- 6.113** On the basis of its analysis the Commission believes that an additional runway at Gatwick or an additional runway at Heathrow, which could be delivered in one of two ways, warrant further analysis as credible options to maintain the UK's position as Europe's most important aviation hub.
- 6.114** The Commission will now subject these three options at the two short-listed sites to a more detailed assessment, including consideration of their economic, social and environmental impacts, to develop as comprehensive a picture as possible of the risks and opportunities within each of the proposals, and to prepare the background evidence needed for the delivery of a final recommendation.
- 6.115** In addition, the Commission intends to carry out further analysis of the feasibility and impacts of an Isle of Grain airport and reach a decision in the second half of 2014 as to whether this constitutes a credible option for detailed development and appraisal. If it concludes that it is, it will be subject to a similar process of appraisal and consultation as the existing short-listed options, prior to the Commission reaching the recommendations in its final report.

¹³⁶ Heathrow Hub Ltd estimate the total number of residences to be lost as 100-150

Chapter 7:

Next steps

SUMMARY

In the second phase of the Commission's work, from now until the publication of its final report in summer 2015, the designs of the short-listed proposals will be further developed and subjected to a more detailed assessment. There will be consultation on the short-listed options and the associated appraisal results in the autumn of 2014.

The Commission will publish a draft *Appraisal Framework* for consultation early in 2014. This will set out details of how scheme designs should be developed and how scheme impacts will be appraised.

The Commission will also set out early in 2014 more details of how it will take forward its further analysis of the option for a new hub airport in the Thames Estuary.

The Commission recognises that the publication of this *Interim Report* may cause unwelcome uncertainty for communities close to the short-listed sites. The Commission encourages the Government and those promoting schemes to consider what steps can appropriately be taken to limit these concerns, including for the limited number of people who may face an urgent need to sell their home before the Commission publishes its final report but find themselves unable to do so.

Introduction

7.1 Following this *Interim Report* the Commission's work enters a new phase.

7.2 The Commission's Terms of Reference set out the following requirements for the final report:

The Commission should report no later than summer 2015 on:

- *its assessment of the options for meeting the UK's international connectivity needs, including their economic, social and environmental impact;*
- *its recommendations for the optimum approach to meeting any needs; and*

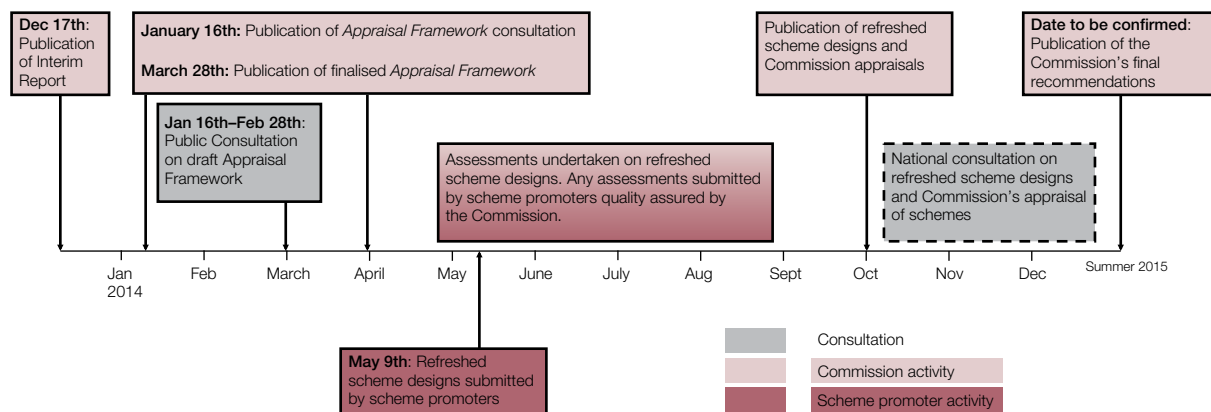
- *its recommendations for ensuring that the needs are met as expeditiously as practicable within the required timescale.*

The Commission should base the recommendations in its final report on a detailed consideration of the case for each of the credible options. This should include the development or examination of detailed business cases and environmental assessments for each option, as well as consideration of their operational, commercial and technical viability.

7.3 The next phase of the Commission's work programme has, therefore, a different focus.

7.4 To understand better the economic, social and environmental impacts of the short-listed options, as well as their operational, commercial and technical viability, the Commission will now subject them to more thorough and rigorous analysis. This analysis will be put to national consultation in autumn of 2014 and, ultimately, will be published alongside the Commission's final report to the Government.

Figure 7.1: Commission's proposed timings for work on the short-listed options



7.5 In addition, as outlined in Chapter 6, the Commission will continue to investigate the option of a potential new hub airport located in the Thames Estuary. This additional work will be undertaken in the first half of 2014 with a view to deciding in the second half of 2014 whether such a proposal should be considered alongside the short-list. If a decision is reached that it should, it will be subject to similar appraisal and consultation processes as the short-listed options, although not necessarily to the same timescale.

Public engagement

- 7.6** A range of stakeholders are likely to want to input into the Commission's process and provide their views both on the short-listed schemes and on the further analysis of the Thames Estuary option.
- 7.7** The first opportunity for such engagement in relation to the development and appraisal of the short-listed schemes will be the consultation on the Commission's draft *Appraisal Framework*. This is expected to be published in early 2014.
- 7.8** The Commission also intends to hold a national consultation in the autumn of 2014. This will present for public scrutiny the refreshed designs of the short-listed schemes, as well as the assessments that have been undertaken on these schemes' economic, social and environmental impacts and on their operational, commercial and technical viability.
- 7.9** Following this consultation the Commission will review the scheme designs and assessments in the light of comments received, and address any gaps or weaknesses in the evidence base. The final versions of these documents will be used to inform the recommendations in the final report, due in summer 2015.
- 7.10** Alongside these consultation processes, the Commission expects that there will be further opportunities for engagement through public evidence sessions, similar to those conducted during the first phase of its work. These sessions will provide opportunities for interested parties and members of the public to comment on elements of the Commission's process and appraisal methods.
- 7.11** They may also provide an opportunity for the Commission to question the promoters of short-listed schemes on the details of their proposals and to take evidence from local authorities, community and business groups and other stakeholders in close proximity to the short-listed areas regarding their views about the schemes under development and the appraisal of those schemes.
- 7.12** Alongside any public engagement activities taken forward by the Commission, it will be important for the promoters of short-listed schemes to ensure that groups representing nearby residents and businesses, and other stakeholders such as passengers and airport users, have the opportunity to make their views known.
- 7.13** The Commission therefore encourages scheme promoters to engage with and understand the views of these groups, and to report on this as part of their submissions.

- 7.14** The Commission's further analysis of the feasibility and impacts of a Thames Estuary airport will incorporate opportunities for input from stakeholders, including those who have previously submitted proposals for such a scheme. The Commission will publish details early in 2014 of how it intends to take this process forward.

Managing impacts on local communities and property markets

- 7.15** In the long-term, should the recommendations in the Commission's final report be taken forward, it will be important that effective and wide-ranging measures are put in place in the relevant locations to ensure local property markets continue to function efficiently as proposals progress through the planning system. The Commission welcomes the recognition of this in the submissions made by the owners of Gatwick and Heathrow airports. For any area that is not the subject of the Commission's final recommendations, any prior impacts should be rapidly alleviated.
- 7.16** In the interim period, however, the Commission recognises that the publication of this *Interim Report* may cause unwelcome uncertainty for communities close to the short-listed sites and may have some impact on local property markets. There is likely to have been some underlying uncertainty for some time in these areas, potentially since well before the Commission was established, as Gatwick and Heathrow are both areas where such proposals have been made previously. But the Commission is aware of the potential of this *Interim Report* to intensify this.
- 7.17** The Commission therefore encourages the Government and those promoting schemes to consider what steps can appropriately be taken to address these concerns. It is important that, at this early stage in the process, any measures are proportionate. This report only proposes a shortlist of schemes for further development, plus a limited period of further consideration of the option for a Thames Estuary airport. It would not be appropriate for wide-ranging measures to be put in place that could see large numbers of property owners incentivised to leave the areas under consideration. Such an approach could have the perverse effect of intensifying blight rather than alleviating it.
- 7.18** Nonetheless, there may be a limited number of property owners, particularly around the short-listed sites, with a clear need to move home or sell their property, who find themselves unable to do so following the publication of this report.
- 7.19** The Commission recommends that where such cases are identified, those promoting schemes should consider what mitigations could be put in place, be that

through individual engagement with the property owners affected or through the introduction of targeted assistance schemes for those in immediate hardship.

- 7.20** It is clear that the successful delivery of any new proposal will depend upon developing fair, open and honest relations with local communities. Alleviating concerns and actively managing relations will be an important step in demonstrating commitment to such an approach.

The role of the Commission

- 7.21** Key elements of the Commission's work between now and the final report will include a) refreshing and developing the designs of short-listed schemes, and b) appraising scheme impacts. The latter will, to some extent, inform the former.
- 7.22** The Commission has a different role to play for each of these tasks. In order to ensure that the Commission's process is transparent, fair and independent, it is important that it has the final decision on the appraisal of all scheme impacts. In designing and developing schemes, promoters should take the lead role.
- 7.23** The Commission has previously stated that it will seek to work collaboratively with scheme promoters, and scheme promoters will be expected to communicate openly with the Commission during both the design and appraisal phases.

Refreshed scheme design

- 7.24** In order to inform its final recommendations, the Commission requires all the short-listed schemes to be developed to an appropriate level of detail, and appraised to a consistent standard.
- 7.25** To this end, the Commission invites scheme promoters to submit a refreshed scheme design by **Friday 9 May**. These refreshed designs will be a development of the specific options short-listed by the Commission, and will be published by the Commission as part of its autumn 2014 consultation. Scheme promoters will be invited to provide further information in a number of areas, including the following:
- **Strategic Overview**, outlining why a proposal is well-placed to address the UK's future aviation capacity and connectivity needs, and how it may support the socio-economic development of local areas, regions and the UK as a whole.
 - **Airport Master Plan**, providing details of the airfield design and its planned modes of operation, including planned airspace requirements.
 - **Engineering Plans**, including for example information on costings, energy and utilities requirements, geo-environmental issues and surface development plans.

- **Mitigation Strategies**, comprising plans to limit detrimental impacts on the environment and local communities.
- **Development Strategies**, detailing how the additional capacity would be funded and project-managed to delivery.

7.26 Further information on each of these scheme elements will be contained in the draft *Appraisal Framework*.

7.27 In addition, scheme promoters will also be invited to submit details of their proposed **Surface Access Strategies**. However, this will be used as an input into an overall programme of work led by the Commission. This is because any surface access improvements to support proposed new airport infrastructure are likely to be at least part-funded by the Government, and the design and appraisal of appropriate surface access measures will require the full involvement of Network Rail and the Highways Agency amongst others. The Commission is well-placed to coordinate this work, working alongside scheme promoters as appropriate.

7.28 The Commission expects that in refreshing scheme designs scheme promoters will wish to refer to the appraisal modules detailed within its *Appraisal Framework*. A final version of this *Framework* is expected to be published at the **end of March**. This will allow promoters time to consider the finished *Appraisal Framework* prior to submitting refreshed designs.

7.29 Once refreshed scheme designs have been submitted, the Commission will review whether further refinements to scheme proposals are required or would be beneficial.

Scheme appraisal

7.30 The final *Appraisal Framework* will set out the areas for appraisal and the assessment methodologies to be used in these areas.

7.31 The results of the various appraisals and assessments undertaken will be used to compile detailed business cases and sustainability assessments. These documents will be produced for each short-listed option, and presented for national consultation in the autumn of 2014 alongside scheme promoters' refreshed scheme designs.

7.32 The Commission will consider any appraisal information submitted by proposers, and submit it to rigorous validation and quality assurance. Final responsibility for scheme appraisal and the content of its autumn consultation documents lies, however, with the Commission, and the Commission will be under no obligation to

use or refer to appraisals submitted by proposers when compiling documents for its national consultation or decision-making process.

- 7.33** Should the Commission decide in the second half of 2014 that a new airport in the Thames Estuary is a credible option for detailed consideration alongside the short-listed schemes, it will undergo a similar process of development, appraisal and public consultation, although not necessarily to the same timescale.
- 7.34** The Commission welcomes views on all the approaches outlined in its draft *Appraisal Framework*, which will be published early in 2014.

Delivering the Commission's final recommendations

- 7.35** In addition to identifying recommendations for meeting the UK's long-term aviation capacity needs, the Commission's remit for the next phase of its process requires it to identify how the delivery of any such recommendation may be expedited.
- 7.36** The Commission has identified a number of areas where further work may be necessary to fulfill this element of its remit. These could include:
- planning issues – including in relation to the development and adoption of any future National Policy Statement, and the resolution of any subsequent planning applications;
 - approaches to noise management, including operational procedures, planning safeguards and compensation for those affected by future noise from any recommended option;
 - other environmental safeguards, for example in respect of carbon emissions or air quality;
 - options for structuring any necessary public sector funding contribution or financing guarantees;
 - changes to the system governing the economic regulation of airports to support the delivery of long-term options; and,
 - measures to enable the maximum use of existing runway infrastructure at other sites as part of an overall aviation capacity and connectivity strategy.
- 7.37** The Commission will provide further details of its work programme in these and related areas in the course of 2014.

Glossary

ACDM	Airport Collaborative Decision Making
ACL	Airport Coordination Limited
ACNUSA	The French Noise Authority translated to Airport Pollution Control Authority
AEF	Aviation Environment Federation
Aero revenue	That part of an airport's revenue derived from a number of charges levied on airlines using the airport
Airline alliance	An airline alliance is an agreement between two or more airlines to cooperate: it may range from marketing agreements through code sharing and joint ventures to mergers. The three global airline alliances are Star Alliance, SkyTeam, and oneworld which provide a global network of destinations for passengers
AMS	Amsterdam Schiphol Airport (IATA code)
ANCON	The UK Civil Aircraft Noise Contour Model (ANCON) is the mathematical model used by the CAA to produce annual aircraft noise contours depicting the magnitude and extent of the aircraft noise around Heathrow, Gatwick and Stansted. It is also used to produce noise exposure forecasts for use in airport planning
AONB	Areas of Outstanding Natural Beauty
APD	Air Passenger Duty
ATC	Air Traffic Control
ATMs	Air Transport Movements. Landings or take offs of aircraft engaged in the transport of passengers or freight on commercial terms
BA	British Airways
BAA	British Airports Authority Limited
BCC	British Chamber of Commerce
Belly hold freight	Refers to cargo on passenger services
Bilateral agreements	An agreement which two nations sign to allow international commercial air transport services between their territories on a reciprocal basis
BRIC	Grouping acronym that refers to the countries of Brazil, Russia, India and China
Business aviation	Refers to dedicated business jets
CAA	Civil Aviation Authority
Capacity constrained forecast	Future passenger and ATM demand is limited to airport capacity where no significant additional runway or terminal capacity added
Capacity unconstrained forecast	Passenger and ATM demand is not limited by runway or terminal capacity
Carbon capped forecast	Modelling scenarios where CO ₂ emissions in 2050 are limited to 2005 levels through higher carbon prices

Carbon traded forecast	Modelling scenario where CO ₂ emissions are part of an ETS, but not limited to any target
CCC	UK Committee on Climate Change
CDG	Paris Roissy-Charles de Gaulle Airport (IATA code)
CGE	Computable General Equilibrium modelling
Charter airlines	These airlines provide charter aircraft specifically for the holidays they sell and/or respond to ad-hoc demand as opposed to providing a year round schedule
CIVET	Grouping acronym that refers to the countries of Colombia, Indonesia, Vietnam, Egypt, Turkey and South Africa
CO ₂ e	CO ₂ equivalent emissions
DECC	Department for Energy and Climate Change
DfT	Department for Transport
DPI	Departure Planning Information
DXB	Dubai International Airport
EC	European Commission
EEA	European Economic Area
ERCD	The Environmental Research and Consultancy of the CAA estimates the noise exposures around London airports (Heathrow, Gatwick and Stansted) on behalf of the Department for Transport
EU	European Union
EU ETS	EU Emissions Trading System
European airports	Classified as the airports located in the European Economic Area (EEA), including for this purpose Croatia, Switzerland and the dependent territories of EEA States
FAS	Future Airspace Strategy
FDI	Foreign Direct Investment
Feeder traffic	Feeder traffic comprises connections at particular airports which ‘feed’ or connect passengers onto ongoing flights. These ongoing flights are therefore supported by higher passenger volumes than otherwise would be the case
Fifth freedoms	Fifth freedoms allow an airline permitted to operate a service between that airline’s home country and the UK, also to pick up passengers on the arrival of that service in the UK and carry them on to a third country (and on returning from that third country to drop off passengers whose destination is the UK before continuing on back to its home country). An example might be a flight which originated in Dubai, stopped at Manchester to pick up and drop off passengers and then continued to New York
FRA	Frankfurt Airport (IATA code)
Freight forwarders	Freight forwarders provide a link between freight customers and those with air freight capacity, typically full service scheduled airlines which provide cargo capacity on passenger services, known as ‘belly hold’
Freighters	Also known as integrated air freighters

Full service carriers	The full service carrier business model is based on sustaining global route networks. As such, full service carriers are based at one or more hub airports where their passengers can connect between a variety of flights. Traditionally network airlines were national carriers. Most of them are members of one of the three global airline alliances. Full service carriers are also known as legacy carriers and network airlines in this report
Fully independent operations	Fully independent operations occur when there is no interdependence between the use of runways at an airport with more than one runway
GDP	Gross Domestic Product (National Income)
General aviation	General aviation (GA) can be defined as a civil aircraft operation that is not a commercial air transport flight operating to a schedule. General aviation flights range from gliders and powered parachutes to corporate jet flights
GHG	Greenhouse gas emissions
GIP	Global Infrastructure Partners
Grandfather rights	Grandfather rights refer to the rights of an airline to retain a series of airport slots on the basis of historic precedence. This historic precedence is determined if the slots have been operated at least 80% of the time during the period allocated in the previous equivalent season. Historic slots may not be withdrawn from an airline to accommodate new entrants or any other category of aircraft operator. Confiscation of slots for any reason other than proven intentional slot misuse is not permitted
GTP	Global Temperature-change Potential
GVA	Gross Value Added
GWP	Global Warming Potential
HAL	Heathrow Airport Limited
Heathrow Q6	Heathrow Q6 relates to the sixth review that the CAA is undertaking of the economic regulation of operators of airports in the UK. Q6 relates to the period 2014-2019
HMRC	Her Majesty's Revenue and Customs
Holding stacks	A holding stack is a fixed circling pattern in which aircraft fly whilst they wait to land. When airports are busy, there can be a build up of aeroplanes waiting to land. Aircraft will sometimes circle around in the stack until air traffic controllers are able to fit them into the landing pattern
HS1	High Speed One
HS2	High Speed Two
Hub-and-spoke network	In hub-and-spoke networks, airlines and alliances route their traffic through one or more key airports ('hubs'), with feeder traffic from other airports in the network (the 'spokes') supplementing local origin and destination traffic at the hubs
IAG	International Airlines Group. IAG is the holding company of British Airways and Iberia
IATA	International Air Transport Association (airline trade body)
ICAO	International Civil Aviation Organisation
I-I	International to International interliners i.e. passengers who are transferring via a UK airport with their origin and destination outside the UK
ILS	The Instrument Landing System (ILS) is a standard system for navigation of aircraft upon the final approach for landing
IMF	International Monetary Fund

INM	The Integrated Noise Model (INM) is a computer model that evaluates aircraft noise impacts in the vicinity of airports. The INM can output either noise contours for an area or noise level at pre-selected locations. The noise output can be either exposure-based, maximum-level-based, or time-based
Integrated air freighters	Integrated air freight companies are dedicated logistics companies, such as FedEx, DHL, and UPS, that offer a complete end-to-end express delivery service and typically control the entire logistics chain from collection to delivery
IPCC	Intergovernmental Panel on Climate Change
IROPI	Imperative reasons of overriding public interest
Isochrone	An isochrone is a line on a map or diagram connecting places from which it takes the same time to travel to a certain point
JFK	John F Kennedy Airport – New York (IATA code)
L_{Aeq}	Leq is the noise measure used to describe the average sound level experienced over a period of time resulting in a single decibel value. This approach is used beyond aviation to measure most environmental noise exposure. Leq is most commonly used with the A-weighted scale, expressed as L_{Aeq} . The A-weighted sound level is the most widely used to quantify sound from all modes of transport. When considering L_{Aeq} , it is always necessary to quote the time period over which the L_{Aeq} applies. UK airports produce noise contours showing locations of equal noise exposure over 16 hours (L_{Aeq} 16H) in effect presenting the average sound level experienced within certain areas around the airport between the hours of 07:00 and 23:00. Historically, UK policy has been to use 57 L_{Aeq} 16H as the level of daytime noise marking the approximate onset of significant community annoyance and this value has influenced the production of annual contour maps at many airports. Measurements are always in decibels (dB), though these are not stated. Thus 57dB L_{Aeq} will be written 57 L_{Aeq} throughout the document
LAMP	London Airspace Management Programme
LCC	Low-Cost Carrier
LCY	London City Airport (IATA code)
LDC	Less Developed Country
LDEN	LDEN is the 24-hr Leq calculated for an annual period, but with a 5 decibel weighting for evening and a 10 decibel weighting for night to reflect people's greater sensitivity to noise within these periods
Legacy carriers	The legacy carrier business model is based on sustaining global route networks. As such, legacy carriers are based at one or more hub airports where their passengers can connect between a variety of flights. Traditionally legacy carriers were national carriers. Most of them are members of one of the three global airline alliances. Legacy carriers are also known as network airlines and full service carriers in this report
LHR	Heathrow Airport (IATA code)
London 2-2-2 system	A theoretical model where London is served by a two runway Heathrow, a two runway Stansted and a two runway Gatwick
London airport system	For the purposes of this report, the London airport system refers to the following airports: Heathrow, Gatwick, Stansted, Luton and London City

Long-haul	For the purposes of this report, 'long-haul' depicts a destination (or route) to or from a country that is not listed in the group of countries as part of the group of countries defined as 'Western Europe' (or 'short-haul')
Long-term options	Long-term options are those which involve the substantial development of a new or existing airport site. This includes the delivery of any surface access links or other infrastructure required to ensure that the new airport capacity can be utilised
Low-cost carrier	Low-cost carriers apply a business model that relies on reducing operating costs to provide passengers with relatively cheap tickets. The model has so far been very successful on short-haul routes
LTMA	London Terminal Manoeuvring Area (also known as London terminal airspace in this report). This airspace contains the arrival and departure routes for the five major civil airports in the London area: Heathrow, Gatwick, Stansted, Luton and London City
MAG	Manchester Airports Group
MCT	Minimum Connecting Time. The minimum time needed to transfer passengers from one flight to another
Medium-term options	Medium-term options are those which do not require the provision of additional runways or terminals, but which may need more than five years to deliver (for example, measures requiring significant planning approvals to be obtained or improvements in surface access infrastructure serving an existing airport)
Mixed mode	Mixed mode operations would allow runways to be used for scheduled arrivals or departures at the same time
MLS	The Microwave Landing System (MLS) is an all-weather precision guidance system making aircraft landings possible at more locations and providing flexibility in approach paths
Movement cap	Movement caps at airports set a limit on the number of air transport movements allowable on an annual basis. Heathrow Airport has a movement cap of 480,000 which was set as a condition of the Terminal Five planning consent in 2001
Mppa	Million passengers per annum
NAPAM	The DfT's National Air Passenger Allocation Model
NAPDM	The DfT's National Air Passenger Demand Model
Narrow bodied jets	A narrow-body aircraft has a typical aircraft cabin width of 3 to 4 metres allowing for between 2 and 6 passengers to sit side by side. Narrow-body aircraft are commonly used for short-haul flights as their range will not allow transatlantic or transcontinental flights
NATS	National Air Traffic Services
Natura 2000 network	Natura 2000 is an EU wide network of nature protection areas established under the 1992 Habitats Directive. The aim of the network is to assure the long-term survival of Europe's most valuable and threatened species and habitats. It is comprised of Special Areas of Conservation (SAC) designated by Member States under the Habitats Directive, and also incorporates Special Protection Areas (SPAs)
NCEs	Non-CO ₂ emissions
NCIS	Noise Complaints and Information Service
Net additional capacity	Additional runway capacity over and above the level of runway capacity available today

Network airlines	The network airline business model is based on sustaining global route networks. As such, network airlines are based at one or more hub airports where their passengers can connect between a variety of flights. Traditionally network airlines were national carriers. Most of them are members of one of the three global airline alliances. Network airlines are also known as legacy carriers and full service carriers in this report
NIC	Newly Industrialised Country
Night noise regime	The Government has historically set restrictions on the operation of aircraft at night at Heathrow, Gatwick and Stansted. The restrictions are collectively known as the ‘night flying regime’ and have been based on: setting a limit on the overall number of night flights; placing restrictions on the noisiest aircraft types; and setting noise quotas which cap the amount of noise energy which can be emitted at night over the course of the regime
Noise contours	Noise contours are lines on a map showing where equal levels of noise are experienced
Noise envelopes	The concept of a ‘noise envelope’ is one which would create a balance between aviation growth and noise reduction with the objective of incentivising airlines to introduce quieter aircraft whilst giving local communities more certainty about the levels of noise they may expect in the future. A noise envelope can be created through the introduction of a movement cap, a quota count system or by setting passenger number limits
Noise quota	Noise quotas form part of the Government’s night noise regime. The noise quota caps the amount of noise energy which can be emitted at night over the course of the regime
Noise respite	The principle of noise respite is to provide defined periods of noise relief to people living directly under the flight path
NOx	Nitrogen oxides
NPRs	Noise Preferential Routes. Paths known as Noise Preferential Routes (NPRs) are followed by aircraft departing airports in the London area. NPRs were set by the Department for Transport (DfT) in the 1960s and were designed to avoid overflight of built-up areas where possible
NPS	National Policy Statement
NSIPs	Nationally Significant Infrastructure Projects
Obstacle limitation surfaces	This refers to the definition of airspace around airports which must be maintained free from obstacles in order to ensure safe airport operations
OD market	Origin and destination markets are characterised by passenger demand for travelling to/from the city in which their air journey starts (the origin “O”) and the city in which it ends (the destination “D”)
Open Skies agreement	Open Skies is an international policy concept that calls for the liberalisation of the international aviation industry—particularly commercial aviation—in order to create a free-market environment for the airline industry. The EU-U.S. Open Skies agreement is one of the most significant open skies agreements concluded in recent years
PAX	Passengers

Performance based navigation	The PBN concept was developed by the International Civil Aviation Organisation (ICAO) and moves aviation away from the traditional use of aircraft navigating by ground based beacons to a system more reliant on airborne technologies, utilising area navigation and global navigation satellite systems
Point-to-point connection	A point-to-point connection means a direct connection between two destinations
Predict and provide approach	An approach based on forecasting future demand and then meeting that demand no matter the cost
PSO	Public Service Obligation. In order to maintain appropriate scheduled air services on routes which are vital for the economic development of the region they serve, European Member States may impose PSOs on these routes
PwC	PricewaterhouseCoopers
Quota count	At Heathrow, Gatwick and Stansted, aircraft operating at night are classified according to a Quota Count (QC) classification system for landing and taking off. The QC classification system is based on the noise emitted by aircraft type and aircraft are given a QC value according to the noise they emit. Airports operating the system have a fixed quota for each of the summer and winter seasons which incentivises airlines to invest in quieter aircraft
RAB	Regulated Asset Base is the historic efficient investment in regulated assets by the company, against which the company is allowed to earn a return
Ramsar designations	Ramsar sites are wetlands of international importance, designated under the Ramsar Convention
Regional airports	For the purposes of this report, 'regional airports' refers to the following airports: Southampton, Norwich, Southend, Bristol, Cardiff, Bournemouth, Birmingham, East Midlands, Coventry, Manchester, Newcastle, Liverpool, Leeds, Bradford, Durham Tees Valley, Doncaster – Sheffield, Humberside, Blackpool, Glasgow, Edinburgh, Aberdeen, Prestwick, Inverness, Belfast International and Belfast City. This is consistent with the approach taken by the DfT aviation forecasts
Reliever airports	The 'reliever airport' concept would see smaller airports and airfields in the vicinity of congested airports are designated to handle specific types of traffic, with a particular emphasis on business and general aviation, as well as smaller aircraft flying scheduled services
Resilience	For the purposes of this report, resilience refers to the ability of an airport to be able to anticipate, absorb or recover from unforeseen events, whether they arise from late passengers or aircraft, or from extraneous events such as fog, low visibility, or strong winds
RPK	Revenue Passenger Kilometre
Runway alternation	In this report, runway alternation refers to the practice at Heathrow airport whereby the designated landing runway is changed at 15:00 (so that the designated departure runway becomes the landing one) when the airport is operating during westerly operations providing predictable periods of relief from the noise of landing aircraft for communities under the final approach tracks to the east of the airport
Sabre	Sabre Airline Solutions – travel transaction processing company
SAS	Scandinavian Airlines

Scheduled monuments	'Scheduling' is shorthand for the process through which nationally important sites and monuments are given legal protection by being placed on a list, or 'schedule'. English Heritage takes the lead in identifying sites in England which should be placed on the schedule by the Secretary of State for Culture, Media and Sport
SEA	Strategic Environmental Assessment. The SEA identifies the significant environmental effects that are likely to result from the implementation of the plan or alternative approaches to the plan
Segregated mode	Under this model of airport operations, one runway is used for arrivals and the other for departures. Heathrow airport operates under segregated mode
Self connecting	Customers may decide to 'self connect' from one flight to another in the absence of airlines facilitating such connections
SERAS	South East of England Regional Air Services Study
SES	Single European Sky
Shadow cost	The extra cost of flying required to reduce passenger demand from above an airport's runway or terminal capacity, to a level that is back within capacity
Short-term options	Short-term options are those which could be delivered without the provision of additional runways or terminals, within 5 years of the publication of our interim report in December 2013
Short- Haul	For the purposes of this report, 'short- haul' has been defined in the same way as 'Western Europe' and comprises the following group of countries: Andorra; Austria; Belgium; Bosnia Herzegovina; Cape Verde; Croatia; Cyprus; Czech Republic; Denmark; Estonia; Faroe Islands; Finland; France; Germany; Gibraltar; Greece; Greenland; Hungary; Iceland; Ireland; Italy; Latvia; Lithuania; Luxembourg; Macedonia; Malta; Republic of Moldova; Monaco; Montenegro; Netherlands; Norway; Poland; Portugal; San Marino; Serbia; Slovakia; Slovenia; Spain; Sweden; Switzerland; Turkey; United Kingdom. This is consistent with the DfT's definition of 'Western Europe' as used in their aviation demand modelling
SIDs	Standard Instrument Departure routes – the planned departure routes within the noise preferential routes
Slots	Airport slots are rights allocated to allow airlines and other aircraft operators to schedule a landing or departure at an airport during a specific time period. Slots are allocated at 'Level 3 – Coordinated Airports' which are defined as those where demand for airport infrastructure significantly exceed the airport's capacity
SPA	A Special Protection Area (SPA) is an area of land, water or sea which has been identified as being of international importance for the breeding, feeding, wintering or the migration of rare and vulnerable species of birds found within the European Union
Special Area of Conservation	Special Areas of Conservation (SACs) are strictly protected sites designated under the EC Habitats Directive
SSSI	Sites of Special Scientific Interest
TDRs	Traffic Distribution Rules
TEAM	Tactically Enhanced Arrival Management. This is a practice seen at Heathrow where both runways are used to land aircraft when a set of trigger points have been reached, namely related to the level of delay experienced on arrival

Theoretical maximum capacity	The maximum number of ATMs that can be scheduled safely
Thick routes	Thick routes are routes which are served, often by multiple airlines, at high frequencies. Examples of such thick routes are from London to New York, Hong Kong or Tokyo. These markets are served with direct connections both by the members of the airline alliances and by airlines specialising in targeting such premium markets (e.g. Virgin Atlantic)
Transfer traffic	Passengers connecting between their origin airport and destination airport through an intermediate airport
US	United States
Vectoring	Aircraft departing from airports are required to follow specific paths called Noise Preferential Routes (NPRs) up to an altitude of 4,000ft, unless directed otherwise by air traffic control. Vectoring is the practice whereby air traffic control turn aircraft off the NPR route once the aircraft has reached 4,000ft at any point along the NPR, or below 4,000 for safety reasons
VFR	Visiting friends and relatives
WebTAG	Department for Transport Appraisal Guidance
Westerly operations	When aircraft arriving at Heathrow make their final approach over London. The direction in which the airport operates is dictated by the wind direction and the westerly preference policy
Westerly preference	Heathrow airport operates a 'westerly preference' which means that when there is a westerly wind arriving aircraft make their final approach over London and departing aircraft depart over west London. During periods of light easterly winds (up to 5kts), aircraft will often continue to land in a westerly direction making their final approach over London. The westerly preference was introduced in the 1960s to reduce numbers of aircraft taking off in an easterly direction over London, i.e. over the most heavily populated side of the airport
Western Europe	For the purposes of this report, 'Western Europe' has been defined in the same way as 'short-haul' and comprises the following group of countries: Andorra; Austria; Belgium; Bosnia Herzegovina; Cape Verde; Croatia; Cyprus; Czech Republic; Denmark; Estonia; Faroe Islands; Finland; France; Germany; Gibraltar; Greece; Greenland; Hungary; Iceland; Ireland; Italy; Latvia; Lithuania; Luxembourg; Macedonia; Malta; Republic of Moldova; Monaco; Montenegro; Netherlands; Norway; Poland; Portugal; San Marino; Serbia; Slovakia; Slovenia; Spain; Sweden; Switzerland; Turkey; United Kingdom. This is consistent with the DfT's definition of 'Western Europe' as used in their aviation demand modelling
Wide bodied jets	A wide-body aircraft has a typical aircraft cabin width of 5-6 metres allowing for between 7 and 10 passengers to sit side by side. The total capacity of a wide body aircraft can be between 200 to 850 passengers.

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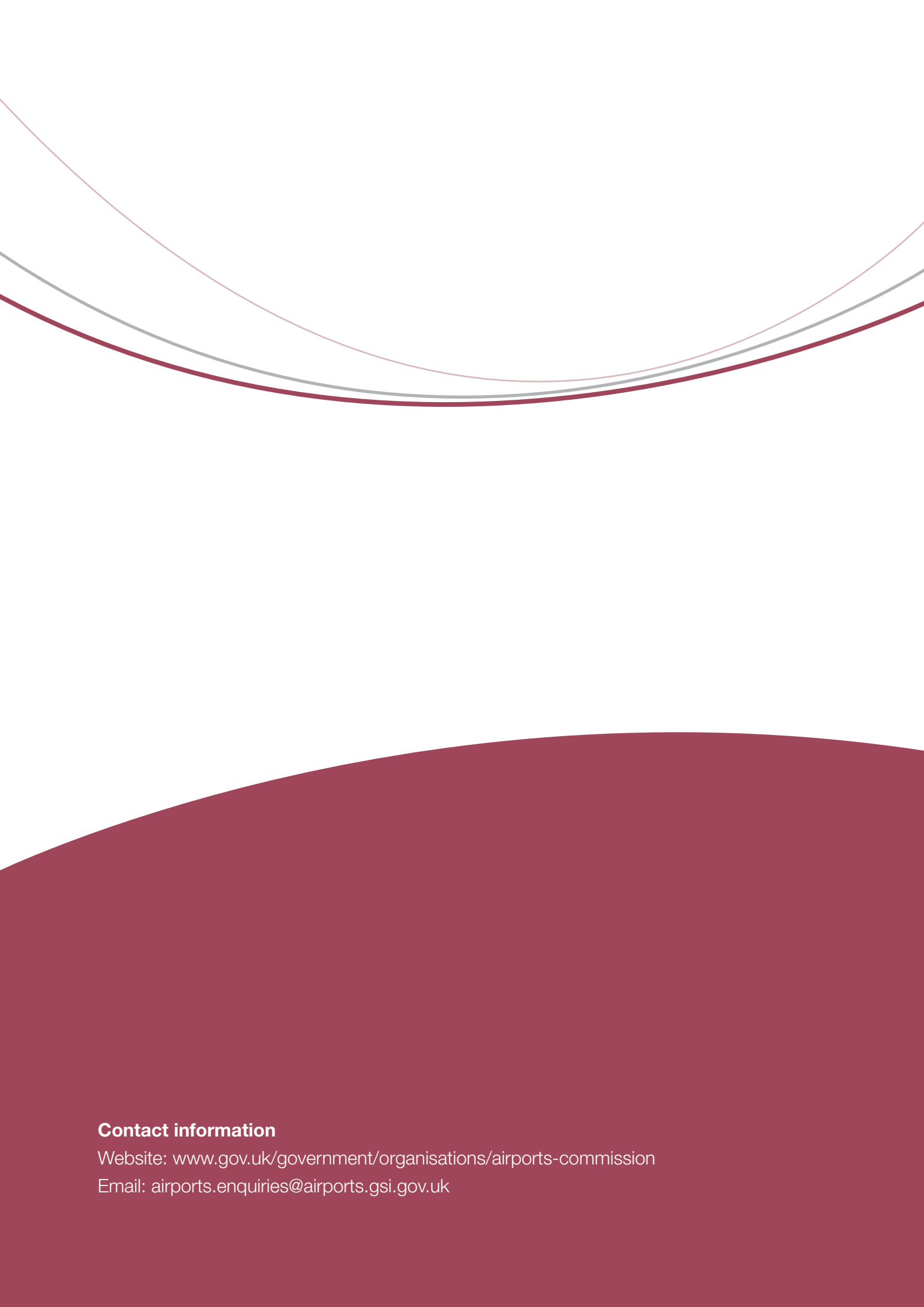
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Contact information

Website: www.gov.uk/government/organisations/airports-commission

Email: airports.enquiries@airports.gsi.gov.uk