Airports Commission

# Discussion Paper 04:
## Airport Operational Models

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An independent commission appointed by Government

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# 1. Introduction

1.1 This paper is one in a series of Airports Commission discussion papers seeking views on how to assess the future need for aviation capacity in the UK. The three papers published to date have considered whether there is a case, in principle, for expanding UK airport capacity. The first paper discussed issues relating to aviation demand forecasting (February 2013), the second considered evidence for the links between aviation connectivity and the economy (March 2013), and the third set out the climate change issues that will need to be taken into account (April 2013). This paper focuses on the nature of any additional airport capacity that might potentially be required.

1.2 At one extreme the UK could focus on developing a single large airport to act as the sole focal point for long-haul connectivity, acting as a hub for the widest possible range of connections to support a comprehensive route network. The rest of the country would need to be well connected to this airport through excellent surface transport and a network of smaller regional airports. In this paper we refer to such an airport as a 'focal' airport. 'Focal' airports are often referred to as 'hubs', but in practice a hub is not created by an airport alone but also depends upon the airlines that operate from it to develop a dense network of interconnecting flights.

1.3 At the other extreme, instead of focusing connectivity in a single location, the UK could seek to develop a more dispersed system of airports each of which would concentrate on providing point-to-point flights, and which would compete with one another on connectivity, price and quality of service.

1.4 Both of these scenarios are attractive for different reasons and neither is likely to be achievable in its pure form. The aviation network sector that develops in any given country or region will be the result of the interplay between various factors, such as a region's demography, economy and geographical position. In addition, regulatory structures at home and abroad, the shape of the local aviation market and the strategies that competing airports in other countries or regions may pursue are also important. Reviewing how these factors operate in the UK may indicate which airport strategies are likely to be most successful.

1.5 In this discussion paper, the Airports Commission seeks to develop understanding in the following three areas, each of which constitutes a separate chapter in the paper.

## What are the trends in the aviation sector? How will the sector develop in the future?

1.6 **Chapter 2** discusses some factors that have shaped the recent development of the aviation sector and provides an overview of how airports and airlines operate. It explains that the liberalisation of the global air transport industry has seen two parallel trends developing. The first of these sees a continuing consolidation of airlines, particularly but not only in the long-haul sector, into international alliances operating increasingly via networks of multiple connecting hubs. The second has been the growth of new types of airline models to challenge long-established carriers. These include the Gulf airlines, which have built significant long-haul route networks from new hubs in the Middle East, and the low-cost sector, which has overwhelmingly specialised in short-haul point-to-point operations, capturing significant market share through low fares and the creation of large numbers of new routes.

1.7 It is not clear at what point these markets will reach a state of maturity. We have therefore outlined a series of possible futures for the development of the aviation industry which might be used to consider potential strategies and recommendations, as part of an overall approach to sensitivity and scenario testing that also covers broader economic and environmental factors.

- **Future 1:** Continuing liberalisation of the aviation sector drives further consolidation of airlines and further strengthening of the alliances, with the result that the dominant role of the major focal airports is enhanced, with other airports increasingly used only by low-cost carriers and to provide 'spokes' into hubs.
- **Future 2:** Decline in the relative importance of the European aviation sector as Middle Eastern and possibly Far Eastern carriers and airports develop dominant roles through aggressive expansion and bilateral partnerships. Focal airports in Europe become increasingly by-passed as Gulf/Turkish/Chinese airlines connect their hubs directly to other regional airports. The major European airports are increasingly left to concentrate on the thickest point-to-point routes, and on traffic across the Atlantic.
- **Future 3:** Integration of the low-cost and full-service models sees more and more airports operating some level of 'hub'-type model – either provided by the airport itself or through airline partnerships. As a result, the dominant role of the focal airports is weakened even as the European aviation sector grows in strength overall.

## What are the distinguishing features of a 'focal' airport and what enables an airport to assume this role?

1.8 **Chapter 3** discusses how aviation hubs are constructed and maintained. It explains the key role played by the airlines in delivering network capacity, and characterises the airports which facilitate such a network by enabling efficient connections for passengers, as 'focal airports'. We discuss the key characteristics of airports in general and the specific conditions that enable an airport to assume the 'focal' role. In general, these features fall into two categories: the first comprises the operational aspects of an airport – in very simple terms an airport must be big enough and provide adequate facilities to serve the required numbers

of transfer passengers, and it must be efficient and cost-effective enough for passengers and airlines to be satisfied with its services. The second category encompasses various components of passenger demand – either originating locally or transferring from one flight to another. This critical mass of passengers is needed to sustain a high frequency of flights to a dense network of destinations.

1.9 This Chapter also discusses the advantages, disadvantages and trade-offs for airlines, users (both passengers and freight) and the UK economy, of concentrating or dispersing airport capacity. A concentrated airport operating model theoretically supports the UK's competitive position relative to other major airports through maintaining high levels of global connectivity for UK residents and through any potential economic benefits which may result. On the other hand, a dispersed airport operating model creates a setting in which several airports are encouraged to compete with one another, in theory making it easier for new airlines to enter the market and potentially benefitting airport users through offering cheaper tickets, more choice and competition-driven higher quality of service. Moreover, by providing connectivity through a dispersed network of airports, this model may provide passengers from a wider range of locations with more efficient access to international aviation services.

1.10 **Chapter 3** also draws upon some international examples to provide relevant real-world comparisons for the UK context.

## The structure and operation of the UK aviation sector

1.11 **Chapter 4** builds on the discussion of different airport's operational models and their characteristics from **Chapter 3**, to analyse the airport sector in the UK. It reviews the impacts of capacity constraints on the sector, including in relation to domestic connectivity and to the handling of international transfer passengers. It also considers the scope for the substantial aviation market in London and the south east to support more than one focal airport and what the potential impacts of such a scenario would be on aviation connectivity in the UK.

1.12 **Chapter 5** provides a list of specific questions on which the Airports Commission would welcome submissions and evidence and provides guidance on how to submit a response to the discussion paper.

# 2. A rapidly changing landscape: airports, airlines and route networks

2.1 From its beginning in the early 1920s, the air transport industry has undergone a significant global expansion and irrevocably changed the ways in which many people travel and work. More people than ever find themselves travelling by air – in 2010, airlines provided services to some 2.8 billion passengers[1] and carried about 48 million tonnes of cargo.[2]

2.2 Flying today is a fundamentally different experience from what it was one or two decades ago. Flying tomorrow will be different too. This chapter explores the main drivers behind the aviation sector's transformation and sheds light on how these drivers may impact developments in the global airline industry in the future. It also briefly summarises how airlines and airports currently operate, providing a brief historical perspective on these issues. Considering the above is fundamental to understanding how airports may want to respond to the future needs of airlines and passengers and, in turn, what kind of airport operational models may prove more successful than others in the UK.

## What factors drive change in the aviation sector?

2.3 Aviation sector developments are driven by regulatory, technological, economic and social changes that are occurring both domestically and globally. Each of these drivers is briefly examined below.

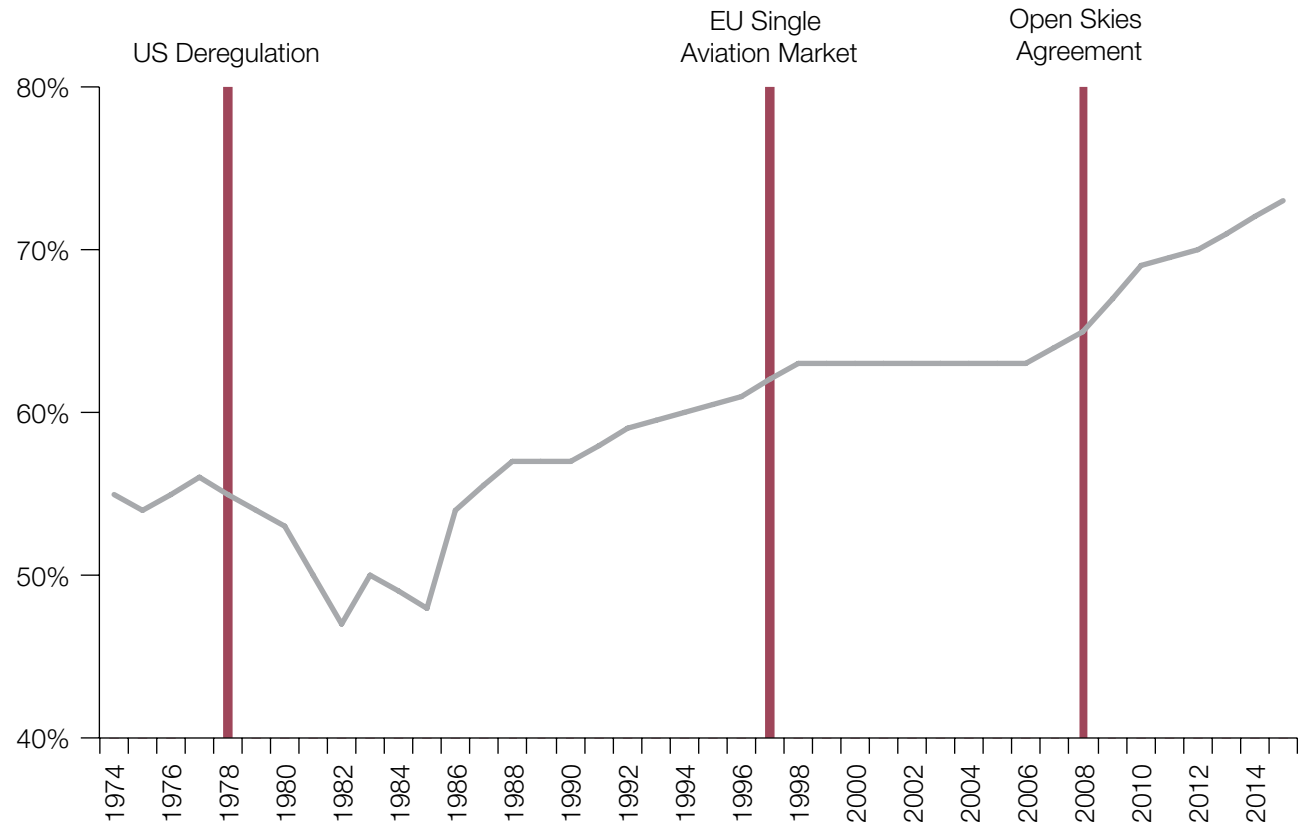
### Regulation

2.4 Over thirty years ago the global aviation market was largely fragmented and protected. At the time, both airports and airlines were typically state-owned monopolies and the aviation sector was considered to be of strategic importance in numerous countries. The state held control over fares, routes and market entry of new airlines. This situation dramatically changed in the US in 1978 with the introduction of the Airline Deregulation Act which removed the Civil Aeronautics Board's powers of regulation, exposing the US airline industry to market forces. The stated goals of the Act included encouraging new air carriers into the market and the continued strengthening of small air carriers. The impact of the Act on creating a more dispersed global airline market is depicted in Figure 2.1 which shows the global market share for the 20 largest airlines in the world: 4 years after the Act was brought to life the 20 biggest airlines' market share dropped by more than 5%.

1 Throughout this document references to numbers of passengers are in accordance with the Civil Aviation Authority (CAA) definition of a 'terminal passenger'. For further information, please refer to http://www.caa.co.uk/default.aspx?catid=1279&pagetype=70&gid=1286&faqid=1133

2 IATA, 2012 Annual Review: http://www.iata.org/about/Documents/annual-review-2012.pdf

**Figure 2.1: Global market share of the 20 largest airlines (%), 1974 – 2014**




Source: Adapted from Deutsche Bank (May 2012), "Global Airline Sector – Achieving Financial Stability through Consolidation", pg.7

2.5 Europe followed the US a few years later: between December 1987 and April 1997 the EU had implemented a package of liberalisation reforms. The resulting EU Single Aviation Market is free of most commercial restrictions relating to routes, number of flights, airfare levels, ownership and control of airlines. Within this area, all European airlines can operate air services on any route of their choosing.[3]

2.6 After internal deregulation within the US and the EU, and some limited moves in the direction of deregulation in other parts of the world, in 2008 the EU-US Open Skies Agreement opened up the aviation market over the Atlantic so that any carrier from either side could fly between any point in the EU and any point in the US. More importantly from the point of view of market consolidation, the Agreement brought previous competitors closer than ever by granting antitrust immunity to airline joint ventures (JVs) across the Atlantic: SkyTeam's Air France-KLM, Delta and Alitalia JV; Star's Atlantic Plus-Plus JV; and oneworld's BA, Iberia, American Airlines and Finnair JV.[4] While the Agreement did not allow non-US control of US airlines or non-EU control of EU airlines, it meant in practice that an EU carrier could be acquired by another EU carrier without fear of losing its US traffic rights, which are the most important intercontinental routes for the majority of EU airlines. This explains to a large extent why deregulation has ultimately reinforced the trend towards a greater global market consolidation (Figure 2.1).

3 See European Commission website: http://ec.europa.eu/transport/modes/air/index_en.htm

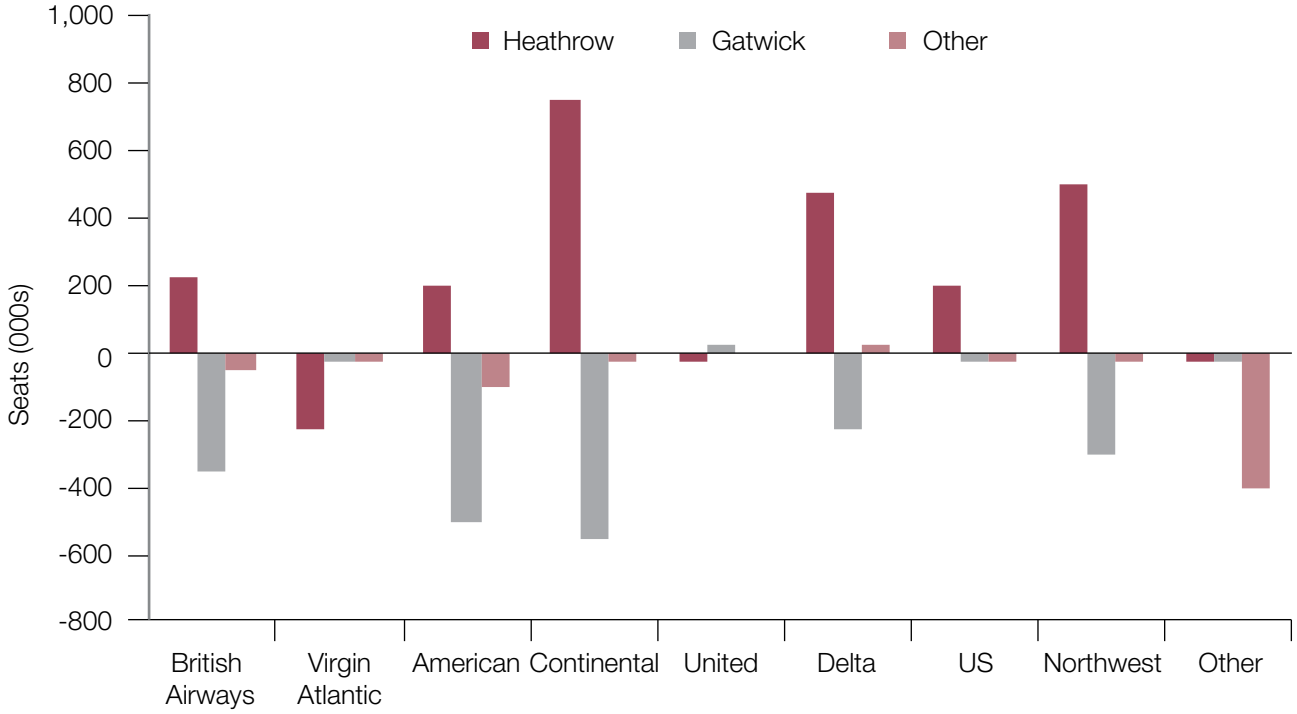
4 http://centreforaviation.com/analysis/capa-airlines-in-transition-report-part-1-the-natural-history-of-airline-alliances-105278 (Accessed: 09/05/2013)

The main detectable result of Open Skies seem to be in the increased concentration of capacity in the hands of mega carriers and alliance joint ventures, with consequent benefits for load factors and yields.

2.7 The US carriers are much more consolidated than the European ones: in 2012, the top five US airlines – United, Delta, American Airlines, Southwest Airlines and US Airways – were holding 82% of domestic seating capacity (compared to 68% in 2008), while the top five European carriers by their capacity on flights within the EU last year – Lufthansa, Air France-KLM, International Airlines Group, Ryanair and easyJet – held 52% of that capacity (compared to 41% in 2008). There are a few reasons for this discrepancy, notably the fact that it is much easier to complete mergers within a single country: the aviation industry is still impacted by the protectionist rules established over 70 years ago, according to which air traffic is usually based on bilateral agreements between governments, and airlines have to be "substantially owned and effectively controlled" by nationals of their own state. It is also difficult to persuade trade unions to support a potential cross-border merger as it may imply job losses.[5]

2.8 Figure 2.2 shows the impact of the EU-US Open Skies Agreement on two London airports (Heathrow and Gatwick) and the resulting change in capacity offered on routes between the UK and the US. The reason for the shift from Gatwick to Heathrow between 2008 and 2009 was that the previous bilateral air services agreement between the UK and the US from 1977, Bermuda II, stipulated that all new routes between the US and London had to operate from

**Figure 2.2: Change in seat capacity on routes between the US and major UK airports, March 2008 – March 2009**




Source: CAA Airport Statistics

5 Financial Times (21 April 2013), "EU airline consolidation slow to take off"

Gatwick. Only two airlines from the UK and two from the US were allowed to operate flights between London Heathrow and the United States: British Airways and Virgin Atlantic, and American Airlines and United Airlines respectively. Once the restriction was lifted, a number of both US and UK airlines capitalised by transferring services from Gatwick to Heathrow, the busier and higher-yielding of the two airports.

2.9 Liberalisation of the EU aviation market does not, however, mean that all restrictions have been lifted. In particular, the aviation sector remains subject to a number of general and more aviation-specific single market rules, notably EU state-aid rules[6] and the Airport Charges Directive as well as Traffic Distribution Rules, which are stipulated domestically.[7]

2.10 Also, there are still a number of specific bilateral agreements on flights between the UK and other countries. Box 1 examines current restrictions on flights to the BRIC[8] countries, which are amongst the strongest emerging economies and likely to be increasingly significant as trading partners in future. It sets out the relative impact on connectivity of restrictions resulting from bilateral agreements and capacity constraints at London Heathrow, as a way of assessing the potential implications for the UK's ability to enhance connectivity with other states.

6 See http://ec.europa.eu/competition/state_aid/legislation/legislation.html

7 For more information on how the CAA regulates the charges paid by airports and airlines see http://www.caa.co.uk/default.aspx?catid=78

8 Brazil, Russia, India and China

**Technology**

2.11 One of the underlying features of the air transport industry is its constant technological progress, which has for the past few decades been motivated by rising and volatile fuel prices. More recently, the need for developing more fuel-efficient aircraft and creating more sustainable aviation fuels has been exacerbated by climate-change considerations.[9] On top of fuel-related technological advancements, producers have been achieving constant progress in developing quieter aircraft with greater capacity to carry passengers.

2.12 The first few decades of the air transport industry were characterised by very rapid technological progress, primarily reflected in increases of aircraft cruising speed. The DC3 was the first mass produced commercial aircraft and became supplemented by larger, long distance aircraft such as the Lockheed Constellation and the Bristol Britannia. The jet age started in the 1960s with mass market jet aircraft such as the Boeing 707. However, since the launch of the Boeing 747 in 1970, with its huge capacity, increases in speed have been minimal (leaving aside Concorde, which no longer flies). Current journey times are still broadly in line with those offered by the Boeing 747 at launch, which halved the length of a London to New York flight compared to the 1950s[10] to just over 5 hours.[11]

9 Airports Commission (April 2013), Discussion Paper 03: aviation and climate change, Airports Commission, https://www.gov.uk/government/publications/discussion-paper-on-aviation-and-climate-change

10 Dennis, "Introduction to the air transport industry", Lecture, Transport Studies Group, University of Westminster

11 Assuming aircraft fly as the crow flies at constant cruising speed

**Box 1: Bilateral air traffic agreements on routes between London and BRICs**

In common with many bilateral relationships that have not been fully liberalised through an Open Skies Agreement, the agreements relating to traffic rights are complex and vary from case to case. In addition to the 'headline' traffic rights there are also often 'doing business' restrictions relating to such issues as airline designation, aircraft capacity, route-specific limits, code-sharing or fifth-freedom rights.[12]

Although London is served by several airports, most of which have available capacity at most times of the day, access to Heathrow is tightly constrained. It is often said to be the biggest barrier to removing bilateral constraints on routes between the UK and emerging markets. This is likely to be the case as foreign carriers would generally prefer to fly to an airport such as Heathrow which is already served by their alliance partners and which offers comparatively easy access to central business districts, has greater international name recognition and the potential for higher yields. Nonetheless, it is noticeable that recently Gatwick has been successful in attracting a number of carriers from the Far East, including from China, as well as seeing the commencement of services to Moscow.

A comparison of traffic rights with service frequencies concerning routes between London and BRIC destinations suggests that, apart from flights between London and Russia, none of the routes appear to be constrained by a bilateral agreement, as the number of services offered is lower than the number of services permitted.

**Permissible and actual number of services per week between UK and BRIC destinations, May 2013**

| | | Traffic rights* | Services per week | | At limit? | |
|---|---|---|---|---|---|---|
| Country | Destination | Frequencies per week | UK | Foreign | UK | Foreign |
| Brazil | Sao Paulo | 35** | 7 | 7 | No | No |
| | Rio de Janeiro | | 7 | 3 | | |
| Russia | Moscow | 35 | 35 | 35 | Yes | Yes |
| | St Petersburg | 7 | 7 | 7 | Yes | Yes |
| India | Delhi | 56 | 18 | 20 | No | No |
| | Mumbai | | 19 | 21 | | |
| | Bengaluru | 14 | 7 | 0 | No | No |
| | Chennai | 14 | 6 | 0 | No | No |
| | Hyderabad | 7 | 5 | 0 | No | No |
| China | Beijing | 31 | 7 | 11 | No | No |
| | Shanghai | | 12 | 4 | | |
| | Guangzhou | | 0 | 4 | | |
| | Chengdu | | 3*** | 0 | | |

* Traffic rights column gives the number of services available per week to each national carrier between London and destination provided in the table.
** Frequency cap to be raised subject to negotiation of a free-pricing article.
*** From September 2013.
Source: CAA analysis

12 For a list of freedom rights of the air, see: http://legacy.icao.int/icao/en/trivia/freedoms_air.htm

Currently, British Airways operates 14 out of a permitted 21 services per week to Brazil, as specified under the Air Services Agreement updated in 2008. The Brazilian airline TAM only operates 10 of the 14 frequencies available to Brazilian carriers.

Capacity constraints at Heathrow seem to be affecting the number of services to Russia. Both UK (British Airways and easyJet) and Russian (Aeroflot and Transaero) airlines operate the maximum number of frequencies permitted under the UK-Russia Air Services Agreement on London-Moscow and London-St Petersburg. The Russian authorities have explicitly stated access to slots at Heathrow as a barrier to further liberalisation. This issue was reiterated during the most recent set of bilateral talks in July 2012.

The UK-India route frequency cap was substantially increased in the course of 2004 and 2005. Neither UK nor Indian carriers currently operate at the frequency cap on any UK-India route. Airlines seem to have adapted their route networks to take advantage of this new opportunity. The liberalisation of the UK – India agreement between late 2004 and mid-2005 provides valuable insight into the effects of market liberalisation on the route network, as these agreements opened up a market that had remained substantially constrained for many years.[13]

The capacity limit on airlines operating between India and the UK on the core routes from London to Delhi and Mumbai more than tripled between 2004 and 2006 – from 34 to 112 services per week – most of these new services were launched from London Heathrow, equivalent to an increase of 77 services per week to and from Heathrow in spite of constraints at the airport. Currently, the permitted capacity on most other routes is such that these markets are practically unrestricted. This loosening of regulatory constraints triggered a rapid increase in the number of passengers carried by airlines of both sides, demonstrating that demand had previously been significantly suppressed.

Finally, the UK-China Air Services Agreement was updated in 2011. Neither the services operated by UK carriers nor those operated by Chinese carriers operate are currently close to the frequency cap set out in the bilateral agreement between the two states.

2.13 More recently, technology developments have focused on increasing aircraft's passenger capacity, fuel efficiency and noise reduction. For example, more fuel-efficient, smaller aircraft that are capable of flying to mid- and long-haul destinations by both Airbus (A350) and Boeing (Boeing 787) are reducing the scale of passenger demand needed to make a long-haul route viable. Such developments may encourage airlines to by-pass hub airports and serve direct connections.

2.14 Apart from the development in aircraft technology, the aviation sector has benefitted from other technological developments. For example, widespread internet access has empowered airline customers with better information on ticket pricing thereby providing customers with cheaper tickets, more choice and making air travel available to more users. Other improvements, such as online check-in technologies, have contributed further to reducing costs and improving passenger convenience.

13 CAA (November 2006), "UK – India Air Services: a case study in liberalisation", http://www.caa.co.uk/docs/589/ERG_EPIA_India_Liberalisation.pdf

### Development of substitutes to aviation

2.15 Developments in the aviation sector are also driven by the availability and popularity of substitutes for flying. This argument may be especially relevant in the European context as most flights from European airports take off and land within the borders of the EU and the shorter the travelling distance, the higher the number of available substitutes, such as travelling by train, car, coach or boat. Moreover, the European continent is penetrated by a dense network of roads and railways.

2.16 Travel by air becomes more attractive as journey distance increases. Aviation is rarely considered an appropriate mode for short distances. For inter-city journeys, rail is generally expected to capture a majority share of the overall market for journey lengths of up to three or four hours.[14] With the introduction of high speed rail, the number of journeys achievable within this timeframe will be increased. Furthermore, the 'tipping point' may move further in rail's favour, the more comfortable and reliable trains become relative to other modes of transport, or if future security procedures make aviation less attractive. Such developments may see rail competing increasingly effectively with aviation on many short-haul point-to-point routes.[15]

2.17 The Channel Tunnel provides the UK's only direct rail and road link to Continental Europe, and the completion of the High Speed 1 link has seen Eurostar's rail services gain a significant share of the market on the routes between London and both Brussels and Paris. On each of these routes, Eurostar has captured approximately 80% of the total rail/air market. Furthermore, Eurostar has some further scope, limited by track capacity, to grow passenger demand from its current base of 10 million passengers by achieving higher load factors and through introducing bigger trains or higher service frequencies.[16]

2.18 Improvements in communication technologies may also offer substitutes to flying. Few people, if any, take flights for their own sake. While the choice of substitutes other than a different mode of transport is limited for those who would like to visit their friends and families abroad, or go for an exotic holiday, those who travel for business may at least to some extent replace air travel with, for example, videoconferencing.[17] Evidence on how aviation demand may be affected by new technologies such as videoconferencing, however, is not conclusive. For example, in a review of the evidence for its 2009 report *Meeting the UK aviation target – options for reducing emissions to 2050*, the UK Committee on Climate Change found that there was modest scope for videoconferencing to reduce demand for air travel.[18] However, Wang and Lee (2007) and Choo and Mokhtarian (2007) suggest videoconferencing could act as

14 See for example, SKM (February 2010), "International Rail Travel Demand Model for HS2 (IRTDM): A Report for HS2"

15 On the other hand, faster and more reliable trains (or other means of transport) may make surface access to airports easier, increasing catchment areas and, in turn, stimulating demand for air travel as airports compete more fiercely between one another and passengers have more choice

16 http://www.railway-technology.com/news/newseurostar-to-expand-services-to-ten-european-cities

17 Airports Commission (March 2013), Discussion Paper 02: aviation connectivity and the economy, https://www.gov.uk/government/publications/discussion-paper-on-aviation-connectivity-and-the-economy, pg.17

18 Committee of Climate Change (December 2009), "Meeting the UK aviation target – options for reducing emissions to 2050", http://downloads.theccc.org.uk/Aviation%20Report%2009/21667B%20CCC%20Aviation%20AW%20COMP%20v8.pdf

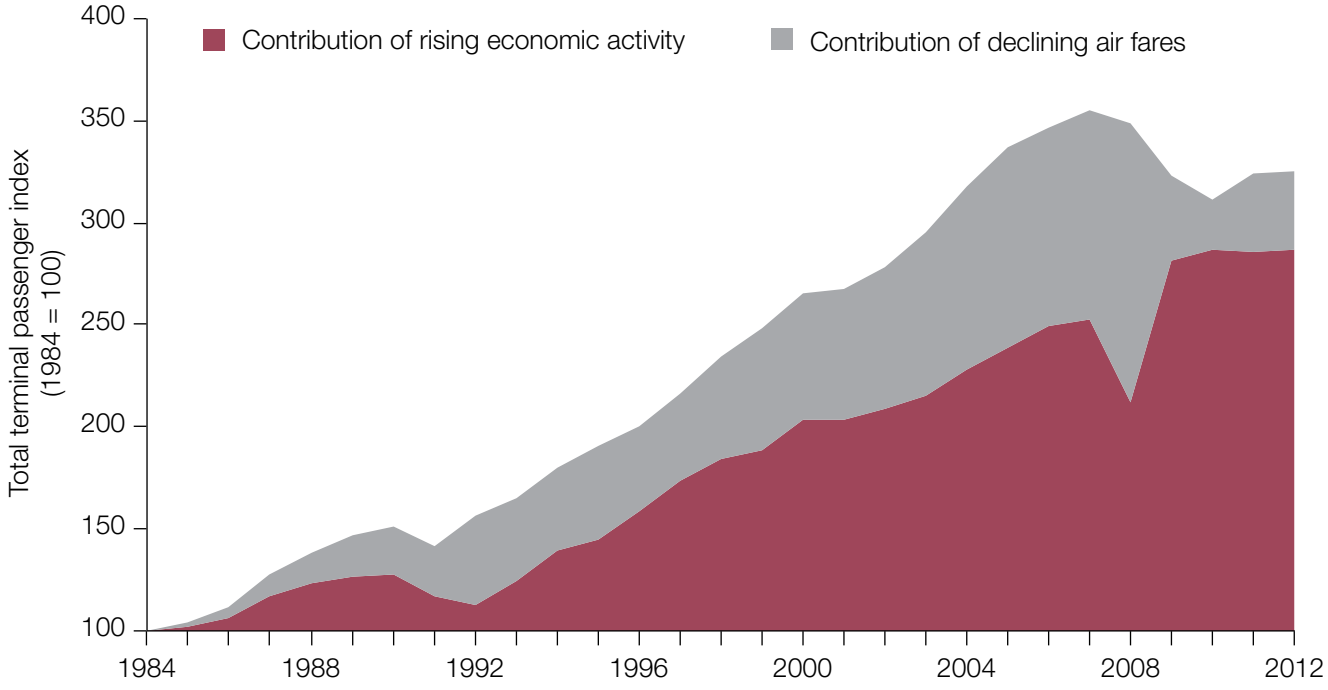
a complement to rather than a substitute for air travel.[19]

2.19 There are also other factors which may affect demand for aviation. Travellers' impressions of airports and willingness to fly to particular destinations may be affected by the duration and intrusiveness of passport checks and border controls – an area for which airports are not responsible – as well as security procedures, which are heavily regulated. Changes in both these areas, either positive changes due to new technology and increased efficiency or negative changes due to stricter controls or external threats, may affect passengers' future willingness to travel by air.

### Economic and social trends

2.20 Lower airfares have been an important factor in making air travel more available to a wider group of consumers, but growing prosperity and disposable incomes as well as increasing economic activity have also played a role.[20] Analysis conducted by the Department for Transport using its National Air Passenger Demand Model confirms the significance of these two drivers in explaining long-term increases seen in aviation demand in the UK, as depicted in Figure 2.3.

**Figure 2.3: Key drivers of air passenger demand, 1984 – 2012**




Source: DfT (January 2013) UK Aviation Forecasts, pg.15

19 Wang and Lee (2007), "Impacts of information and communication technologies on time use and travel behaviour: a structural equation analysis". Choo and Mokhatrian (2007), "Telecommunications and travel demand and supply: aggregated structural models for the US", http://www.uctc.net/papers/831.pdf

20 For example, Graham (2000), "Demand for leisure air travel and limits to growth", Journal of Air Transport Management 6, 2000, pg. 109-118 and Dargay and Hanley (2001), "The determinants of demand for international air travel to and from the UK". http://www.researchgate.net/publication/228602669_The_determinants_of_the_demand_for_international_air_travel_to_and_from_the_UK

2.21 Passenger demand has also been affected by changes in the ways in which people decide to live and work. For almost a decade, the EU aviation market has been experiencing a surge in demand for air travel to visit friends and relatives as more people take advantage of increasing European integration to live and work outside of their country of origin. This trend is very obvious in the availability of seats between the UK and Member States that have recently joined the EU. For example Figure 2.4 shows a five-fold rise in the number of seats available between Poland and the UK after 2004, once Poland had entered the EU.

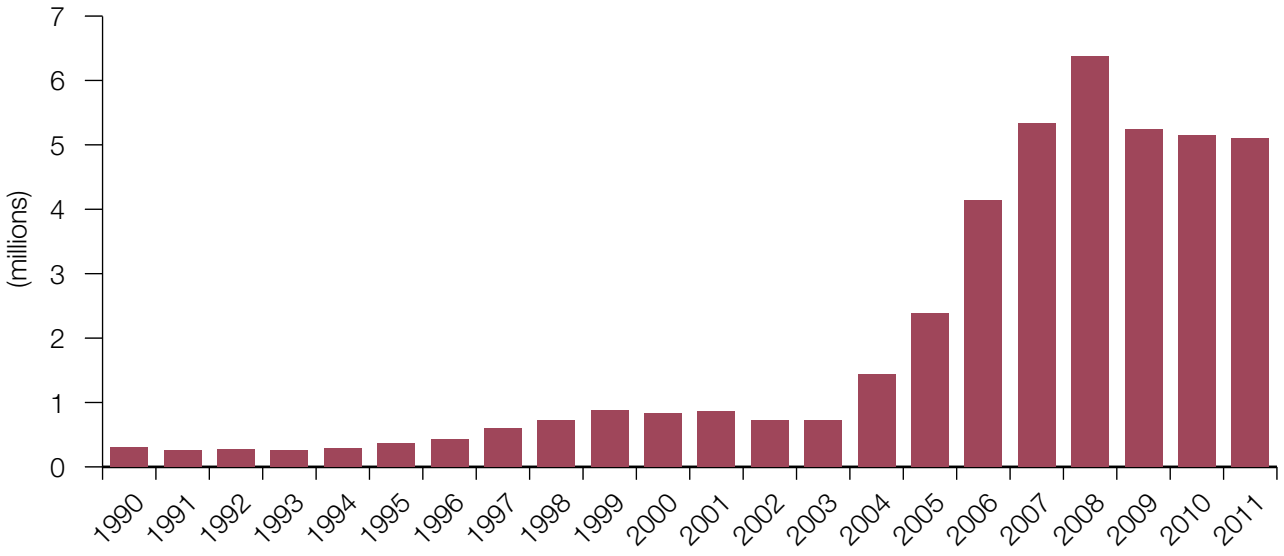
2.22 Changing consumer preferences may be affecting aviation demand as well – for example, as an alternative (or addition) to an annual summer holiday, many European tourists have begun taking regular flights abroad for shorter visits to second homes or for last-minute weekend city breaks or short holidays. In the future, this trend may either continue as people become more affluent or may reverse as more travellers and businesses start being more conscious of their carbon footprint.[21]

2.23 Incentives provided to consumers by the airlines themselves can also influence route networks and service frequencies, notably through the loyalty programmes provided by all major carriers. As airline alliances incentivise customers to favour their services over those of their competitors, there is a question as to what extent these loyalty programmes influence consumers' choices. Shedding more light on this issue would help understand how passenger choice may be influenced in the future as the industry evolves.

## Airports and airlines are constantly evolving

2.24 The effects of market liberalisation can be seen in two trends in the European

**Figure 2.4: Estimated seats available on direct flights between the UK and Poland, 1990 – 2011**




Source: CAA Airports Statistics

21 Individuals and businesses can now easily calculate the carbon footprint of their journeys, for example: http://www.transportdirect.info

aviation sector: global consolidation of airlines and market expansion of low-cost carriers.

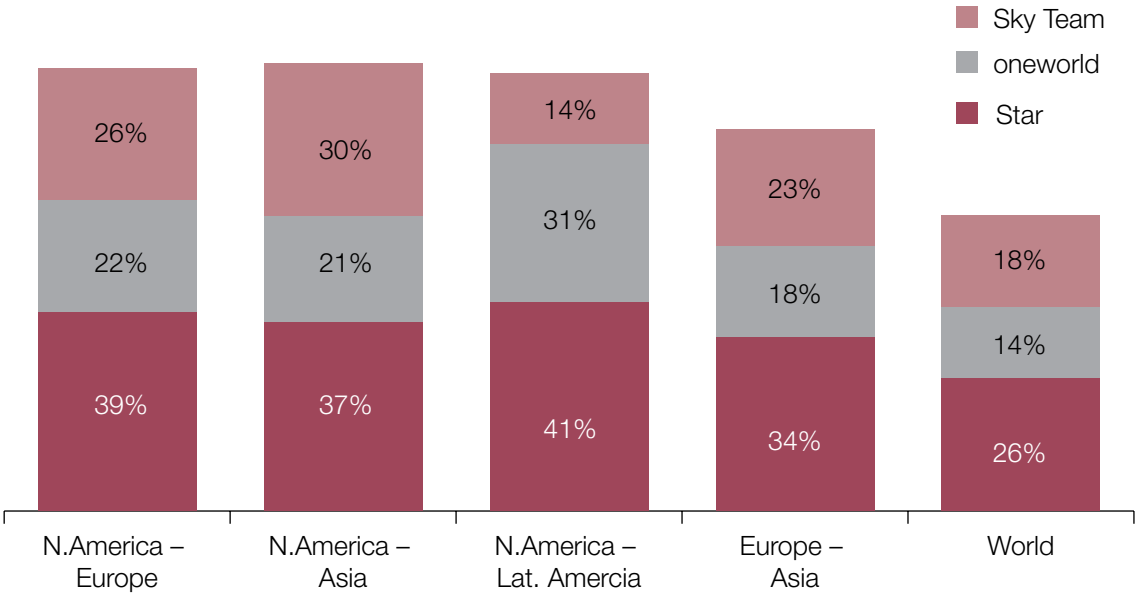
2.25 Over recent years there has been a global trend towards airline consolidation: in 2012, 59% of all global capacity was in the hands of three global air alliances – oneworld, Star Alliance and SkyTeam (Figure 2.5). Table 2.1 below depicts the most important statistics for these three air alliances.

2.26 The global airline alliances were a response to two factors: first the market liberalisation that took place in the United States in the late 1970s, in Europe in the early 1990s and between the US and the EU in 2008-9; and second, the continuing regulation in many regions of the ownership and operation of airlines. The establishment of the alliances enabled the emergence of global route networks focused on a number of key airports where large numbers of passenger transfers take place. In this paper, we will call these airports "focal airports". At a focal airport an airline generally seeks to optimise connecting opportunities for passengers, wherever possible by operating a number of daily waves of flights. As such, a hub-and-spoke network requires a concentration of traffic in both space and time.[22]

2.27 Routing passengers through a focal airport has two major advantages for an airline (or an airline alliance). First, bringing connecting passengers to a hub increases passenger throughput at that airport, creating more connection possibilities and making it more viable to add new routes or increase frequencies on existing routes. Second, by basing its operations at one airport, airlines can drive down their operational costs.

2.28 Figure 2.6 shows the dominance of different airline alliances at a selection of

**Figure 2.5: Airline alliance market share by seat capacity, June – January 2012**




Source: Deutsche Bank (May 2012), "Global Airline Sector - Achieving Financial Stability through Consolidation", pg.8

22 Burghouwt and de Wit (July 2003), "The temporal configuration of European airline networks", University of Montreal, Agora Jules Dupuit – Publication AJD-74

**Table 2.1: Global airline alliances: key statistics**

| | Star Alliance (as of November 2012) | SkyTeam (as of November 2012) | oneworld (as of February 2013) |
|---|---|---|---|
| Member airlines (number) | 27 | 19 | 12 |
| Aircraft (number) | 4,570 | 4,137 | 2 473 |
| Passengers per year (million) | 671 | 552 | 341 |
| Airports (number) | 1,329 | About 1,000 | 841 |
| Countries served (number) | 194 | 187 | 155 |
| Members | Adria Airways, Aegean Airlines, Air Canada, Air China, Air New Zealand, ANA, Asiana Airlines, Austrian, Avianca AV, TACA Airlines TA, Brussels Airlines SN, Copa Airlines CM, Croatia Airlines OU, EGYPTAIR MS, Ethiopian Airlines ET, LOT Polish Airlines, Lufthansa LH, Scandinavian Airlines SK, Shenzhen Airlines ZH, Singapore Airlines SQ, South African Airways SA, SWISS LX, TAM Airlines JJ, TAP Portugal TP, THAI TG, Turkish Airlines TK, United UA, US Airways US | Aeroflot, Aerolíneas Argentinas, Aeromexico, Air Europa, Air France, Alitalia, China Airlines, China Eastern, China Southern, Czech Airlines, Delta Air Lines, Kenya Airways, KLM, Korean Air, Middle East Airlines, Saudia, TAROM, Vietnam Airlines, Xiamen Air | airberlin, American Airlines, British Airways, Cathay Pacific, Finnair, Iberia, Japan Airlines, LAN, Malaysia Airlines, Qantas, Royal Jordanian, S7 Airlines |

Source: http://www.staralliance.com/en/, http://www.SkyTeam.com/ and http://www.oneworld.com/

major global airports. The reason why the airport in Dubai does not have a dominant air alliance operating from there is that it is a base for the non-aligned Emirates airline which uses the airport as its hub.

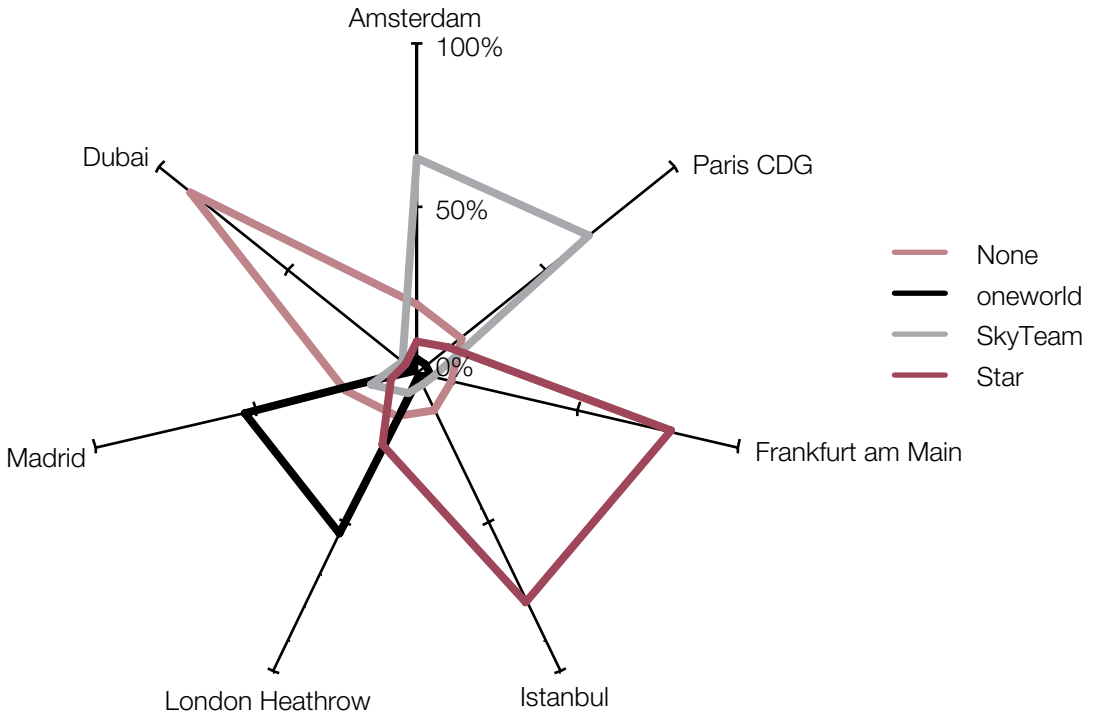
2.29 The growth of the airline alliances and the global hub-and-spoke networks that they operate, however, has by no means crowded out the growth potential for airlines offering passengers direct (point-to-point) connections. On the contrary, the point-to-point network has also been growing in strength, in particular through the increasing scale of the low-cost airline sector.[23]

2.30 Direct point-to-point services are clearly attractive to passengers, as they avoid the need for inconvenient transfers between services and reduce the scope for delays or disruption. There are also several reasons why point-to-point connections are potentially attractive to airlines.

2.31 First, the thickest point-to-point routes may offer a market premium to airlines who can capture a significant share. Many airlines compete on long-haul

23 For the conceptual analysis of this phenomenon, see Airports Commission (March 2013), Discussion Paper 02: aviation connectivity and the economy, https://www.gov.uk/government/publications/discussion-paper-on-aviation-connectivity-and-the-economy, pg. 17-19

**Figure 2.6: Distribution of scheduled flight departures at selected hubs by airline alliance, 2012**




Source: Airports Commission analysis (based on OAG flight schedule data)
Note: Provisional estimates. Dubai's airport is dominated by the unaligned airline Emirates

point-to-point connections with big origin and destination (OD) markets for this reason.[24] Examples of such thick routes are from London to Hong Kong, New York 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). Some low-cost airlines are also seeking to tap into these routes in an effort to capture a share of the market, with Norwegian Air Shuttle, for example, opening routes from Oslo and Stockholm to Bangkok and New York by the end of 2013.

2.32 Second, in the short-haul sector, an increasingly diverse range of profitable point-to-point routes has been developed. A number of factors have driven this trend – liberalisation of the European market, the availability of capacity at under-used airports, the efficiencies achieved by low-cost carriers and the significant growth (in part driven by lower fares, but also by wider demographic changes as described above) in the markets for leisure travel and for travel to visit friends and relatives.

2.33 Although the low cost carriers began by operating flights for leisure passengers and often utilising airports at secondary cities, or at some distance from the main conurbations, the sector is becoming increasingly diverse, with some airlines now operating at primary airports and/or targeting business passengers. easyJet, for example, offers services to both Amsterdam Schiphol and Paris Charles de Gaulle, and airberlin flies to a large number of destinations from Frankfurt Airport.

24 A big OD market is characterised by high 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")

**Box 2: The low-cost carrier model**

Low-cost airline models are built around reducing operating costs and providing a simple offering to passengers. The model began being used in the early 1990s and has grown rapidly ever since. The popularity of low-cost airlines has grown hugely with passengers; this has mainly been driven by low fares and a growing network of hundreds of short-haul destinations. Low-cost airlines have created new demand by opening up once commercially unviable routes, undercutting incumbent airlines on heavier routes and by attracting new price sensitive (often leisure) traffic.

To achieve such low fares and operate such significant route networks, low-cost airlines focus their businesses on lowering operating costs. Though models differ between airlines these commonly include:

- high aircraft utilisation with rapid aircraft turnaround;
- operating efficient and standardised aircraft (often Boeing 737 or Airbus A320);
- generating a high proportion of on-line ticket sales and check-in to reduce administration costs;
- offering a one class service, charging for additional services;
- flying a short-haul point-to-point network, often from regional and secondary airports.

The low-cost model is most effective when used within in a short-haul network, with flights up to 4 or 5 hours in length. The model becomes less effective beyond this, where fuel costs become a more significant proportion of total flight costs and passengers require more legroom and comfort, both of which become harder to provide at such low cost.

2.34 The scale of the low-cost sector has grown significantly over recent years. The number of passengers at UK airports flying with the four largest low-cost airlines by the number of UK passengers – easyJet, Ryanair, and Flybe – increased by well over 300% between 2000 and 2012. These 3 airlines accounted for 35% of all terminal passengers at UK airports in 2012 compared to 10% in 2000. Ryanair and easyJet combined accounted for 30% in 2012 compared to 8% in 2000. At the same time, the number of passengers using BA increased by 10% over this period and their share fell slightly from 21% to 19% although BA still had the largest share in 2012.[25]

25 CAA Airports Statistics

## How might this picture change?

2.35 Changes in the relationships between the global airline alliances, the major Gulf carriers and the low-cost sector are likely to play an important role in the future development of the international aviation industry.

2.36 Currently, all three main Gulf carriers (Emirates, Qatar and Etihad) remain outside the global alliances, but they are adopting different approaches for the medium- to long-term. Qatar Airways has applied to join oneworld, whereas Emirates and Etihad are strengthening their worldwide coverage through bilateral arrangements with other airlines. Emirates has recently, for example, entered into a partnership with Qantas to provide links from Australia to

Europe, with the Australian airline moving its main stopover point to Dubai.[26] Similarly, Etihad has also entered into partnership with Air France-KLM, as well as investing in and building links with low-cost carrier, airberlin.[27] The question of whether these strategies will see the Gulf carriers integrate into the global alliances (either through formal membership or through bilateral links with member airlines), or whether their increasing global reach will see them providing a competitive alternative, remains open.

2.37 Similarly, the low-cost carriers are following a range of strategies. As well as entering into partnership with Etihad as described above, airberlin has also joined the oneworld alliance, but other low-cost carriers have not yet followed suit, even where they are serving major airports, working increasingly closely with alliance members (for example, Flybe has entered into codeshare agreements with Air France and British Airways, as well as with Etihad) or entering into long-haul markets.[28] As with the Gulf carriers, it remains uncertain to what extent low-cost airlines will continue to serve separate markets from the major alliances, or to what extent they will integrate or compete with them.

2.38 A further area of potential change is the role airports will play in facilitating passenger travel. Airports directly benefit from having more passengers – partly because a busier airport is likely to be more attractive to airlines, but also because a significant proportion of airport revenues are driven by commercial activities (such as the retail opportunities that they offer). For these reasons, it is not uncommon to see airports striving to attract passengers through media campaigns, especially when their catchment areas overlap with their competitors', or by offering improved services, efficient connections or attractive executive lounges and shopping areas.

2.39 In the future, airports may take an even more active role in attracting passengers. One possibility into which airports may tap is the fact that a growing number of low-cost airline customers may decide to "self-connect" from one flight to another in the absence of airlines facilitating such connections. For example, in 2011 around 1 in 20 (610,000 out of over 12 million) easyJet passengers landing at Gatwick connected to another flight at that airport,[29] despite the fact that easyJet's business model does not facilitate transfer traffic. Similarly, in 2011, 27% or 341,000 of Flybe passengers at Gatwick connected to another flight[30] and, as described above, Flybe has entered into a number of codeshare agreements with other airlines to enable an enhanced route network for its passengers.

2.40 Milan Malpensa Airport is an example of an airport playing an active role in attracting connecting passengers by offering a service called "Via Milano".[31] Via Milano offers passengers the possibility of reaching their destination by combining two or more routes from different airlines that fly to and from

26 http://www.telegraph.co.uk/travel/ultratravel/luxury-travel-news/9988253/Qantas-and-Emirates-partnership-Details-announced.html (Accessed: 09/05/2013)

27 http://centreforaviation.com/analysis/etihad-ties-up-with-air-france-klm-next-qatar-oneworld-and-the-aviation-world-turns-on-its-head-84721 (Accessed: 09/05/2013)

28 http://www.economist.com/news/business/21576672-bjorn-kjos-norwegian-air-shuttles-boss-success-may-depend-ruthlessness-here-come?fsrc=nlw%7Chig%7C4-25-2013%7C5600908%7C37064371%7CUK (Accessed: 09/05/2013)

29 CAA passenger survey, 2011

30 CAA passenger survey, 2011

31 http://www.flyviamilano.eu/en/how-it-works

Milan Malpensa Airport, where they will be guaranteed assisted transit service. The connecting service is managed directly by the airport itself rather than by the airlines who operate there and is mostly used by passengers travelling for leisure purposes to airports in southern Italy and other holiday destinations in the Mediterranean.

2.41 A further area of potential change is likely to be the relative attractiveness of different airports. The biggest impacts are likely to stem from – first – technological and – second – economic and associated social changes.

2.42 As for the former, the introduction of the A350 and Boeing 787 aircraft, which can be operated profitably on long-haul routes with lower passenger numbers, may enhance the geographical advantages of the Middle Eastern hubs, by making it easier for Gulf carriers to compete with Europe-based airlines in some of the largest markets, such as North America (see Figure 2.7).

2.43 Moreover, as the centre of economic gravity shifts eastwards (see Figure 2.8), being pulled by south and east Asia and the southern hemisphere, UK airports that provide long-haul routes mostly over the Atlantic may see their share of long-haul traffic diminish in comparison with other airports whose relative geographical location may improve.

2.44 Nonetheless, on some key routes – particularly between the Americas and the Far East – the major European airports are likely to retain the geographical advantage over their Middle East competitors. This can be seen from table 2.2, which compares distances via London Heathrow and Dubai on a selection of routes longer than could be served direct, even following the introduction of the 787 Dreamliner.

## Conclusion

2.45 This chapter sheds light on factors shaping the aviation sector and provides an overview of how airports and airlines operate. On one hand, due to both liberalisation and consolidation of the

**Figure 2.7: Global airline seat capacity, 2011**


Source: Deutsche Bank (May 2012), "Global Airline Sector - Achieving Financial Stability through Consolidation", pg.35

**Figure 2.8: Average location of economic activity across geographies, 1980 – 2049**

Source: Danny Quah (2011), "The Global Economy's Shifting Centre of Gravity", *Global Policy*, 2(1), pg.6-9
Note: Black dots depict changes in the economic centre of gravity from 1980 until 2009, red ones are projections (2010-2049)

**Table 2.2: Distances for various direct trips and transfer trips via London Heathrow and Dubai**

| ROUTE | Direct Distance (miles) | Via London Heathrow (miles) | Via Dubai (miles) |
|---|---|---|---|
| New York – Singapore | 9530 | 10220 | 10484 |
| New York – Jakarta | 10046 | 10739 | 10917 |
| Sao Paolo – Beijing | 10933 | 10953 | 11241 |
| Sao Paolo – Hong Kong | 11205 | 11868 | 11287 |
| Sao Paolo – Tokyo | 11492 | 11848 | 12570 |
| Atlanta – Singapore | 9963 | 10976 | 11232 |

Source: http://www.gcmap.com/

global air transport industry, more and more airlines are joining alliances and operating in a network of multiple connecting hubs. On the other hand, the Gulf carriers and the low-cost airlines have been growing in importance, and increasingly competing against but also partnering with longer-established carriers. As these two trends continue to characterise the developments in the aviation sector, it is not clear when the sector will reach a state of equilibrium and there are many possible futures against which any future decisions on UK aviation strategy must be weighed.

2.46 We outline below three such possible futures for the development of the aviation industry which might be used to consider potential strategies and recommendations, as part of an overall approach to sensitivity and scenario testing that also covers broader economic and environmental factors.

- **Future 1:** Continuing liberalisation of the aviation sector drives further consolidation of airlines and further strengthening of the alliances, with the result that the dominant role of the major focal airports is enhanced, with other airports increasingly used only by low-cost carriers and to provide 'spokes' into hubs.
- **Future 2:** Decline in the relative importance of the European aviation sector as Middle Eastern and possibly Far Eastern carriers and airports develop a dominant role through aggressive expansion and bilateral partnerships. Focal airports in Europe become increasingly by-passed as Gulf/Turkish/Chinese airlines connect their hubs directly to other regional airports. The major European airports are increasingly left to concentrate on the thickest point-to-point routes, and on traffic across the Atlantic.
- **Future 3:** Integration of the low-cost and full-service models sees more and more airports operating some level of 'hub'-type model – either provided by the airport itself or through airline partnerships. As a result, the dominant role of the focal airports is weakened even as the European aviation sector grows in strength overall.

2.47 The Commission is particularly interested in answering the following questions:

- *To what extent do the three potential futures outlined in this chapter present a credible picture of the ways in which the aviation sector may develop? Are there other futures that should be considered?*
- *How are the trends discussed in this chapter (e.g. liberalisation, growth of low-cost carriers, consolidation of alliances, and technological changes) likely to shape the future of the aviation sector? Do they strengthen or weaken the case for developing hub versus non-link capacity?*

# 3. What are the key characteristics of the different airport operating models?

3.1 Point-to-point journeys taking passengers from one place directly to their destination have been the traditional mode of operation for most of the industry's history and remain a fundamental element of aviation today. However, as we have seen from Chapter 2 there is an alternative, more complex model which has emerged over recent decades in which airlines and their alliances use particular airports as a hub through which passengers transfer between flights to reach a broad network of destinations.

3.2 In this paper, we call these airports "focal" to avoid the implication that being a hub is a permanent feature of an airport – an airline may decide to move its hub to a different airport. Other airports, although not a focal airport or hub, are often the ends of the spoke and some airports will have separate journeys in their own right completely apart from any hub-and-spoke operation.

3.3 No two airports are the same but all fall somewhere between the two extremes of having no interaction with a hub-and-spoke network, effectively an exclusively point-to-point operation, or dealing only with transfers – a mega hub. This chapter looks at these two extremes and tries to indentify their key characteristics, costs and benefits, recognising that very few airports operate exclusively as one or the other.

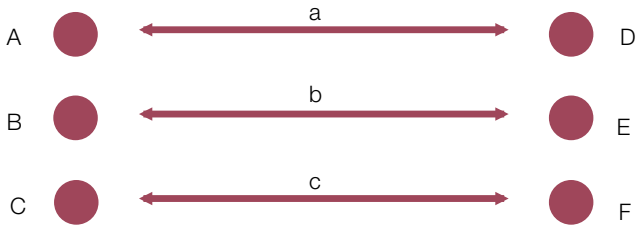
3.4 In recent years the hub-and-spoke model has more often been the subject of academic study and public debate than the point-to-point model. The Commission is interested in addressing this imbalance.

## What makes a hub-and-spoke network?

3.5 A hub-and-spoke network seeks to achieve efficiencies by directing connecting passengers to focal airports in the route network. Airlines supplement local demand for their flights to/from an airport with transfer passengers, providing traffic volumes which support higher frequencies of services on more popular routes and enabling services on more marginal routes which would not have proved viable with fewer passengers.

3.6 Consider an airline that operates three point-to-point routes (AD, BE, CF) as depicted in the Figure 3.1.

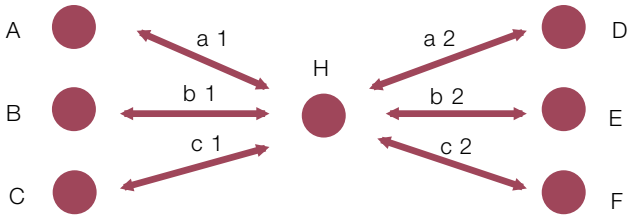
**Figure 3.1: A point-to-point network**




Source: Airports Commission

3.7 If the airline sends all of its flights through a focal airport H, passengers flying from A now theoretically can travel to five different destinations, B, C, D, E and F. Organising a route network in this way provides passengers with many more destination options than the traditional point-to-point network (Figure 3.2).

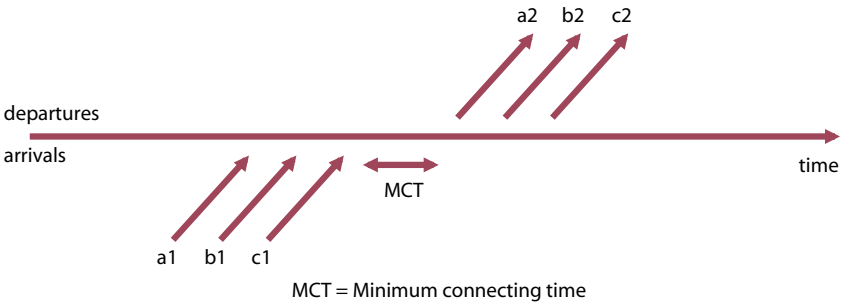
**Figure 3.2: A hub-and-spoke network**




Source: Airports Commission

3.8 In its efforts to maximise possible connections available, an airline concentrates flights into a focal airport in a number of waves during the day (see Figure 3.3). These should see a large number of flights arriving in a short space of time, then a large number departing again as soon as a sufficient interval in which to redistribute passengers and their luggage has elapsed. The minimum connecting time (MCT) provides an idea of the capability of a given airport to process such transfers, but what matters to airlines and alliances is the average connecting time (ACT) for their flights.

**Figure 3.3: A wave of flights**




Source: Airports Commission

3.9 To take full advantage of wave operations in connecting passengers, it is crucial for an airport to have facilities that will enable efficient transfer of passengers and baggage. At congested airports, it is often necessary to build some contingency allowance for late arrivals into the MCT to try and ensure that as many passengers as possible make their connecting flight. The average MCT at major European airports is clustered around 45 minutes. British Airways at Heathrow has a 60 minute MCT within Terminal 5, while Munich Airport's Terminal 2 boasts an MCT of 30 minutes.[32]

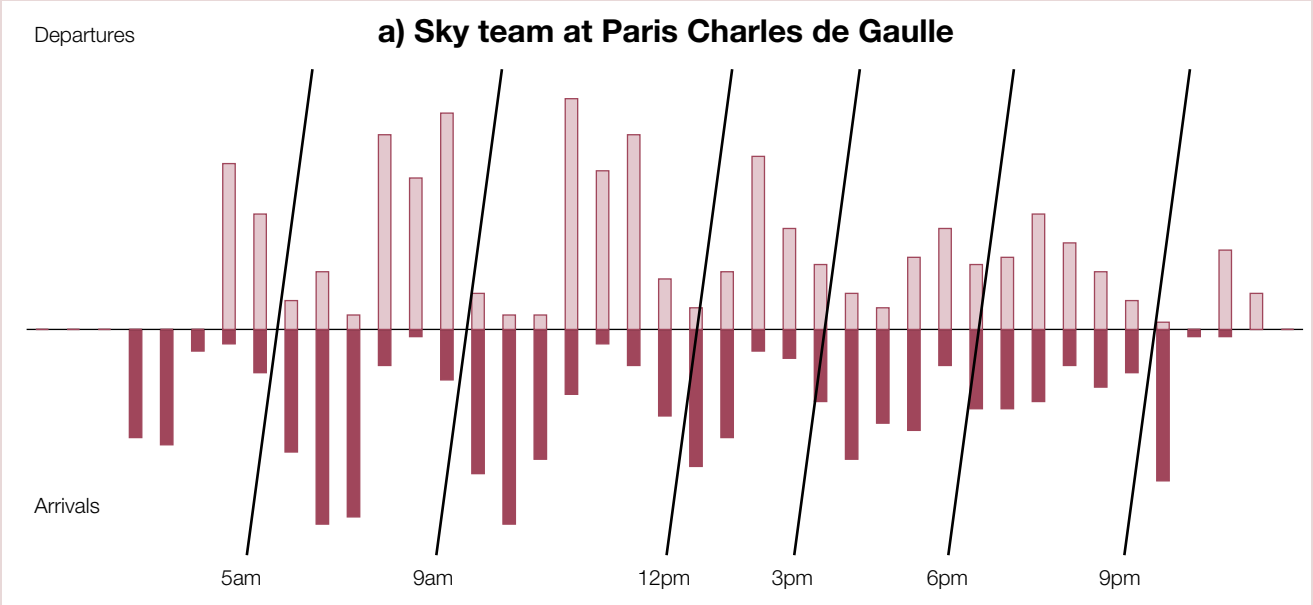
3.10 Multiple terminals set some distance apart are not well suited to connecting traffic. For this reason airline alliances usually have a strong preference for remaining within the same terminal. The design of the terminal itself is also important. For example, a long thin terminal with aircraft on one side only will increase walking distances for transfer passengers, whereas a circular or X-shaped layout with remote landside facilities is much more efficient for transferring passengers.

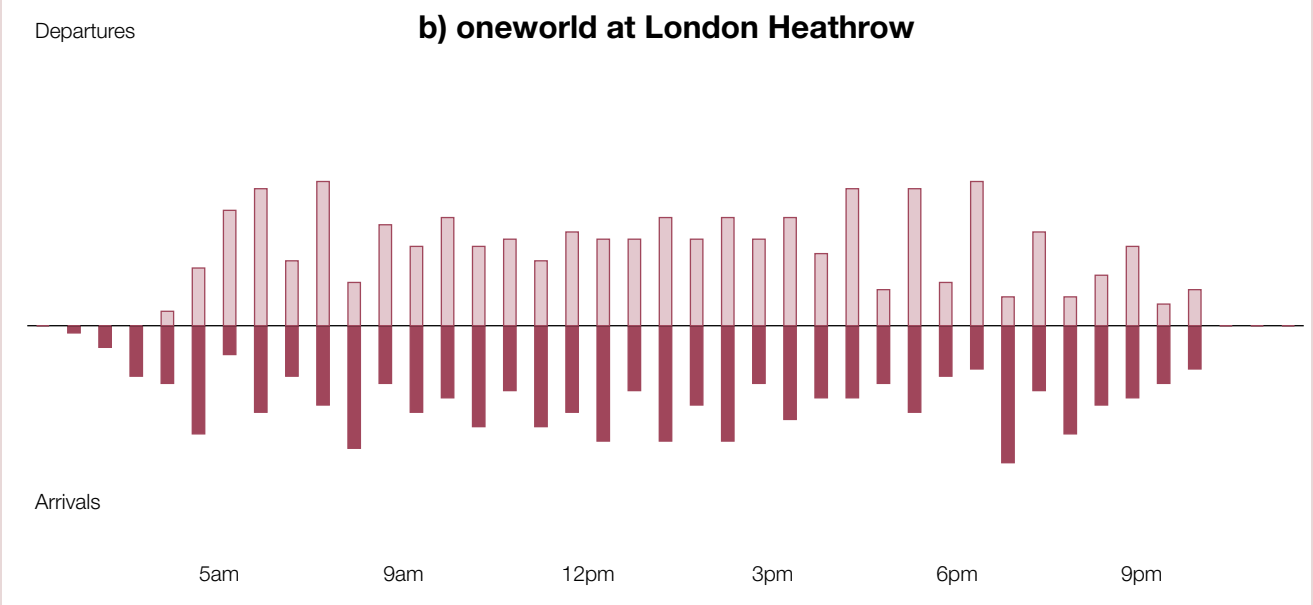
32 www.munich-airport.de/en/micro/tm/connect/index.jsp

## Box 3: Is Heathrow an effective hub?

The chart below demonstrates the limitations of Heathrow's ability to facilitate the wave system effectively – due to its runway-capacity constraints, the waves of arrivals and departures become "elongated", which makes waves much less pronounced than at other focal airports (here we compare oneworld's wave system at London Heathrow with SkyTeam's wave system at Paris Charles de Gaulle). Analysis of schedules by the CAA highlights the impact that this has; oneworld are able to offer an average of 31 feasible connections from each inbound flight at Heathrow whilst SkyTeam can offer an average of 38 at Charles de Gaulle and Star can offer an average of 50 at Frankfurt.[33]

**Arrival and departure waves for a) SkyTeam at Paris Charles de Gaulle and b) oneworld at London Heathrow**




Source: Based on an analysis of OAG flight schedule data for 15/06/2012 that includes connections within 3 hours to sensible onward destinations

33 CAA analysis based on OAG flight schedule data for 15/06/2012

## Airport characteristics

3.11 Europe's five largest airports in terms of passenger numbers are Heathrow, Paris Charles de Gaulle, Frankfurt am Main, Amsterdam Schiphol and Madrid Barajas. These are generally regarded to be the continent's main focal airports serving as a connection point to many of their passengers.

3.12 Most of the traffic at these focal airports is served by at least one of the three global alliances. Star Alliance, the biggest of the three, is headquartered in Frankfurt in Germany, but also uses other German airports, notably Munich and Düsseldorf, as its bases. Both SkyTeam and oneworld connect the majority of their passengers at two European hubs – SkyTeam from both Amsterdam (where its headquarters are) and Paris Charles de Gaulle, and oneworld (whose headquarters are in New York) from London Heathrow and Madrid Barajas.

3.13 A common characteristic of each of the five main European airports is that they provide a significant proportion of the international connectivity of the entire country in which they are located. This is particularly true for long-haul connectivity. For example, around 70% of passengers travelling between the UK and long-haul destinations use Heathrow.[34]

3.14 A combination of local demand and transfer traffic provides these airports with sufficient mass to provide greater connectivity than can be sustained at other airports. London and Paris have particularly large populations (12.3 million and 11.5 million respectively). Their main airports are sustained with proportionally fewer transfer passengers (34% and 31%) compared to those of Frankfurt and Amsterdam which have relatively small local populations (2.5 million and 1.5 million) but high proportions of transfer passengers (54% and 41% respectively).[35]

3.15 Thus it is possible to place the key characteristics of an airport into two categories. The first comprises the operational aspects of an airport – in very simple terms, an airport must be able to provide adequate facilities to serve the required numbers of passengers and it must be efficient and cost-effective enough for passengers and airlines to be satisfied with its services. This is particularly acute for focal airports where the need to transfer passengers and their baggage efficiently between connections goes to the heart of the operation.

3.16 The second key category relates to sources of passenger demand. A point-to-point airport will rely upon demand from its catchment area or from travellers wishing to visit its locality, whereas a focal airport may generate additional demand by attracting connecting passengers.

### Airport operations

3.17 Quality of service achieved by an airport's operations is clearly important, and there are several different components that account for it. For focal airports one of the most important of these components is an airport's capacity at peak times. Earlier we discussed how effective hub operations rely on creating waves of arrivals and departures to maximise their effectiveness. In order to be able to create such waves efficiently, an airport

34 CAA Airport Statistics

35 Data for Frankfurt: www.frankfurt.de Other cities: UN population division, 2010

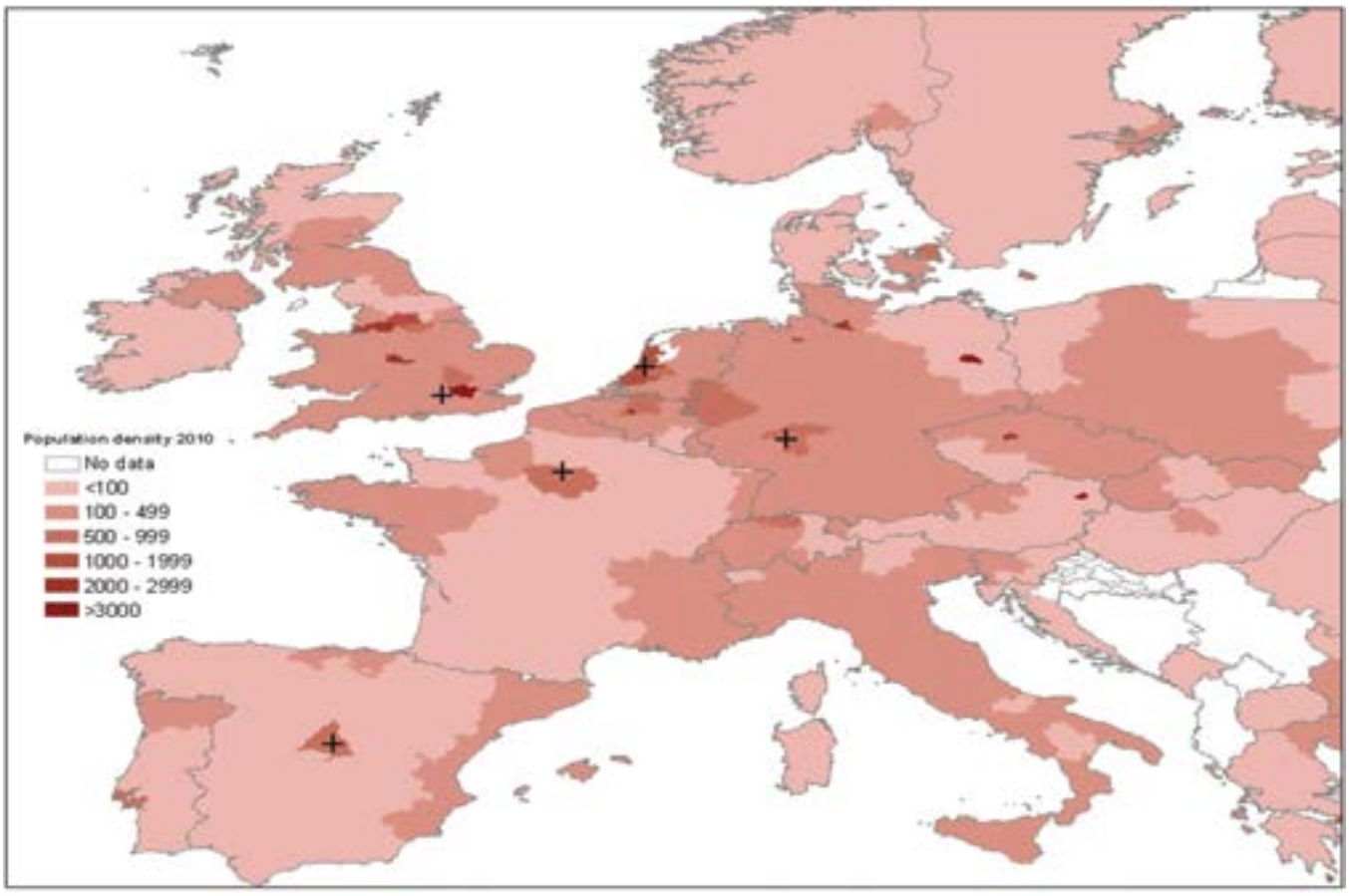
must have enough apron, terminal and runway capacity at peak times. The apron and terminal capacity of an airport decide on the number of aircraft that can be accommodated simultaneously. The runway capacity decides on how many take-offs and landings may be accommodated during peak times. If either of these capacities is insufficiently provided, the wave system will not be able to operate efficiently. These specific factors are of less importance to point-to-point operations. Here the general efficiency of passing passengers through the airport takes prominence and for low-cost carriers maximising the use of aircraft.

### Passenger demand

3.18 As demand is spread unevenly across countries and different regions in the world, it is attractive for airlines to choose airports located close to large urban areas. Two of Europe's largest airports, for example, are located close to the EU's largest metropolitan areas, London and Paris. Even where this is not the case, focal airports tend to be located in relatively densely populated parts of Europe (Amsterdam and Frankfurt are at the centre of regions that have population density of over 1,000 inhabitants per square kilometre) as depicted in Figure 3.4. In these cases the airports also rely on higher proportions of transfer passengers to sustain a dense route network.

3.19 Another key factor is the ability of an airport's location to attract leisure or business passengers. Business passengers in particular are usually of more importance to airlines as they

**Figure 3.4: Population density in Europe, 2010, with locations of major focal airports**




Source: Eurostat
Note: Based on NUTS 2 population density data

generate higher per passenger profit. Equally, well-functioning surface transport will ensure shorter onward journey times and improve local demand, especially amongst high value segments of the market.

3.20 Finally, passenger demand also depends on the geographical location of an airport in relation to both the most important passenger and freight traffic flows and a wide range of internationally significant markets. Even if an airport is not located close to a large agglomeration, it can still be attractive as a focal point due to its ability to serve specific connecting passenger flows. For example, Madrid (see Figure 3.4) is unsuited to intra-European traffic but is well-suited for serving the Europe/South America market. Although Copenhagen is poorly located in relation to mainland Europe and the main long-haul flows, it is well situated to act as a gateway to Scandinavia. Helsinki has a much smaller origin and destination market compared to other European focal airports but its geographical position gives it an advantage serving transfer traffic between Europe/North America and Asia/Pacific. For example, connections between New York and major Asian cities via Helsinki all benefit from a 200 to 500 mile advantage compared to connections made through London Heathrow or Dubai.[36]

## Advantages, disadvantages and trade offs

3.21 As set out in the Department for Transport's recent Aviation Policy Framework, the UK Government's overarching strategy for the country's aviation sector is to 'support its growth within a framework which maintains a balance between the benefits of aviation and its costs, particularly its contribution to climate change and noise'.[37] In this context, a key issue that the Airports Commission will need to consider is what capacity and connectivity would maximise the benefits to UK residents and businesses while minimising any costs. Any strategy inevitably involves trade-offs, and in this case the type of capacity favoured (hub-and-spoke, or dispersed[38]) as well as the physical location of the airports in question will determine who benefits and who is affected.

3.22 Broadly we might say that a hub-and-spoke network could potentially bring some additional connectivity benefits, but this is likely to be at the expense of those who live in close proximity. These costs will include noise, pollution and surface-transport congestion. In addition, a focal airport may draw traffic away from regional airports, and those who live further away may see a decline in connectivity. Conversely, a dispersed system of point-to-point airports may not deliver all of the connectivity benefits of a hub-and-spoke model, but it is likely to distribute costs and benefits more equitably across the country. In reality neither of these states will exist exclusively in their pure form and airport connectivity, at least in the UK, will continue to be a mix of both.

### Advantages, disadvantages and trade offs for UK residents and businesses

3.23 If connectivity indeed provides benefits to the economy through facilitating various kinds of cross-border business

36 www.gcmapper.com

37 https://www.gov.uk/government/publications/aviation-policy-framework

38 For example, Germany has a dispersed model where a number of large airports serve different regions of the country. See the international comparisons section at the end of this chapter for more details.

activity and to the consumer by providing more opportunities to travel, then focal airports must provide more of these benefits as they generate more connectivity than other airports – research shows that where focal airports specifically add value is provision of a greater number of more frequent long-haul routes.[39] A study by Bel and Fageda (2009) concludes that a 10% increase in intercontinental direct routes results in a 4% growth in international headquarters in European metropolitan areas.[40] Focal airports may thus generate significant additional incentives for businesses that rely on air travel and transportation to locate in their vicinity.[41]

3.24 On the other hand, even if focal airports produce additional economic and social benefits, there is a question of how significant these benefits are and to what extent a more dispersed network of airports would ensure benefits from aviation connectivity are distributed more evenly across the country, even if their overall impact is smaller.

3.25 In terms of costs, large focal airports with substantial market power usually charge a premium to airlines which is passed on to the consumer. In dispersed networks airports are more likely to effectively compete with each other, driving prices down and producing other benefits, such as product differentiation to meet the demand of a wider range of consumers. Also, a dispersed network of airports can offer more choice to the passenger by giving more access to medium-sized airports with relatively good connectivity.[42]

3.26 A dispersed network may offer greater scope and flexibility to respond to future changes in passenger demand. For example, if very high levels of passenger growth are experienced, there may be limits to the ability of a single focal airport to accommodate this efficiently, leading to delays and congestion and a diminished passenger experience. In contrast, with a dispersed network, the effects of such growth might be spread across a number of locations.

**Advantages, disadvantages and trade offs for the airlines and airports**

3.27 Airlines based at one large airport can benefit from economies of scale when it comes to staff utilisation and overheads, and effective utilisation of feeder traffic networks. Also, a major airport at the centre of the UK's route network may be able to compete for traffic with other European and non-European focal airports, which may in turn increase connectivity for UK users and make an airport a more attractive base for an airline as it would attract more connecting passengers.

3.28 These potential benefits, however, may be offset by the accumulation of market power by major airports and any resultant loss of competition. In the UK, Heathrow, Gatwick and Stansted airports are already designated to economic regulation. The charges that these airports levy on airlines are therefore controlled by the Civil Aviation

39 See Burghouwt (February 2013), "Airport Capacity Expansion Strategies in the Era of Airline Multi-hub Networks", International Transport Forum Discussion Paper 2013/05

40 Bel and Fageda (2008), "Getting there fast: globalization, intercontinental flights and location of headquarters"

41 For more examples: Airports Commission (March 2013), Discussion Paper 02: aviation connectivity and the economy, https://www.gov.uk/government/publications/discussion-paper-on-aviation-connectivity-and-the-economy

42 Lijesen, Rietveld and Nijkamp (2001), "Hub premiums in European civil aviation"

Authority (CAA),[43] which also ensures that they meet minimum service levels. Notably, non-aligned low-cost carriers that have been growing in the UK at a much faster rate than other carriers tend to prefer non-focal airports with lower charges.

## International operating models

3.29 This paper has focused on the theoretical extremes of possible airport models. A brief look at real world examples provides useful insight into how airports compromise between these two extremes.

3.30 Dubai International Airport's growth has been focused on providing a hub for international traffic. Since opening in 1960 it has become the largest airline hub in the middle east and the 4th largest for international passenger traffic in the world. The Airport and its related economic activity provides over a quarter of Dubai's GDP and is also a good example of what is possible despite a relatively small origin and destination market and with aggressive pursuit of competitive advantage through a strategic partnership between the Government, the airport and Emirates.[44] Key elements of this strategy are heavy investment in infrastructure (a new 5 runway airport planned for the future), competitive landing charges, targeting of underserved routes (particularly in Asia and Africa) and Dubai's strategic geographic location, with two thirds of the world's population within 8 hours flying time.[45]

3.31 A merger between Air France and KLM provides an insight into how a dual hub system can be successfully run, in this case Amsterdam Schipol and Paris Charles de Gaulle. The two focal airports both operate from large European origin and destination markets and both serve long-haul destinations where European demand justifies this. Such double service offers passengers more choice and benefits the airline alliance that can service high-yield local origin and destination demand at both airports. Where demand is below this threshold then the long-haul routes are focused on the focal airport with the largest relevant origin and destination market: francophone destinations are served only by Paris CDG, while Amsterdam serves northern European destinations.[46]

3.32 The structure of the airports sector in Germany is notable for its significantly different nature to that of its major European competitors, reflecting the country's more dispersed urban geography, with no single dominant city or region. The country's main airport, Frankfurt am Main, serves its major financial centre but not its capital city (Berlin) or its most populous region (the Rhine-Ruhr area). As a result, its 57 million passengers in 2012 accounted for a much lower proportion of total national aviation capacity than that provided by other major European hub airports. In contrast to other European nations, Germany is the only country other than the US and China to have two or more entries in the top 30 of the Airports Council International list of leading international airports.[47] Lufthansa

43 For more information on how the CAA regulates the charges paid by airports and airlines see http://www.caa.co.uk/default.aspx?catid=78

44 Oxford Economics (June 2011), "Explaining Dubai's Aviation Model"

45 http://www.dubaiairport.com/en/media-centre/Documents/Dubai%20Airports%20-%Strategic%20Plan202020.pdf, pg. 14-15

46 Further information: Burghouwt (February 2013), "Airport Capacity Expansion Strategies in the Era of Airline Multi-hub Networks", International Transport Forum, Discussion Paper 2013/05: http://www.internationaltransportforum.org/jtrc/DiscussionPapers/DP201305.pdf

47 Airports Council International (2013), 2012 world traffic rankings

operates a multihub system, mainly through its operations at Frankfurt am Main, Munich and Düsseldorf. However, rather than acting in a complimentary manner as per the Paris CDG and Amsterdam model, Munich and Düsseldorf with much smaller long-haul markets seem to operate more as "overflow" hubs to the main Lufthansa inter-continental operation at Frankfurt, catering for traffic on the thickest long-haul routes that cannot be accommodated at Frankfurt.[48]

3.33 Finally New York is often cited as a good comparison for London as a city with a similar size population and three major airports. The cities field comparable numbers of flights, and very similar proportions of long-haul international flights. And, if we define a focal airport in terms of connectivity through an airline alliance, then it is clear that both cities have one conventional focal airport: Heathrow (oneworld) and Newark (Star Alliance). The New York airport system is notable because its focal airport, Newark, is not the busiest airport serving the metropolitan area. John F Kennedy serves more passengers as a point-to-point airport and provides them with comparable connectivity (See Table 3.1).[49]

## Conclusion

3.34 The analysis above points out that there are two conditions an airport must meet to be successful: it must support efficient operations and generate sufficient passenger demand. Focal airports will pay greater emphasis to ensuring that the operations are efficient at processing transfers and arrivals and departures are grouped in "waves", whereas point-to-point airports will seek to maximise local passenger demand.

**Table 3.1: Top 10 destination for Newark and JFK airports in New York**

| | Newark Top 10 busiest international routes, 2011 | JFK Top 10 busiest international routes, 2011 |
|---|---|---|
| 1 | London | London |
| 2 | Tel Aviv | Paris |
| 3 | Frankfurt | Madrid |
| 4 | Toronto | Santiago (Dominican Republic) |
| 5 | Paris | Santo Domingo (Dominican Republic) |
| 6 | Munich | Frankfurt |
| 7 | Amsterdam | Tel Aviv |
| 8 | Brussels | Tokyo |
| 9 | Mumbai | Sao Paulo |
| 10 | Toronto | Amsterdam |
| | *6 Europe, 1 Asia, 1 Middle East, 2 North America* | *5 Europe, 2 Central America, 1 Asia, 1 Middle East, 1 South America* |

Source: Port Authority of New York and New Jersey, www.pamynj.gov/airports/

48 Ibid

49 See: Port Authority of New York and New Jersey (PANYNJ). Zupan (January 2013), "Upgrading to World Class: The Future of the New York Region's Airports", International Transport forum

3.35 Different models have different advantages and disadvantages. In this analysis the advantages of a concentrated airport operating model in terms of high levels of global connectivity to UK residents and businesses needs to be weighted against the domestic competition advantages of a dispersed model.

3.36 The Commission is interested in views on these issues. In particular we would like to invite submissions which shed light on the following questions:

- *What are the impacts on airlines and passengers of the fact that the wave system at Heathrow operates under capacity constraints?*
- *How does increasing size and scale effect the operation of a focal airport. Is there a limit to the vible scale of an airport of this kind?*
- *Would expanding UK hub capacity (wherever located) bring materially different advantages and disadvantages from expanding non-hub capacity? You may wish to consider economic, social and environmental impacts of different airport operational models.*
- *Do focal airports and non-focal airports bring different kinds of connectivity and, if so, which users benefit the most in each case?*
- *What would be the competitive effects (both international and domestic) of major expansion of hub capacity, and what are the associated benefits and risks?*
- *To what extent do transfer passengers benefit UK airports and the UK economy?*

# 4. The structure and operation of the UK aviation sector

4.1 This chapter examines the current structure of the UK aviation sector. It begins by setting out the respective roles of the country's major airports in supporting UK connectivity, and the impact of current capacity constraints on the number and frequency of destinations served. It goes on to consider the characteristics of the UK air passenger market, and the scope for the UK market to support more than one focal airport.

## UK airports: an overview

4.2 All the major UK conurbations are served by one or more airports, and aviation services are accessible to the large majority of the UK population. As can be seen in Figure 4.1 on p.35, however, most UK airports mainly provide short-haul domestic and European services, with long-haul routes to other countries focused on a smaller number of the largest airports.

4.3 Some long-haul routes (mainly to the US or the Gulf hubs) are served from Belfast International, Glasgow, Edinburgh, Newcastle and Birmingham, whilst Manchester Airport maintains a more substantial long-haul network. However, as set out in Table 4.1 on p.36, the largest numbers of long-haul services are to be found at the two largest London airports, Heathrow and Gatwick. This is likely to reflect the population density and high proportion of GDP in London and the south east, as well as the comparative attractiveness of London as a destination for foreign travellers, both business and leisure.

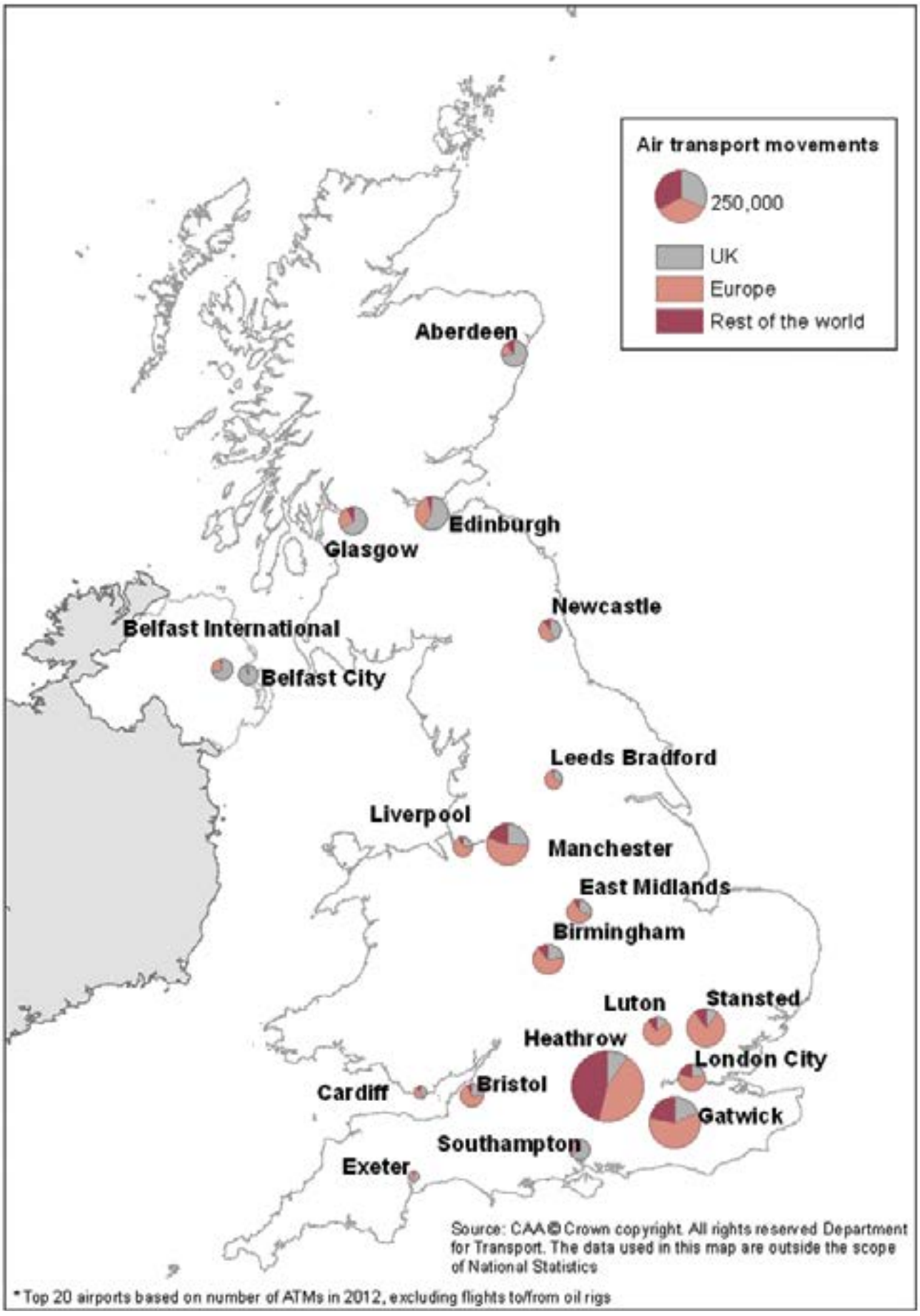
4.4 London airports evidently play an important national role in providing connectivity, for example by enabling passengers from UK regions to connect to long-haul destinations that are not served by regional airports. Taken together the capital's five major airports served more destinations in 2012 than any other European city – over 360 with a least a weekly service.[50] London's 5 airports also offer more capacity for passengers than any other city. For example, there were 86 million seats available on scheduled flight departures from London compared to 71 million from New York in 2011.[51]

4.5 The UK's airports also play an important role in respect of freight transport, as described in the Airports Commission's earlier discussion paper on aviation connectivity and the economy. More freight passes through Heathrow than any other airport, almost the entirety of which is carried in the hold of passenger services, enabling shippers to benefit from the dense route network offered by the airport. Only a very small number of freight-only services operate from Heathrow due to the significant capacity constraints described below.

50 CAA Airport Statistics weekly service: where a destination has at least 52 passenger flights a year

51 OAG data

**Figure 4.1: Air Transport Movements at major UK airports, 2012**




Source: DfT Statistics

**Table 4.1: Characteristics of the UK's five largest airports, 2012**

| | Heathrow | Gatwick | Manchester | Stansted | Luton |
|---|---|---|---|---|---|
| **Passengers** | | | | | |
| Terminal Passengers (millions) | 70.0 | 34.2 | 19.7 | 17.5 | 9.6 |
| Transfer passengers | 37% | 7% | 2% | 4% | 2% |
| Business passengers | 30% | 15% | 19% | 15% | 16% |
| **Destinations (at least weekly)** | | | | | |
| UK destinations | 8 | 12 | 15 | 7 | 7 |
| European destinations | 70 | 121 | 103 | 141 | 80 |
| Rest of the world destinations (long-haul) | 90 | 50 | 35 | 3 | 3 |
| Total destinations | 168 | 183 | 153 | 151 | 90 |
| **Destinations (at least daily)** | | | | | |
| Total destinations | 118 | 101 | 61 | 60 | 32 |
| Rest of the world destinations (long-haul) | 53 | 10 | 8 | 0 | 1 |

Source: CAA Airport Statistics

4.6 Other airports with significant freight operations include Stansted and East Midlands, which benefit from greater capacity availability and fewer restrictions on night flights. These airports are able to accommodate higher numbers of freight-only services, and have attracted the UK air freight operations of the major international express freight firms.

## Capacity constraints at UK airports

4.7 Given their important national role, it is perhaps unsurprising that London airports are both the busiest and the most capacity-constrained in the country. Taken together, the five London airports (the four mentioned above plus London City) were at 81% capacity in 2011 and they are forecast to be 90% full in 2020 and almost completely full by around 2030.[52] However, this is in sharp contrast to the picture at a national level where DfT forecasts predict that even by 2030 only around 50% of total runway capacity will be used.

4.8 Heathrow has been operating at or close to capacity for approximately 10 years. The apparent result of this has been for profitable routes to be operated at higher frequencies than other airports but with aircraft operators consequently reducing the total number of destinations they serve from the airport over time. The total number of destinations available from Heathrow with at least a weekly service reached a high point of 175 in 2006, declining to 163 in 2011. The number of international destinations served at least weekly reached 166 in 2006, declining to 156 in 2011.[53]

52 DfT (January 2013), UK Aviation Forecasts, https://www.gov.uk/government/publications/uk-aviation-forecasts-2013

53 DfT analysis of CAA Airport Statistics

**Table 4.2: UK regional services to major airports, 2012**

| London Heathrow | London Gatwick | Amsterdam Schiphol | Frankfurt | Dubai |
|---|---|---|---|---|
| Aberdeen | Aberdeen | Aberdeen | Aberdeen | Birmingham |
| Belfast City | Belfast City | Belfast City | Birmingham | Glasgow |
| Edinburgh | Belfast Int | Birmingham | East Midlands | Manchester |
| Glasgow | Edinburgh | Bristol | Edinburgh | Newcastle |
| Leeds Bradford | Glasgow | Cardiff | Guernsey | |
| Manchester | Guernsey | Durham TV | Manchester | |
| Newcastle | Inverness | East Midlands | | |
| | Isle of Man | Edinburgh | | |
| | Jersey | Exeter | | |
| | Newcastle | Glasgow | | |
| | Newquay | Guernsey | | |
| | | Humberside | | |
| | | Inverness | | |
| | | Jersey | | |
| | | Leeds Bradford | | |
| | | Liverpool | | |
| | | Manchester | | |
| | | Manston | | |
| | | Newcastle | | |
| | | Norwich | | |
| | | Southampton | | |

Source: Airports Commission analysis

4.9 This pattern is repeated in relation to domestic routes. The number of domestic UK destinations served at least weekly from Heathrow has fallen to seven in 2013, compared to 10 in 2000. Other London airports continue to serve a wider network of UK destinations, with links to Gatwick providing some access to long-haul connectivity for cities and regions no longer connected to Heathrow. It should be noted, however, that if capacity constraints at Gatwick become more severe, this may impact on the number of domestic airports that are served, depending on how the airport's route network develops.

4.10 Given the significant proportion of the UK's long-haul connectivity accounted for by Heathrow, this trend may to some degree have reduced access to long-haul aviation from many UK regional cities. It should be noted, however, that as domestic connections to Heathrow have declined, many new routes have opened from the UK regions to other focal airports, providing additional opportunities to access long-haul services. Initially these routes have been to European focal airports, although more recently an increasing number of direct connections to the major Gulf hubs from regional UK airports have been established. Table 4.2 above sets out the services offered from regional UK destinations to a range of major airports.

4.11 A number of these routes are operated by low-cost airlines, which may require passengers to self connect, potentially limiting their practicality as feeder routes into long-haul services. In addition, some routes to international hubs are from destinations that are too close to London to justify an air link, such as Southampton or East Midlands, but

which have good surface connectivity to the capital.

4.12 In future, the Department for Transport's demand forecasts indicate that the capacity constraints at the UK's airports, and particularly in London and the south east, are likely to become more severe. Heathrow's runways are already full at most times of the day, while Gatwick is forecast to be unable to accommodate any additional services by around 2020, as is London City. Stansted and Birmingham are forecast to be full by around 2030, although Birmingham and Manchester could have spare capacity beyond 2030 assuming some further improvements to infrastructure and operations.[54]

4.13 The scarcity of slots at congested airports such as Heathrow has led to a secondary market at those airports with airlines paying substantial amounts to acquire the most attractive peak-time slots. Recent estimates suggest that an early morning daily slot at Heathrow is valued at around £15 million.[55]

## The UK air passenger market

4.14 The UK has a strong aviation market that served around 219 million passengers in 2011. London in particular, with its five key airports, is one of the world's biggest single aviation markets. Together the capital's five airports serve more passengers than any other world city and, in Heathrow, it incorporates the most heavily used international airport in the world.

### Trends in passenger numbers at UK airports

4.15 Heathrow is still by some distance the largest airport in the UK, handling more than twice as many passengers as the second most heavily used airport, Gatwick. Heathrow also has a much larger proportion of connecting passengers, 37% in 2012, than any other UK airport.

4.16 Gatwick, meanwhile, is the most intensively used single runway airport in the world in terms of number of flights (air traffic movements – ATMs). Heathrow facilitates fewer flights per runway but more passengers per runway than Gatwick and it does so through accommodating larger aircraft. For example, in 2011 the average number of passengers per flight at Heathrow was 146 compared to 138 at Gatwick and a UK average excluding Heathrow of 100.[56]

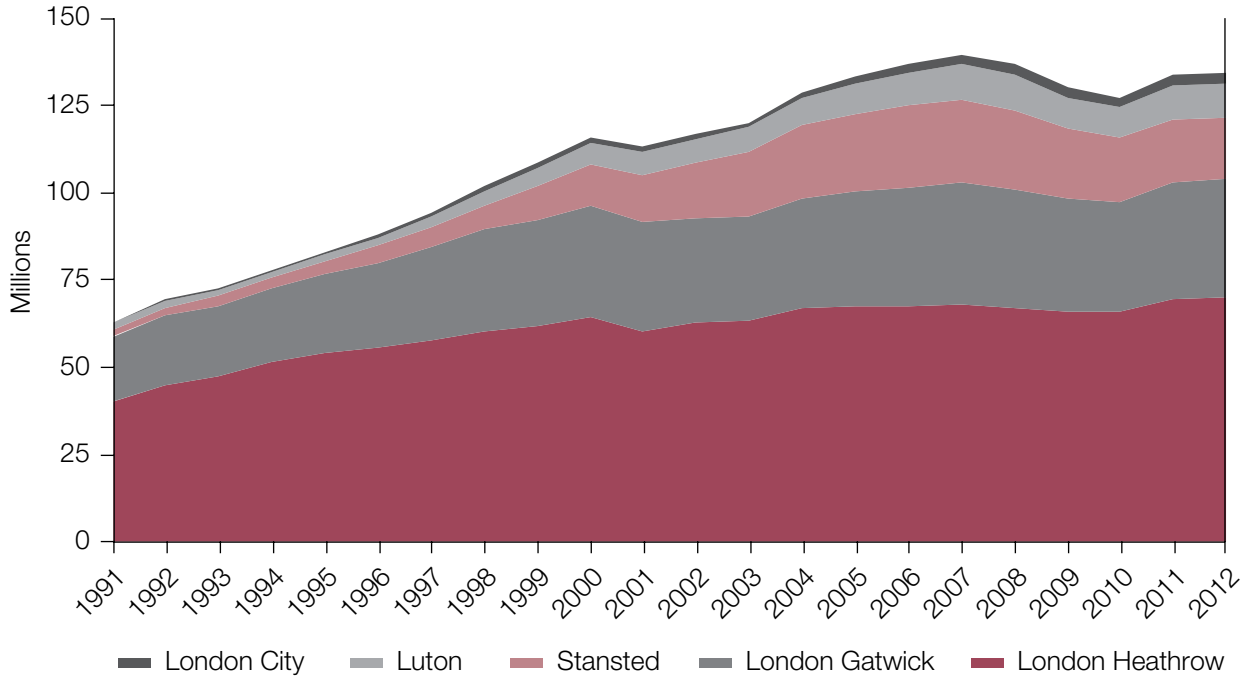
4.17 As can be seen from Figure 4.2 on p.39, which shows changes in passenger numbers at the five main London airports since 1991, passenger growth at the smaller London airports (Stansted, Luton and London City airports) has outstripped that at the two largest airports, Heathrow and Gatwick. However, these smaller airports – particularly Stansted, but also Luton and Gatwick – were also more strongly affected by the economic downturn since 2007 than Heathrow and London City.

54 DfT (January 2013), UK Aviation Forecasts, https://www.gov.uk/government/publications/uk-aviation-forecasts-2013

55 http://www.routesonline.com/news/29/breaking-news/164365/world-routes-economic-downturn-drives-down-slot-prices/

56 The UK average is from all CAA reporting airports, that is airports with regular scheduled passenger flights

**Figure 4.2: Passenger numbers at London Airports, 1991 – 2012**




Source: CAA Airport Statistics

4.18 These trends have significantly affected the relative share of passengers using Heathrow and Gatwick compared to the other London airports. Two decades ago only 6% of London passengers used Stansted, Luton or London City airports, but by 2010 their combined share had increased to 24%. This is likely to reflect the rapid growth of low-cost airlines in the UK which has driven increases in passenger numbers at Stansted and Luton. Capacity constraints at Heathrow, on the other hand, may help to explain the rise in passengers at London City, an airport mainly used by business passengers as depicted in Figure 4.3.

4.19 Regional airports, meanwhile, have seen more significant growth in recent years. Between 2000 and 2007 passenger numbers increased by 63% at non-London UK airports,[57] compared to 21% in London. However non-London airports did experience a greater decline between 2007 and 2011, falling by 15%, compared to 4% across the London airports.[58] Manchester, Birmingham and Bristol are now the three largest regional airports in England, accounting for around 34.5 million passengers in 2012.[59]

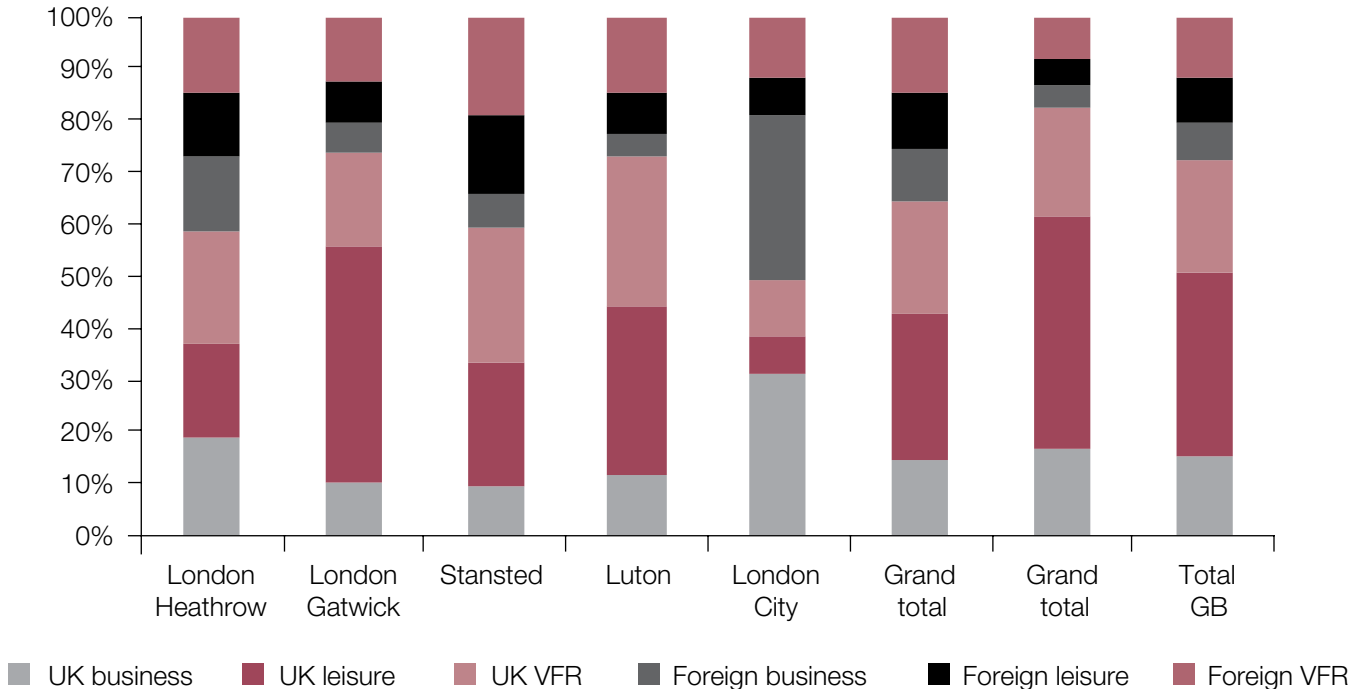
4.20 As can be seen from Figure 4.3 on p.40, business travellers account for a higher proportion of passenger numbers at regional airports than at any London airport other than Heathrow and London City, which may indicate the importance of these links for local and regional business sectors. Aviation links to London play a particularly important role for cities in Scotland and Northern Ireland, as they are needed not only for access to international connectivity via the capital's airports, but also – given their distance from London – to provide efficient links for business passengers and others to the city itself.

57 Also excludes Scottish airports

58 CAA Airport Statistics

59 DfT Transport Statistics Great Britain 2012, table AVI0102b

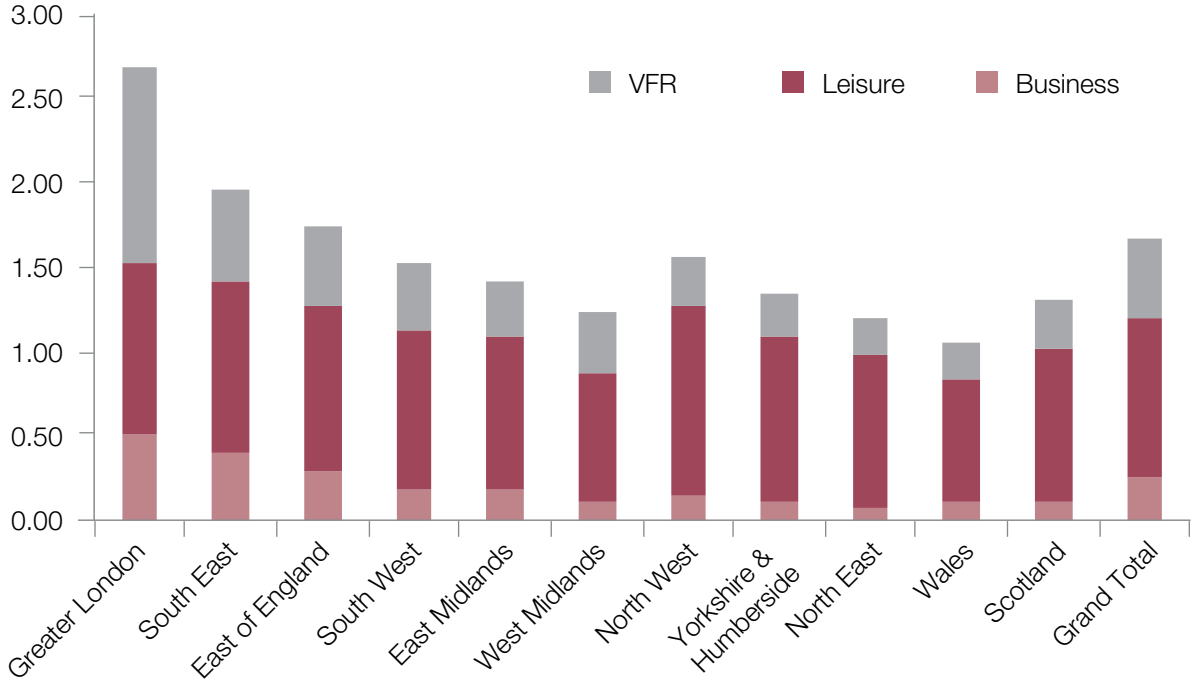
**Figure 4.3: UK airport passengers by residency and purpose of travel, 2011**




Source: CAA Passenger Survey 2011

4.21 Figure 4.4 sets out the number of flights taken per year, on average, by residents of each of the UK regions and nations. It indicates that residents of London and the south east have much higher propensity to fly abroad than residents of other regions of the UK. While on average in the UK, each resident takes just over 1.5 flights abroad per year, a resident of London takes on average 2.5 flights and a resident of the south east takes almost 2 flights per year.

**Figure 4.4: Passengers flying abroad per head of population, by UK region and purpose of travel**




Sources: CAA Passenger Survey (several years weighted to 2010 levels) and ONS 2009 population statistics

4.22 London's higher overall propensity to fly is mainly explained by the higher number of international residents than in other regions and by its economic profile, with many more London residents taking flights abroad to visit friends and relatives (VFR) and a higher level of aviation use for business purposes. In contrast, the propensity of London residents to fly for leisure purposes appears to be closer to the UK average, and broadly similar to some other regions, such as the north west.

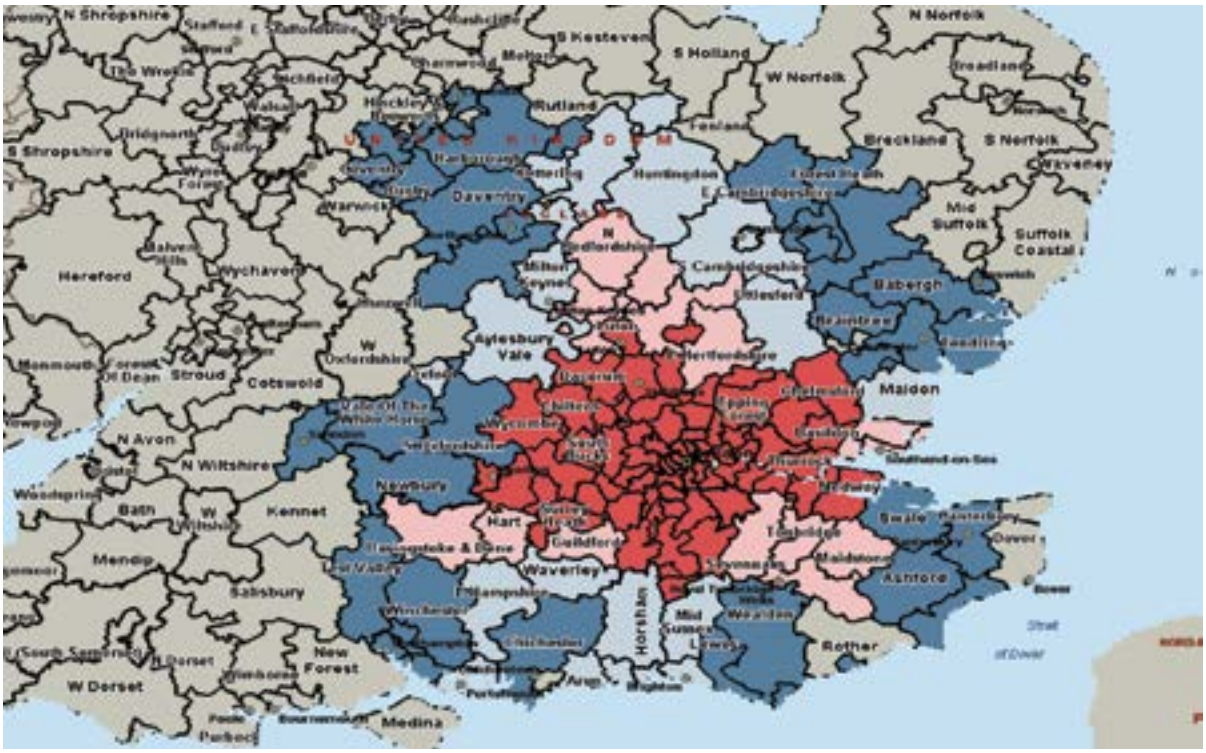
### Airport competition and passenger choice

4.23 There is significant overlap between the catchment areas of airports in a number of regions of the UK, which indicates some degree of passenger choice. However, the extent to which airports compete in practice will depend on specific factors such as the overlap of the routes that they serve and how time-sensitive passengers are – a leisure traveller may be willing to travel for a longer time to access a cheaper service, whereas business passengers may place a greater premium on their time.

4.24 Opportunities for competition exist in a number of areas – for example, between Edinburgh and Glasgow airports, between Manchester and Liverpool, or between Birmingham and East Midlands. The most significant potential for competition, however, is likely to be in London and the south east, which is served by as many as six major airports, and with the potential for other airports to become significantly more accessible as new high speed rail infrastructure is completed.

4.25 Figure 4.5 shows the overlaps of the surface travel time catchment areas for

**Figure 4.5: Number of London airports within 90 minutes travel time of English local authority districts**




Blue: 1 airport; Light blue: 2 airports; Light red: 3 airports; Red: 4 airports

Source: CAA analysis (using DfT surface access data)

four London airports[60] – Heathrow, Gatwick, Luton and Southend – based on a 90 minutes threshold. A substantial number of areas (those coloured in red), including most of Greater London, are located within 90 minutes of all four London airports. Several other areas are within 90 minutes of 2 or 3 airports, particularly around north and south west London. Subject to the caveats set out above, this suggests that many passengers in and around Greater London may have significant levels of choice between airports – particularly in relation to short-haul services.

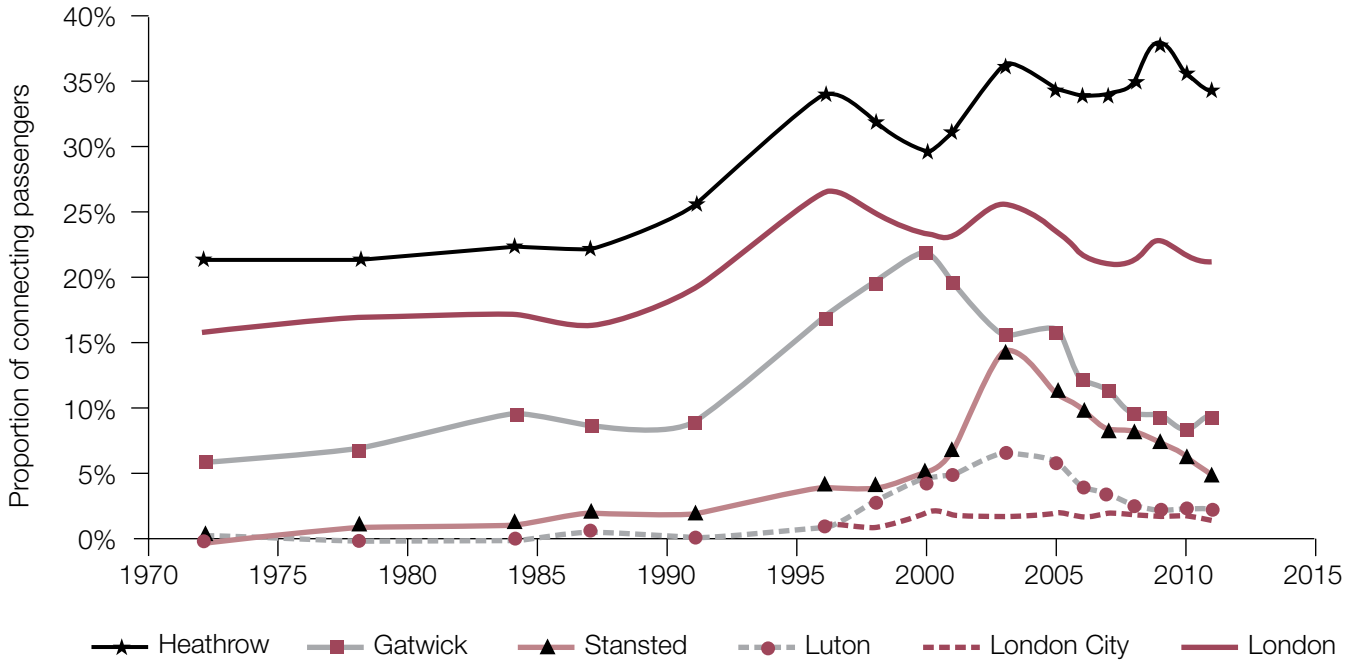
### The transfer passenger market

4.26 Heathrow has the highest share of connecting passengers (37%) of all UK airports. Most of these passengers connect within three airline alliances present at Heathrow: oneworld, Star Alliance and SkyTeam. Heathrow is the home base of its largest customer, British Airways (oneworld alliance); no other airline at Heathrow provides as much connecting traffic as British Airways.

4.27 About 8% of Gatwick's passengers connect between flights at the airport, the second largest share after Heathrow. At Stansted, only 6% of passengers connect between flights and, given the prevalence of low-cost carriers at the airport which do not facilitate connecting traffic, most of these passengers self-connect. The figures at regional airports are smaller still, with only 2% of passengers transferring at Manchester, the regional airport offering the most significant long-haul network.[61]

4.28 The shares of connecting passengers at London airports have changed markedly over the last 20 years, which is shown in

**Figure 4.6: Connecting passengers as a proportion of total passengers at London airports, 1972 – 2010**




Source: CAA Passenger Survey
Note: Some numbers have been interpolated for Stansted, London City and Luton airports and the data exclude passengers connecting between flights at different airports

60 London City and Stansted are excluded from the catchment area analysis

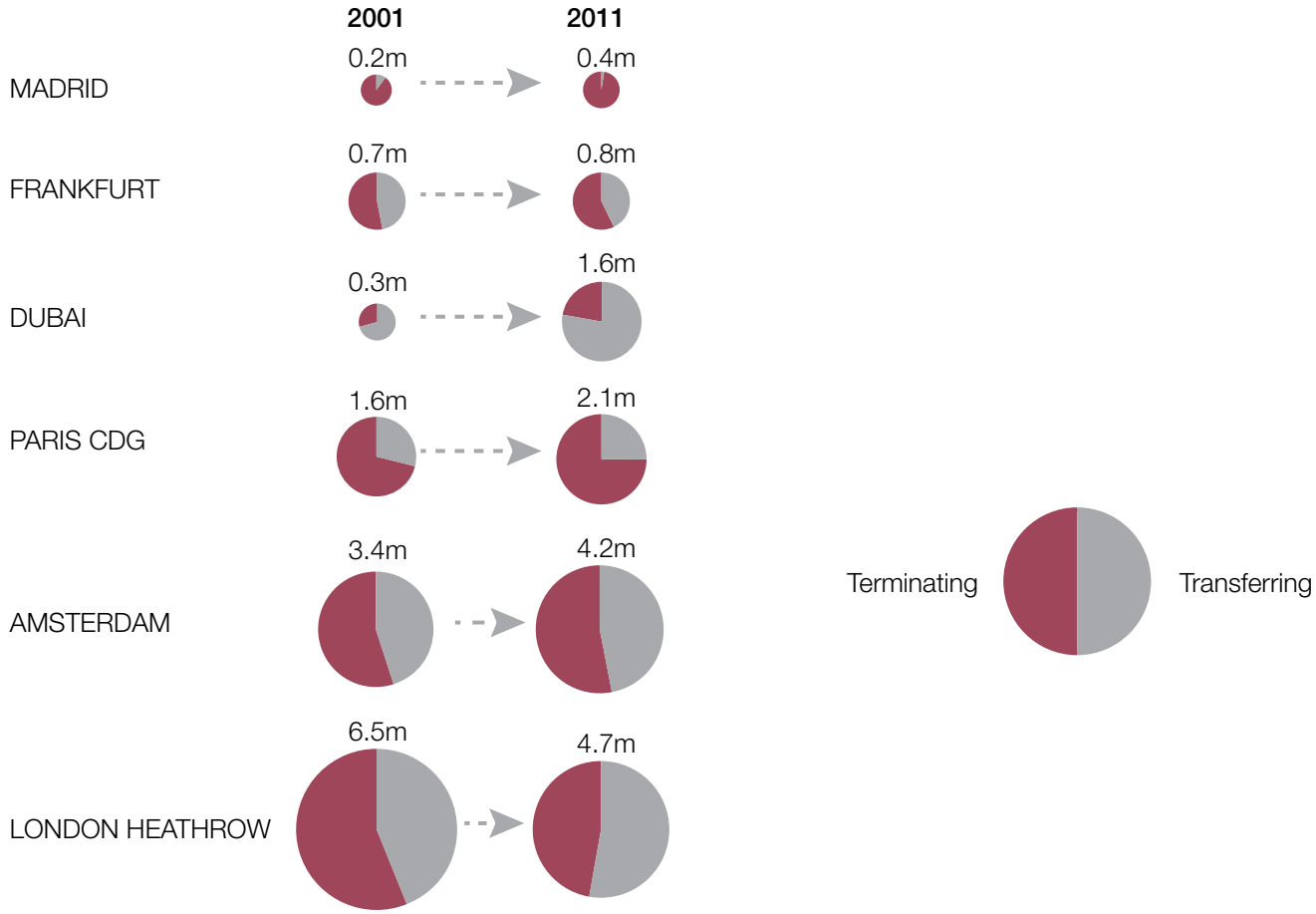
61 CAA Passenger Survey

Figure 4.6. Until the early 1990s the share of transfer passengers at all London airports was broadly flat, before rising substantially, first at Heathrow, then at Gatwick. Between 2000 and 2005 the share of transfer passengers also briefly spiked at Luton and Stansted, possibly as a result of the significant strengthening of the low cost carriers' route networks at these airports over this period.

4.29 While for the past decade a third of all passengers at Heathrow have connected to another flight, Gatwick's share of transfer passengers[62] has decreased very sharply since 2000, from over 20% to under 10% in 2010. The move of transatlantic flights to Heathrow following the liberalisation of the EU-US air services market, the abandonment of British Airways' dual hub strategy and the growth of low-cost carriers at Gatwick may all have contributed to this development.

4.30 However, even though Heathrow is currently the only airport in the UK that all three airline alliances use as their focal point for connecting passengers that by no means implies that all UK residents who cannot (or choose not to) go to their destination directly use Heathrow as a connecting point. Indeed, over recent years significant growth has been seen in the number of connections

**Figure 4.7: Estimated number of passengers flying to and from non-London UK airports to European hubs and then terminating or transferring to another destination (2001 and 2011)**




Source: CAA passenger survey

62 See footnote 1, pg.7

from UK airports to a range of international hubs. Figure 4.7 on p.43 shows the numbers of terminating and connecting non-London UK passengers travelling to major foreign airports.

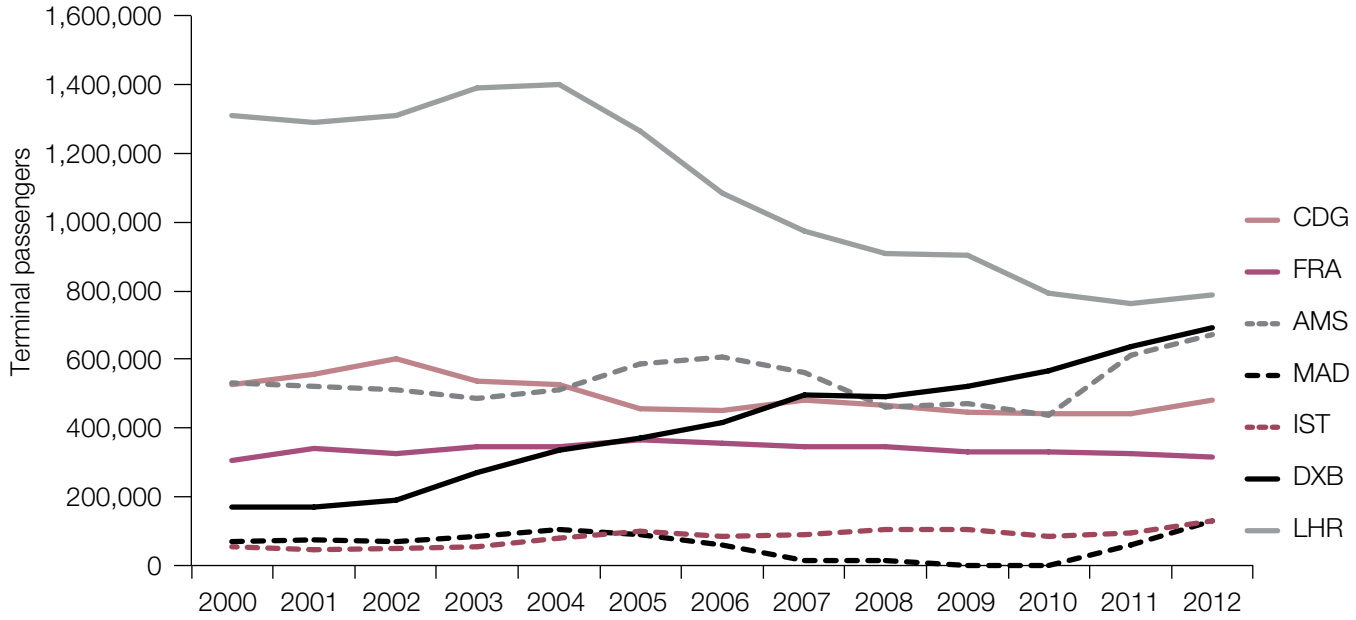
4.31 The figures show a substantial rise in the importance of non-UK airports as connecting points for UK travellers. In 2001, similar numbers of non-London passengers flew through both Heathrow and major foreign airports: 6.5 million passengers travelled through Heathrow and 6.3 million passengers through Amsterdam, Dubai, Frankfurt International Airport, Istanbul, Madrid and Paris Charles de Gaulle combined. 2.8 million and 2.6 million of these passengers changed onto another flight at Heathrow and foreign connecting airports respectively.

4.32 In 2011 however, the number of non-London passengers flying to and from Heathrow decreased to 4.7 million, of which 2.4 million passengers were transferring, while the number of passengers flying to and from foreign focal airports rose to 9.1 million, of which 4.1 were connecting. Interestingly, between 2001 and 2011, each of these foreign airports experienced a rise of non-London UK passengers, both terminating and connecting.

4.33 Similar trends can be observed when looking at specific non-London airports in isolation. For example, figure 4.8 below shows changes in numbers of passengers to and from Manchester Airport to a number of major focal airports. The numbers of passengers travelling to and from Heathrow over this period has declined significantly, although this is likely in part to reflect the impact of improvements in rail services to central London.

4.34 In contrast, the markets from Manchester to Amsterdam and, in particular, Dubai have seen significant growth over the same period. The success of the Gulf hubs in providing long-haul connectivity for travellers from the UK regions is reflected in the increasing number of services to and

**Figure 4.8: Manchester terminal passengers flying to major hubs, 2000 – 2012**




Source: CAA Passenger Survey

from the Middle East from airports such as Manchester, which itself now sees multiple daily services from all three major Gulf carriers.

4.35 *The Airports Commission is interested in any evidence of whether the fact that UK passengers and potential interlining passengers from abroad are using foreign airports for connecting to destinations of their choosing provides significant costs to these passengers or to the UK economy as a whole.*

4.36 This pattern is not repeated for passengers travelling to and from London airports to major focal airports abroad. Three European airports – Schiphol, Frankfurt and Charles de Gaulle – lost almost 3 million passengers from London airports between 2001 and 2011, although proportionately the fall in the number of connecting passengers was significantly smaller – from 1.5 million in 2001 to 1.2 million in 2011.

4.37 Madrid was the only European hub to experience a rise in passengers arriving and departing from London – from 1.6 million to 2.5 million. At the same time, the numbers of London passengers terminating and connecting at two large non-European airports, Dubai and Istanbul, grew from 1.5 million in 2001 to 3.4 million in 2011, with the number of connecting passengers increasing by 1 million to 1.7 million.

4.38 A key question for the Commission is whether the benefits provided by foreign connecting airports to the UK consumer in terms of increased choice and competition outweigh any potential costs of such transfers to the UK economy as a whole – for example in relation to possible direct long-haul routes from the UK that cannot be made commercially viable as a result of limited connecting traffic at key London airports.

4.39 We have used the DfT forecasting model to attempt to consider this issue and, in particular, to assess the impact on overall levels of transfer traffic at UK airports from passengers using foreign hubs to connect as a result capacity constraints in the UK. Comparing DfT's constrained and unconstrained forecasts shows a higher number of trips taking place via hubs outside of the UK in the constrained case. These results indicate that by 2050 capacity constraints could mean:

- An estimated 1 million fewer passenger journeys to or from UK airports made by passengers travelling between one international destination to another (for example, New York to Bangalore), and
- An estimated 2 million fewer passenger journeys to or from UK airports made by passengers travelling between a UK and an international destination (for example, Edinburgh to Beijing).

4.40 The model results also suggest that, of this increase in passengers starting or ending their journeys in the UK transiting through foreign hubs, more than 60% would choose to use a Gulf hub as opposed to Amsterdam, Paris or Frankfurt, reflecting the difference in service frequency for those routes affected. Figure 4.9 shows the predicted origins and destinations for these passengers in both 2030 and 2050.

**Figure 4.9**

Lost international-to-international transfer passengers

2030

2050

Additional UK origin and destination passengers using foreign hubs

2030

2050

Source: CAA Passenger survey

4.41 *The Commission would welcome submissions covering the potential impacts of capacity constraints at UK airports on the international transfer market. This might include consideration of whether this analysis accurately reflects likely future patterns of demand, how the modelling could be supplemented or enhanced, and what additional evidence might be taken into consideration, either supporting or challenging the analysis.*

## Could the UK support two focal airports?

4.42 The London airports system is estimated to be larger than that of any other city in the world – serving more than 140 million passengers in 2010 compared to approximately 103 million passengers at New York airports and 98 million passengers at Tokyo airports (the second and third busiest airport systems).[63] Given the comparatively low proportion of transfer passengers at London airports compared to their European and Gulf competitors, this indicates an extremely substantial origin and destination market. For these reasons, the Commission has considered whether it may be viable for the London market to sustain two separate focal airports.

63 http://centreforaviation.com/analysis/beijing-to-overtake-london-as-worlds-largest-aviation-hub-massive-new-airport-planned-58776

**Box 4: The role of night flights**

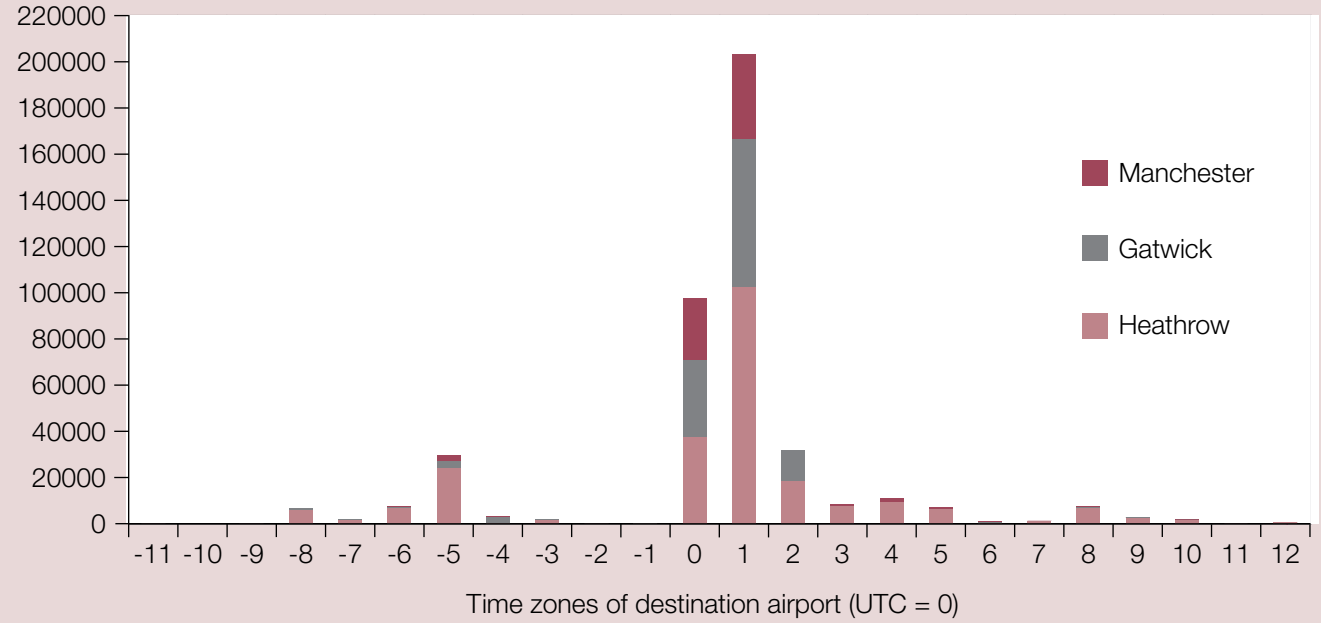
Increasing connectivity has led focal and point-to-point airports to consider further when passengers arrive and depart, in some cases introducing night flights. Noise impacts of night flights are regarded as far less acceptable than those of day flights which is why historically restrictions on operations of aircraft at night have been imposed. Supporters of night flights argue that they are essential for the international competitiveness of UK airports and ability to facilitate cargo freight operations.

Our initial analysis, shown in Figure 4.10, suggests that there a few destinations over GMT+8 hours that could potentially benefit from relaxing early morning flight restrictions at London airports. For example, flights leaving from Hong Kong at 23.00 and arriving at London Heathrow at 5.30 (current night flight quotas operate between 23.30-6.00) would enable business travellers to make the necessary connections onward to other regional or European destinations for the working day. As other EU airports operate in a GMT+1 time zone they have an advantage over the UK when it comes to incoming flights from Asia.

There was unused night movement capacity over the course of the last year at Heathrow, Gatwick and Stansted airports. Based on initial responses to the recent DfT consultation on night noise, airlines and airports appear broadly content with the current system of restrictions, though some pointed to the need for the next regime to take account of future operational demand.[64]

The Commission is also interested in how technological changes, for example the introduction of the Boeing 787 Dreamliner with a larger range, may alter the argument for night flights in the future.

**Figure 4.10: Passenger flight departures by time zone, 2012**




Source: CAA Airport Statistics

64 https://www.gov.uk/government/consultations/night-flights-consultation

4.43 We do not consider that spreading one airline's hub operations over multiple airports in the London metropolitan area is likely to be a successful approach. This is because it would be expected to diminish the economies of scale relating to staff costs and overheads, and route density benefits for that airline. These were described in more detail in **Chapter 3**.

4.44 A network airline that decided to split feeder traffic between two airports would risk a substantial loss of connectivity, unless its overall connectivity could be "unpacked" and divided up into two "bundles" which would be able to function relatively independently, or the two airports functioned as a 'virtual hub' as the 'Heathwick' concept.

4.45 If such an arrangement could ensure that connectivity loss would be minimal, it could have broader advantages for the airline. First, it would provide more than one potential location for new routes or increased frequencies and, hence, could create competitive pressures between the two airports to offer reduced pricing or other incentives. Second, in case of capacity constraints at one airport, it could provide opportunities to move some of its operations to the second location. And third, it could provide some resilience benefits in the event of severe weather or other disruptive incidents. These arguments may have been relevant to British Airways' attempt to operate a dual-hub system from Gatwick and Heathrow in the 1990s, which the airline subsequently abandoned.

4.46 Analysis undertaken by the Airports Commission illustrates why such attempts at 'unbundling', whilst attractive in theory, are difficult to achieve in practice. Figure 4.11 is a graphical, non-spatial, representation of Heathrow's route network, showing routes used by 5,000 or more passengers each year. The 'thickness' of the routes is indicated by the size of the dots, with the 'thickest' routes grouped around the edge of the diagram and labelled for ease of reference. The complexity of the diagram shows the interconnectedness of the different routes, with each line representing the feeder traffic from other routes within the network.

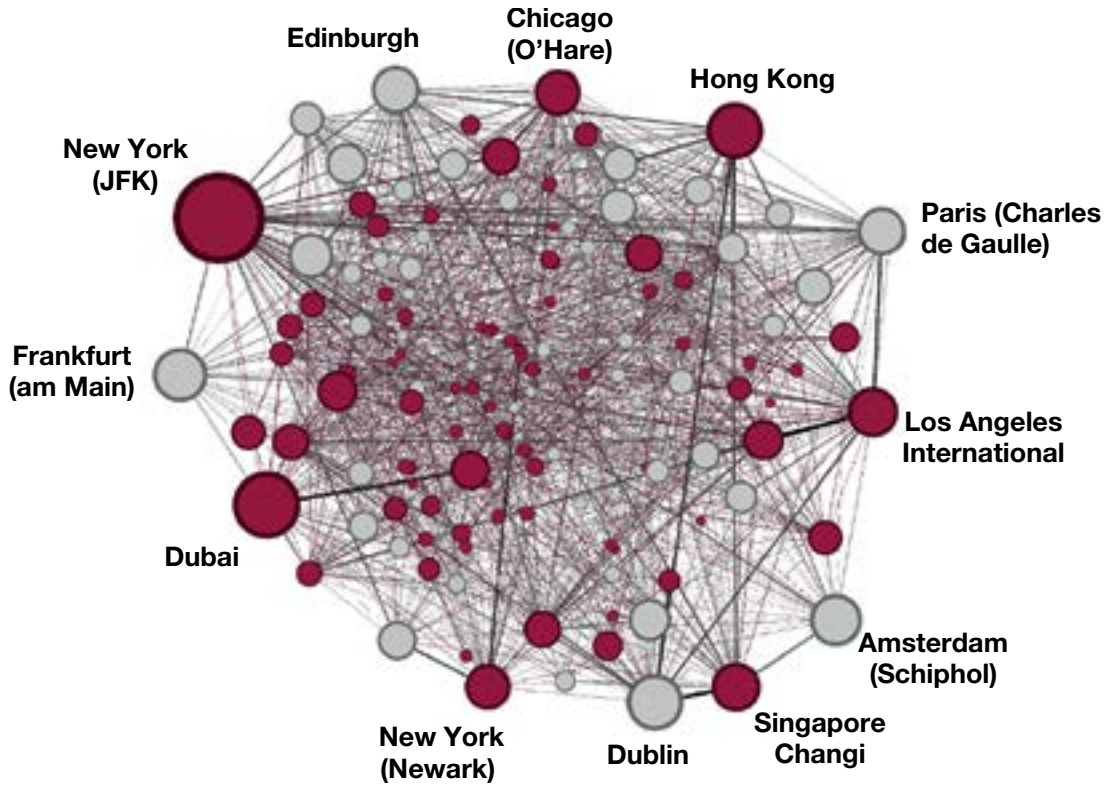
4.47 To make this clearer, Figure 4.12 isolates one 'node' within the Heathrow route network, namely Hong Kong, and any 'feeder routes' carrying more than 20,000 passengers per year. As the diagram illustrates, the Heathrow – Hong Kong route is supported by feeder traffic from a number of domestic and short-haul routes, such as Heathrow – Edinburgh, Heathrow – Dublin, Heathrow – Stockholm, and Heathrow – Barcelona. Any 'unbundling' that involved relocating one or more of these routes away from Heathrow would affect overall demand for the Heathrow – Hong Kong route, although the modelling presented here does not allow us to gauge the impact on the route's commercial viability.

4.48 This analysis suggests that it would be very difficult for a single airline to spread its hub operations over multiple airports. A complete alliance might, however, find it possible to transfer the entirety of its network to a different airport if it chose to do so and the necessary capacity was available.

4.49 Modelling work conducted for the Airports Commission by the CAA[65] demonstrates that if any of the alliances

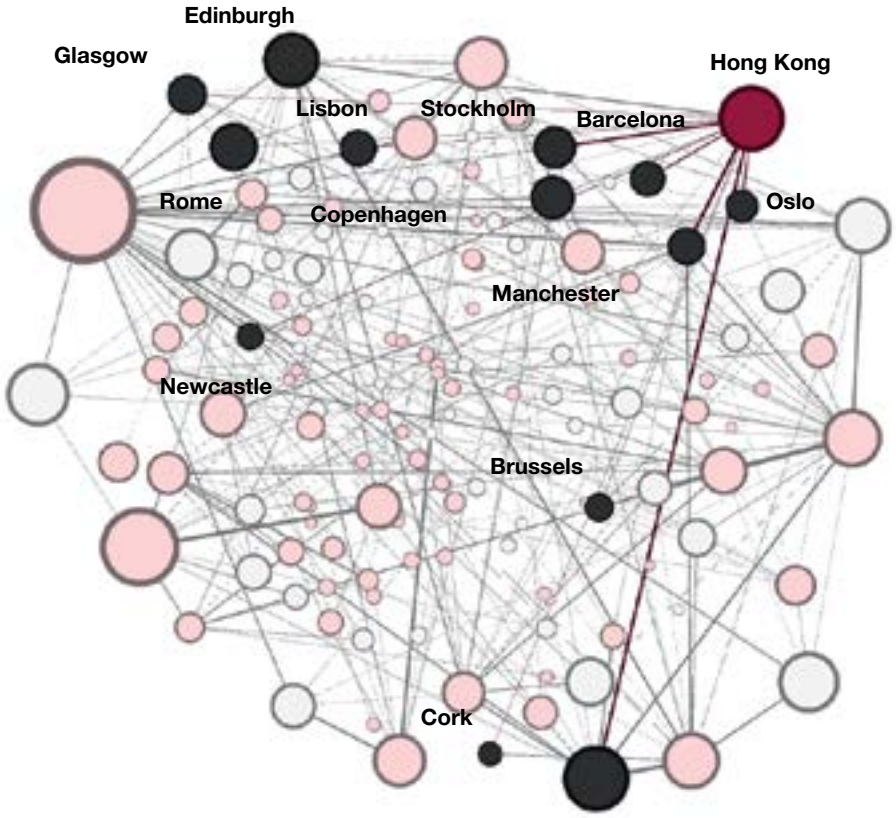
65 CAA plan to publish their own paper on this subject

## Figure 4.11: Heathrow's route network, 2011




Source: Airports Commission analysis (based CAA Passenger Survey data)

## Figure 4.12: Heathrow–Hong Kong and its feeder routes, 2011




Source: Airports Commission analysis (based CAA Passenger Survey data)

currently present at Heathrow – Star Alliance, oneworld or SkyTeam – opted to relocate to either Gatwick, Luton or Stansted, theoretically this would not result in substantial connectivity losses to passengers of that particular alliance.

4.50 The model developed by the CAA aims to help answer two questions:

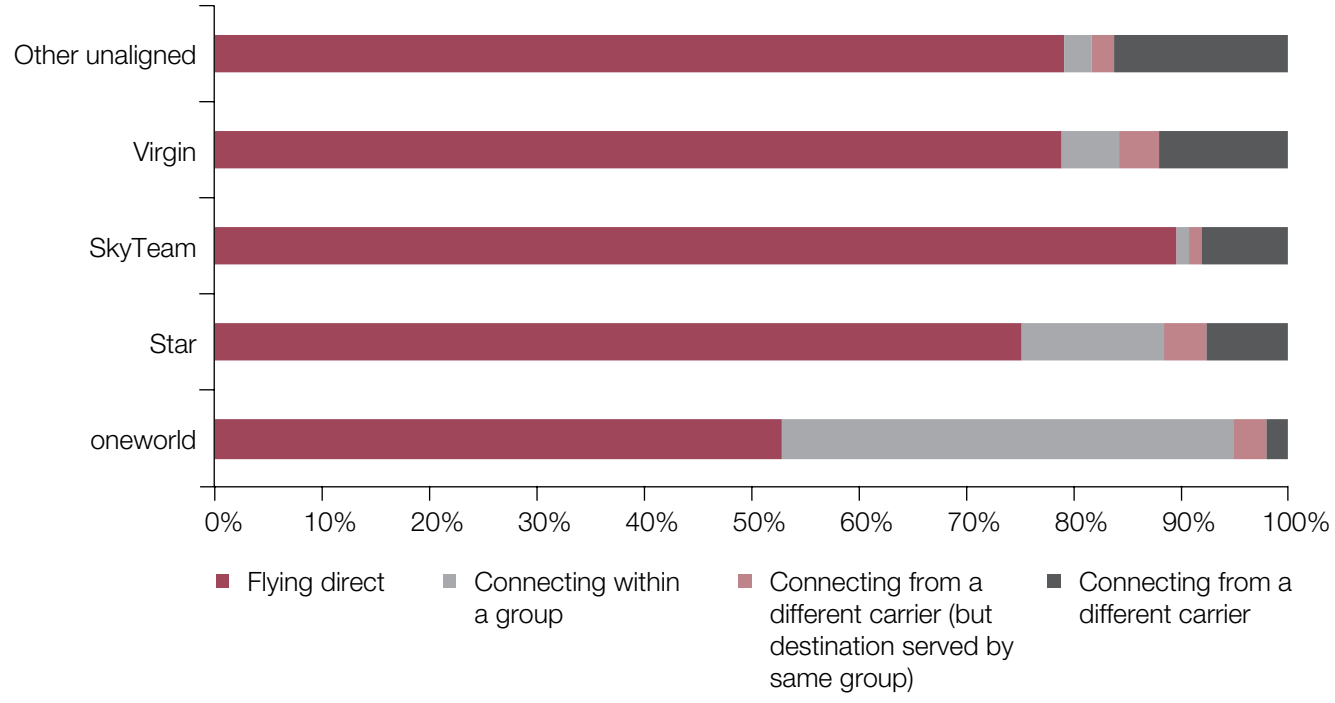
- To what extent does each alliance at Heathrow currently depend on feed from other carriers?
- How much of this feed could be provided at another London airport if an alliance were to relocate there?

4.51 The model splits Heathrow traffic into five different groups: oneworld, Star Alliance, SkyTeam, Virgin and other non-aligned carriers, which is depicted in Figure 4.13.

4.52 If an alliance opted to "transplant" to a different airport, it would be able to preserve traffic from the first three segments. This is based on a simplifying assumption of "geographical neutrality" on the part of passengers – in other words, an assumption that all direct connections within these segments would be preserved as exactly the same passengers would be willing to fly from the new airport. That is to say, the alliance would preserve all of its own passengers, and would also preserve passengers transferring from services offered by different carriers or alliances but which it also offers. As for the fourth group of passengers, the alliance is assumed to be able to keep only the traffic on routes which were served at the airport to which it is "transplanted".

4.53 In reality, this assumption of geographical neutrality is unlikely to be entirely borne out. The catchment areas vary between different London airports, meaning that some passengers would be less likely to transfer to an alternative airport than others. This would also be affected by the quality and speed of

**Figure 4.13: Passenger demand at Heathrow by airline alliance and demand segment, 2011**




Source: CAA analysis

surface access to different airports from key locations such as the City of London or the West End.

4.54 Pricing at different airports and the potential yields achievable would also play a role, and 'softer' factors might also have an impact, such as an airport's reputation or brand, and the quality of customer service offered.

4.55 The degree to which each of these factors might incentivise (for example lower charges) or deter (for example slower surface access links) an alliance or airline from switching, and whether any deterrent effects could be mitigated or addressed through investment or other mechanisms will be a key issue for the Commission to consider should our assessment indicate that expansion of the UK's aviation capacity is required.

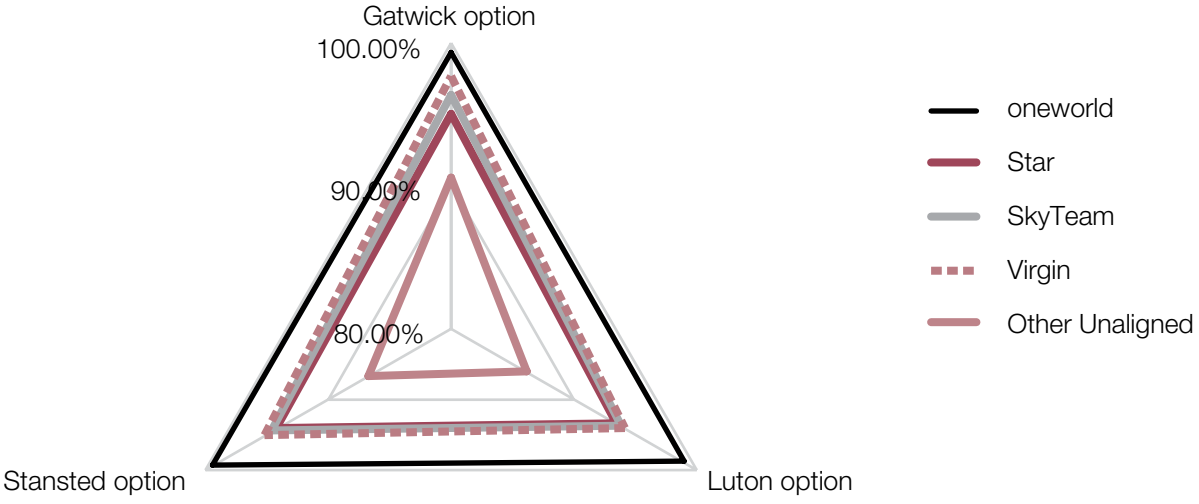
4.56 For the three alliances at Heathrow – oneworld, Star Alliance, SkyTeam – 2%, 7% and 8% of their traffic respectively connects from routes which are currently served only by airlines from outside of the alliance in question. This suggests that all three alliances are relatively self-sufficient at Heathrow. The values for Virgin and other unaligned airlines are higher at 12% and 16% respectively.[66]

4.57 Thus, under the assumptions above, up to 98% of all oneworld's traffic, 93% of Star's traffic and 92% of SkyTeam's traffic might be preserved if the alliance chose to relocate to a different London airport. Furthermore, this does not take into account any additional demand that might be generated from existing routes at the new airport which could provide a transfer feed for the alliance – for example, through self-transfers or facilitated connections from a low cost carrier.

4.58 The results of the modelling exercise are summarised in Figure 4.14 below.

4.59 It should be noted that although this suggests that the oneworld alliance could most effectively maintain its route network if it moved away from Heathrow, in practice the barriers to

**Figure 4.14: Traffic after an airline group has relocated to a different airport (per cent of original traffic at Heathrow), 2011**




Source: CAA analysis

66 CAA analysis

this would be relatively high given its current dominant position at the airport and the fact that it includes in British Airways, Heathrow's key network airline.

4.60 This analysis does, however, suggest that in the right conditions it might be possible for another alliance to relocate its services whilst maintaining approximately 90% or more of its passenger traffic. Understanding the viability of such a decision would require analysis of both the commercial impact of any loss in passenger traffic but also of any commercial opportunities presented by a change of location which might offset, or even outweigh, this.

4.61 Despite all of the above, and the lower charges at competitor airports, none of the alliances present at Heathrow has moved its network or services to another London airport. We have identified a number of potential reasons for this in current circumstances:

- Heathrow is currently the only London airport of sufficient scale to operate effectively as a focal airport;
- Heathrow is likely to be more attractive to airlines than other airports due to the high yields achievable;
- Heathrow's location to the west of London places it close to a high density of affluent travellers, and its surface access links offer comparatively more efficient access to central London;
- Heathrow is the UK's best-known airport, so overseas visitors may be prepared to pay more to fly into Heathrow than into other UK airports;
- The costs of switching airport are likely to be high, for example relocating staff, negotiating slots, and drawing up new schedules; and
- Moving away from Heathrow would release slots at Heathrow and, hence, could provide a benefit for competitors.

4.62 A further issue the Commission will need to consider is the scope for a UK regional airport to act as a secondary hub outside London and the south east. In Germany, for example, Munich has been developed as a secondary hub by Lufthansa since the 1990s, due to earlier capacity constraints at the airline's primary hub in Frankfurt. Together with Düsseldorf, Munich now effectively plays the role of an 'overflow' hub to Frankfurt.

4.63 Germany is unusual in having more than one hub, and this arguably reflects its relatively dispersed economic geography. The Commission would welcome views on whether a similar model could work in the UK, and what the advantages and disadvantages of such a model would be.

## Conclusion

4.64 This chapter has discussed the current structure of the UK aviation sector, the key characteristics of the UK air passenger market and the scope for the UK to support more than one focal airport.

4.65 The Commission would be interested in any submissions discussing these issues. In particular, respondents may wish to consider the following questions:

- *Is there any evidence that the UK (or individual countries and regions within the UK) are disadvantaged by using overseas focal airports?*

- *What specific characteristics of the UK and its cities and regions should be considered? For example, does the size of the London origin and destination market and the density of route networks support or undermine the case for a dominant hub?*

- *Could the UK support more than one focal airport? For example, could an airline or alliance establish a secondary hub outside London and the South East, for instance in Manchester or Birmingham?*

- *To what extent is it possible to operate a successful 'constrained' focal airport by focusing on routes where feeder traffic is critical and redirecting routes which are viable as point-to-point connections to other UK airports?*

# 5. Conclusions

5.1 This paper has discussed the nature of any additional aviation capacity that might be required in the UK. One strategy for the UK could be to further develop its hub capacity by investing in a large 'focal' airport and the necessary supporting infrastructure to ensure that it is accessible to the rest of the country. An alternative strategy could be to facilitate a more dispersed system of airports competing with each other to potentially offer the best deal to passengers. The UK aviation sector is currently somewhere between these two extremes, with Heathrow acting as a focal point for hub operations, but arguably not to its full potential, and a more competitive market operating between a number of other airports such as Gatwick, Stansted, Birmingham and Manchester.

5.2 Several of the UK's overseas competitors, for example in Amsterdam, Frankfurt, Istanbul and Dubai, either already have greater hub capacity than the UK or are seeking to develop their hub capacity further. The Commission will need to consider carefully how the UK should position itself in relation to these overseas competitors. This task is complicated by some important uncertainties around the future development of the aviation sector, such as the prospective role of airline alliances, the evolution of the low-cost market, and the potential importance of middle-eastern and far-eastern carriers. However other factors, such as the geographical position of the UK and the strength of the London origin and destination market, are known quantities and will continue to exert a significant influence over the development of the UK aviation sector.

5.3 We have set out in this document a number of particular areas in which we would welcome views and evidence. To guide those preparing submissions on airport operational models, we have set out below a number of more specific questions of interest. This should not be considered an exhaustive list, however, and we would welcome submissions covering any other relevant topics or issues.

- *Do you consider that the analysis supports the case for increasing either hub capacity or non-hub capacity in the UK? Is there any additional evidence that you consider should be taken into account?*
- *To what extent do the three potential futures outlined in Chapter 2 present a credible picture of the ways in which the aviation sector may develop? Are there other futures that should be considered?*
- *How are the trends discussed in Chapter 2 (e.g. liberalisation, growth of low-cost carriers, consolidation of alliances, and technological changes) likely to shape the future of the aviation sector? Do they strengthen*

*or weaken the case for developing hub versus non-hub capacity?*

- *What are the impacts on airlines and passengers of the fact that the wave system at Heathrow operates under capacity constraints?*
- *How does increasing size and scale affect the operation of a focal airport? Is there a limit to the viable scale of an airport of this kind?*
- *Would expanding UK hub capacity (wherever located) bring materially different advantages and disadvantages of expanding non-hub capacity? You may wish to consider economic, social and environmental impacts of different airport operational models.*
- *Do focal airports and non-focal airports bring different kinds of connectivity and, if so, which users benefit the most in each case?*
- *What would be the competitive effects (both international and domestic) of a major expansion of hub capacity, and what are the associated benefits and risks?*
- *To what extent do transfer passengers benefit UK airports and the UK economy?*
- *Is there any evidence that the UK (or individual countries and regions within the UK) are disadvantaged by using overseas focal airports?*
- *What specific characteristics of the UK and its cities and regions should be considered? For example, does the size of the London origin and destination market and the density of route networks support or undermine the case for a dominant hub?*
- *Could the UK support more than one focal airport? For example, could an airline or alliance establish a secondary hub outside London and the south east, for instance in Manchester or Birmingham?*
- *To what extent is it possible to operate a successful 'constrained' focal airport by focusing on routes where feeder traffic is critical and redirecting routes which are viable as point-to-point connections to other UK airports?*

5.4 Submitted evidence will inform the Commission's assessment of the nature, scale and timing of the UK's aviation capacity and connectivity needs, as part of its interim report at the end of 2013.

## How to respond

5.5 Submissions of evidence should be no longer than 15 pages and should be emailed to airport.models@airports.gsi.gov.uk clearly marked as a response to the 'Airport Operational Models discussion paper'. Evidence will be reviewed thereafter by the Commission. If further information or clarification is required, the Airports Commission secretariat will make contact as appropriate.

5.6 We are therefore inviting submissions and evidence by 11th July 2013 to inform our consideration of the nature of any additional aviation capacity that might potentially be required in the UK.

5.7 In exceptional circumstances we will accept submissions in hard copy. If you need to submit a hard copy, please provide two copies to the Commission Secretariat at the following address:

Airports Commission
6th Floor
Sanctuary Buildings
20 Great Smith Street

London SW1P 3BT

5.8 We regret that we are not able to receive faxed documents.

5.9 We are also expecting to hold public evidence sessions later this year to help us form our assessment of the UK's future capacity and connectivity needs. These sessions are expected to be based on this paper and the other thematic papers the Commission will be publishing, including on aviation and climate change, and on demand forecasting. More information on the structure and scope of these sessions will be published on our website: https://www.gov.uk/government/organisations/airports-commission.

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**Websites:**

A number of insightful papers for the International Transport Forum can be found at: http://www.internationaltransportforum.org/jtrc/RoundTables/2013-Expanding-Airport-Capacity/index.html

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