

Airport Operational Models

The Mayor of London's response

July 2013

1. Summary of key points

- I.1. In May 2013, the Airports Commission issued a Discussion Paper on Airport Operating Models (DP 04). This response addresses the issues raised, as per below.
- I.2. Accompanying this submission is a supporting Evidence Base document, providing further detail on some of the key issues. This includes data from a significant new analysis of destinations and frequencies under future airport expansion scenarios.

The Value of a Hub

- I.3. Hubs enable a virtuous circle of connectivity by aggregating demand for passengers and freight, drawing on origin/destination and transfer traffic and a comprehensive mix of shorthaul and longhaul flights.
- I.4. With a UK hub, that direct connectivity to the UK strongly benefits the UK economy. There are economic consequences for the UK when passengers hub abroad instead.
- I.5. A UK hub airport needs to serve London because a strong O/D catchment is key.
- I.6. Hubs continue to play a key role in aviation because they serve the economic interests of airlines and meet the connectivity needs of passengers and freight.
- I.7. Hubs are driven by anchor airlines – and not alliances. The potential to develop a hub-model based on low-cost airline traffic or 'self-connecting' is limited.

Key conclusion:

An effective hub airport is the only way of delivering the global connectivity we require

The Future Shape of Aviation

- I.8. Competition between hubs globally is becoming more intense – with a smaller number of superhubs emerging in Europe, Asia and elsewhere as the aviation market increasingly divides into the hubs and 'hub-nots'.

Key conclusion:

Hubbing will remain key but focused on fewer, globally competitive hubs

The Options for Delivering Hub Connectivity

- I.9. As well as a single-site hub with sufficient capacity, dispersed expansion is an alternative option proposed, with an additional runway at one or more London airports; a variant of this links two London airports with a high speed link (to mimic a single hub location). Growth at airports outside the southeast is also considered.
- I.10. According to the new route-by-route analysis undertaken, only a single, effective four-runway hub can meet the UK's connectivity needs; it would mean:
 - a quadrupling of destinations in emerging markets such as China and South America, 50% more in the US and restoration of domestic hub routes.
 - London serving 20% more destinations than under dispersed expansion (2-2-2), 35% more in North America and 160% more in South America.
- I.11. Attracting airlines to a new hub airport, underpinned by an anchor carrier, is feasible if Heathrow ceased to be the airport it is today. But under dispersed expansion, Gatwick and Stansted would struggle to attract airlines from Heathrow voluntarily.
- I.12. An effective hub airport with sufficient spare capacity will maximise passenger choice and promote airline competition, enabling new entrants, routes and frequencies. Dispersed expansion would do little for domestic competition while harming our international competitiveness, with no UK airport truly able to take on foreign hubs.
- I.13. Dispersed expansion faces challenges in the cost of new surface access infrastructure to two airports, the planning risks and complications in taking forward multi-site expansion and that Heathrow's dire noise impacts would continue unabated.
- I.14. Dispersed expansion in London – with Gatwick as a 'Second Force' in UK aviation – has been tried and failed. There exist no comparable multi-hub systems in one city region; the New York airports system, though oft cited, is not an example, nor is it a model of connectivity or efficient operation.
- I.15. A split site, even if it could overcome substantial barriers to transfers between sites, would be uncompetitive against rival hubs offering connections at a single location.
- I.16. Regional growth will continue to be an important element of UK aviation – but cannot offer the level of direct connectivity to serve as a substitute for hub airport capacity.
- I.17. In a world of intensifying hub competition, if London and the UK cannot provide the hub capacity to keep pace with demand, its global connectivity will suffer and business, trade and inward investment will begin to look elsewhere.

Key conclusion:

The capacity and global connectivity that the UK requires can only be provided with a new single, effective hub airport serving London

2. The Value of a Hub

A hub airport aggregates demand for passengers and freight

2.1. The hub airport builds a critical mass of demand of 'local' origin/destination (O/D) and transfer traffic – supporting a wide range of routes and frequencies that increases the airport's attractiveness. This in turn supports further routes and frequencies, creating a virtuous circle of connectivity that develops at the hub (see Figure 1 below).

2.2. Both the O/D and transfer flows are key – and the exact proportion of each will vary significantly from route to route. The transfer flows are underpinned by a comprehensive mix of both longhaul and shorthaul destinations, maximising journey opportunities.

A UK hub airport needs to serve London

2.3. To ensure sufficient O/D traffic, the airport needs a strong catchment area – in terms of total population but also economic profile: the hub airport needs to be situated in a region that is home to people and businesses with an above average propensity for air travel. In the United Kingdom, the London and the southeast region has the combination of population and economic profile to ensure the critical mass required to enable a hub airport. *[See evidence: A]*

2.4. Freight also benefits from a concentration of services, both in terms of the opportunities for transshipment and the potential to build a logistics cluster with the economies of scale that brings. Moreover, freight in bellyhold typically contributes 5-10% of the revenues on a longhaul passenger flight, supporting its viability.

Hubs serve the economic interests of airlines

2.5. The hub airport model continues to play a key role in aviation because it is inherently efficient. It gives airlines economies of scale and enables them to offer an extensive route network that is commercial viable. The commercial impetus for airlines to organise flights in a hub is set out by Goedecking¹. The critical mass of demand attracted by the hub supports yields for airlines and thus the profitability of flights.

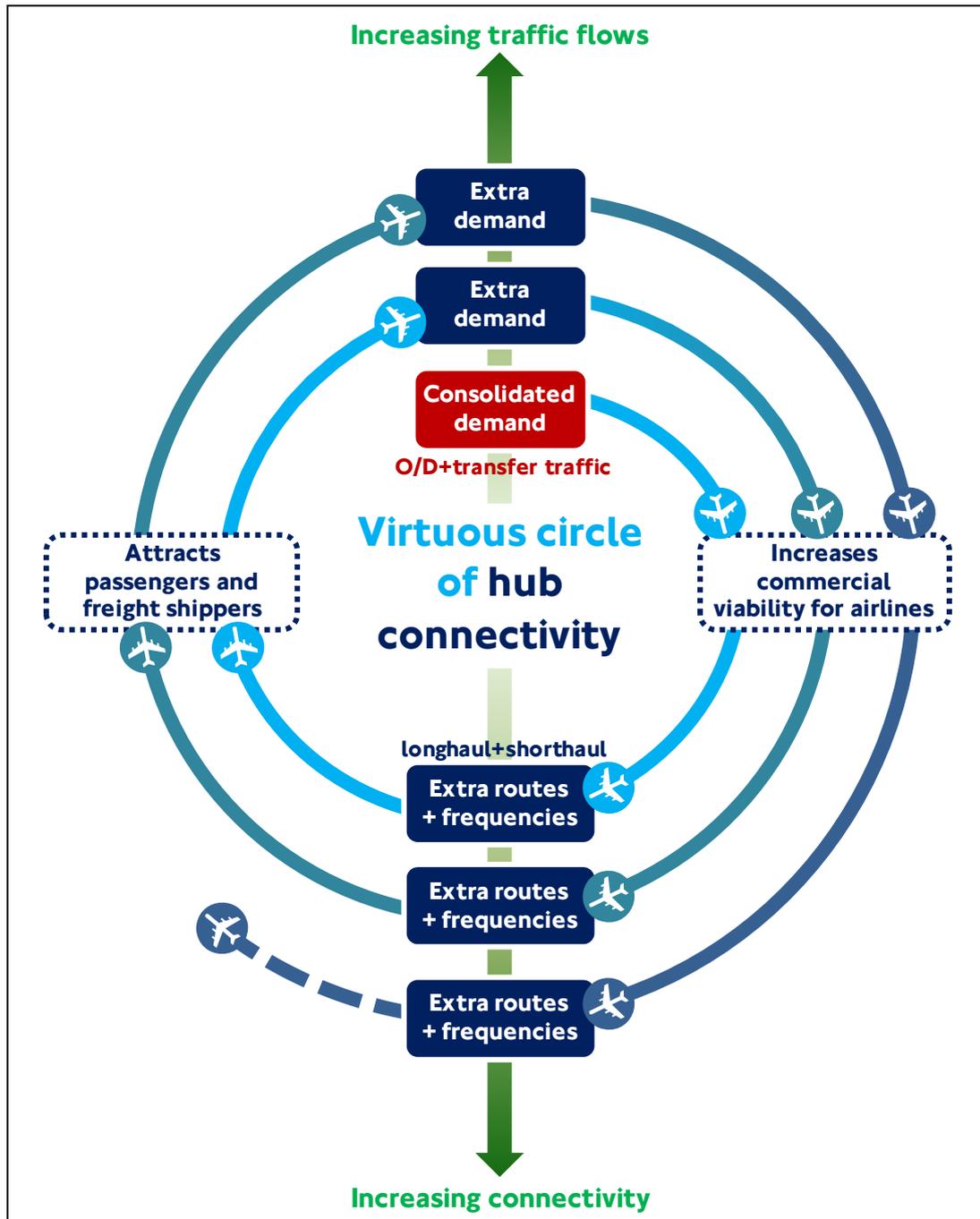
Hubs meet the connectivity needs of passengers and freight

2.6. Hubs – and the route networks that are forged around them – maximise the journey opportunities available to passengers and freight customers worldwide.

2.7. For those in the hub's catchment, the hub offers a level of direct connectivity in terms of routes and frequencies that would otherwise not be possible:

- This global connectivity meets the needs of business and leisure travellers, with a particular role in supporting trade, inward investment and inbound tourism.
- For manufacturers and related service businesses, it means direct, reliable access to global markets and, especially, just-in-time supply chains.

Figure 1: The virtuous circle of hub connectivity



An airport is either a hub or not a hub

- 2.8. In the second paragraph of the Discussion Paper, a distinction is drawn between a focal airport – serving "as the sole focal point for longhaul connectivity" – and a concept of the 'hub' which includes reference to the airlines operating from it.
- 2.9. But this distinction is perhaps illusory; as this submission sets out, the only way of achieving the global connectivity required is through a hub airport - with the appropriate configuration of airlines and demand. An airport is either a hub or not a hub: if it is not a hub, an airport – focal or otherwise – is largely a distraction from the objective of ensuring the widest range of connectivity for the UK's economic needs.

A successful hub airport must feature key characteristics

- 2.10. A successful hub has certain qualities which ensure its operational efficiency and, ultimately, its attractiveness: to airlines as a business location and to passengers as a convenient place to fly to/from/through. The extent to which it displays these characteristics will determine the extent to which it can operate as an effective hub.

Sufficient Capacity

- 2.11. It is essential that the hub can offer sufficient capacity to allow the launch of new routes and frequencies and to enable the hub carriers to organise their flights in connecting banks that minimise transfer times for passengers. This also ensures the hub's resilience in the face of disruption and delay. *[See evidence: B]*

Optimised Facilities

- 2.12. A successful hub needs to be competitive with rival airports with the facilities it can provide, if it is to attract airlines, passengers and freight. This includes minimising costs and turnaround times for airlines and processing times for freight and passengers (including minimum connection times). *[See evidence: C]*

Ability to support relatively unrestricted 24 hour operations, without dire impacts on local communities

- 2.13. It is essential for a hub to be effective in supporting passenger and freight operations, specifically early morning longhaul arrivals and night-time freighter services. The standard 8 hour night period applied to most noise sources (including road and rail traffic) is 2300–0700. This should be the benchmark – not the shorter 6½ hour period generally referenced in relation to UK aviation, or the 5 hour quasi-curfew period that currently applies at Heathrow. *[See evidence: D]*
- 2.14. An airport with these characteristics and able to draw on a strong catchment area will be able to attract the airline(s) to operate as an effective hub; this is explored further in section 4.41.

Heathrow does not and cannot operate as an effective hub

- 2.15. By contrast, Heathrow is severely constrained by runway capacity, as per Table 1 below. It lacks the space to offer the optimised, well-configured facilities. Its proximity to residential areas has severe noise impacts and leaves it unable to meet the need for extensive night flying.

Table 1: Runway capacity and utilisation at major European hubs

	Runways	Max Flights/hour²	Current utilisation
Amsterdam	6	120	70%
Frankfurt	4	126	74.5%
Paris CDG	4	120	73.5%
Heathrow	2	87	98.5%

Source: A new airport for London Part 2, Mayor of London, 2011

- 2.16. Heathrow owes its current status to its history and access to the London economy.

But its serious imperfections are corrosive for its connectivity and are eroding its attractiveness to airlines and passengers. It is already losing out to competitors in continental Europe who can serve as genuinely effective hub airports.

- 2.17. Moreover, Heathrow's highly constrained urban location – with the lack of sufficient available land and dire local noise impacts – means it could never conceivably be allowed to expand to satisfy the needs of an effective hub.

The hub enhances the direct connectivity that can be offered

- 2.18. By combining O/D and transfer traffic, the hub can build a critical mass of demand which enables a significantly greater range of routes and frequencies than could otherwise be supported by O/D traffic alone.
- For example, in 2007, on the high frequency Heathrow-New York JFK route, British Airways offered 7½ flights a day – 39% of the passengers were changing planes at Heathrow – effectively three planes' worth of passengers.
 - On 39 routes from Heathrow, over half the passengers are connecting at Heathrow³ – and a majority of these are longhaul routes such as Hyderabad and Phoenix, most operating daily or less, which would likely not exist without transfer traffic. Some 80% of longhaul routes at Heathrow would suffer a loss of frequency or be closed altogether without transfer traffic⁴. *[See evidence: E]*

The hub is uniquely able to unlock longhaul connectivity

- 2.19. The hub and its combination of O/D and transfer traffic is transformative in terms of the connectivity that can be offered, particularly longhaul. Heathrow accounts for 40% of UK all scheduled air passenger traffic – yet 80% of all UK scheduled longhaul air passenger traffic⁵. *[See evidence: F]*
- 2.20. By contrast, Gatwick – as a non-hub airport – has a notably weak longhaul network. In 2012-13, longhaul passenger numbers fell 1.4%⁶. In Summer 2013, it is offering just 30 scheduled longhaul destinations⁷. Half of these are in just two regions: the Caribbean (8) and Canada (7). There is just one US city served (Orlando) and only four in the Far East, each of which would be operating from Heathrow – likely at a higher frequency – if the airlines could have secured the slots⁸.

Hub connectivity supports UK trade, inward investment and jobs

- 2.21. This unique level of connectivity, particularly longhaul, is of paramount importance to the UK, supporting trade and inward investment – and ultimately jobs. The economic benefits of connectivity are set out in the Mayor's response to Discussion Paper 02.
- 2.22. The UK's connectivity is already lagging, because of Heathrow's constraints; yet in the future, a more multi-polar world economy – underpinned by the rise of emerging economies such as China and Brazil – means we will need access to a wider range of destinations to maintain our prosperity. Without the capacity at our hub airport, our ability to maintain and develop such trading links will be harmed. *[See evidence: G]*

2.23. It is not simply a case of the more connectivity the better – there is a requisite level of connectivity that the UK needs simply to maintain its place in the global economy and then to provide scope for economic growth. An effective hub airport is the only way we can meet this connectivity need.

We need an effective hub in the UK

2.24. The UK has historically benefited strongly from access to a hub airport providing the direct connectivity it needed. Direct flights are particularly important for key market segments such as business travellers and inbound tourists – as well as for freight: many high-value exports and imports supporting just-in-time manufacturing need fast, reliable passage. Thanks to the presence of a hub, the UK has been able to build a global network of trade and investment – which is being put at risk as the connectivity offered by the hub is significantly eroded.

2.25. Table 2 below sets out the differences if passengers fly via foreign hubs over preference to a London hub. *[See evidence: H]*

Table 2: Comparison of passengers connecting via UK and overseas hubs

Passenger connecting via UK hub	Passenger connecting via overseas hub
<ul style="list-style-type: none"> • contributes to the UK’s connectivity, helping make direct flights viable • supports UK aviation jobs (in operation of airport and aircraft⁹) • constitutes an <u>export</u> of UK air services (when foreign passenger) 	<ul style="list-style-type: none"> • directly contributes to connectivity of foreign location – and so to competitive advantage of rival economy • constitutes an <u>import</u> of air services by the UK (when UK passenger)

2.26. There will always be an element of foreign hubbing. But it would be economically perverse to recommend a UK aviation strategy which encourages more passengers to use a foreign hub in preference to one in the UK – or, indeed obliges them to, as limiting hub capacity effectively does.

An effective hub will benefit the UK regions

2.27. A hub for the UK is one that benefits the whole country – in terms of the wider economic benefits accruing to every part of the UK – and the direct benefits of the improved connectivity, whether the hub is reached by surface transport (road, rail) or by domestic air connections.

2.28. However, in a capacity-constrained hub, lower yielding domestic routes are squeezed out. This reduces access to the hub and its connectivity for the UK regions. Domestic destinations served from Heathrow have fallen from 18 in 1990 to just seven in 2013.

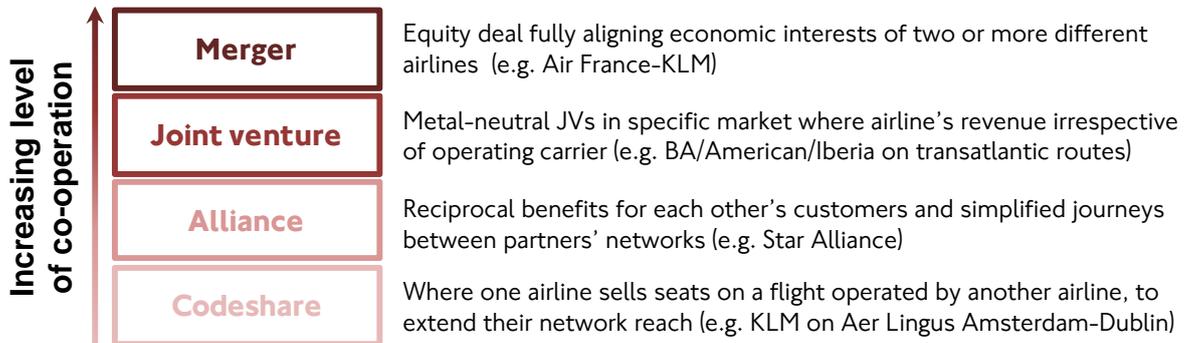
KEY CONCLUSION
An effective hub airport is the only way of delivering the global connectivity we require

3. The Future Shape of Aviation

Airlines not alliances will continue to shape the industry

- 3.1. Much is said about alliances and their role in the aviation industry, but they are simply a tool for maximising airline revenue, no less, no more. They are just one option in a hierarchy of modes of co-operation between airlines, as set out in Figure 2 below.

Figure 2: Airline co-operation models



- 3.2. Were it not for political and regulatory hurdles, airlines would consolidate through mergers (and takeovers), as happens in most industries. Alliances are not monolithic entities dominating the industry landscape – but are a convenient intermediate form of co-operation that airlines participate in to boost revenue.
- 3.3. Alliances are very limited in their ability to ensure members act in concert. Airlines are likewise ready to work outside their alliance to further their interests as needed. The recent decision by Qantas to end its long-standing joint venture with Oneworld alliance partner British Airways, to ally with non-aligned Emirates, exemplifies this.

Airline consolidation will see fewer, stronger airlines and hubs emerge

- 3.4. The long-term trend is likely to be towards greater consolidation as pressure increases to remove the barriers that stop cross-border mergers, reducing the role for alliances. As fewer, stronger, airlines emerge, they will look to cut cost duplication – this could include scaling back their hubs, as has been the case following consolidation in the US. *[See evidence: 1]*

Hub airports are driven by anchor airlines, not alliances

- 3.5. To be effective, the hub requires a level of co-ordination only achievable by a single aligned economic interest – namely a single airline or airline group anchoring the hub.
- The anchor airline will develop the scale of operations at the hub while optimising schedules, pricing and passenger experience.
 - Alliance and codeshare partners of the anchor carrier are attracted by the transfer opportunities and will maximise yields by co-ordinating their commercial offering and schedules with the anchor carrier.
 - Other carriers including key competitors and even low-cost airlines are attracted

by the critical mass of connectivity and demand which supports their yields. For example, easyJet has a significant presence at hubs such as Paris CDG, Madrid and Amsterdam. *[See evidence: J]*

- 3.6. This raises the question of how to attract an anchor airline in the case of a new hub; this is addressed in section 4.4I below.

Low-cost carriers and ‘self-connecting’ cannot replicate connectivity of hub

- 3.7. No-one has yet made the longhaul low-cost model work at any significant scale. When longhaul low-cost routes have been launched, they have tended to focus on adding volume to existing popular routes, rather than launching valuable new secondary destinations in established or emerging markets. *[See evidence: K]*
- 3.8. Alternatively, it has been proposed that low-cost shorthaul carriers can support longhaul connectivity thanks to passengers ‘self-connecting’ – where the passengers buy two separate tickets (e.g. longhaul plus low-cost shorthaul) and build the connection themselves. But these ‘accidental’ transfers, not being accommodated by the airlines, are not co-ordinated, not optimised and not co-priced; they may sometimes hold an appeal for those seeking a cheaper fare, but are least attractive to high-value passengers. As such their traffic potential is limited – and this curtails their ability to sustain routes, particularly longhaul. *[See evidence: L]*

In European aviation there is an increasing focus on hubs for longhaul

- 3.9. Two distinct trends are discernible in European aviation today:
- **Shorthaul:** a definite shift towards point-to-point services, driven by low cost airlines such as Ryanair and easyJet;
 - **Longhaul:** an increased concentration of services around a handful of major hub airports, notably London Heathrow, Paris CDG, Frankfurt and Amsterdam.
- 3.10. Smaller mainline carriers have been squeezed – without the cost base to compete with the low-cost carriers and without the scale to compete with the major hubs (in Europe and beyond) and the level of longhaul connectivity they can offer.
- 3.11. It is likely that these two trends will continue to shape European aviation – with a handful of hub airports dominating longhaul services to/from Europe, while shorthaul is catered for by a plethora of point-to-point services. *[See evidence: M]*

Next generation aircraft are reinforcing, not undermining hubs

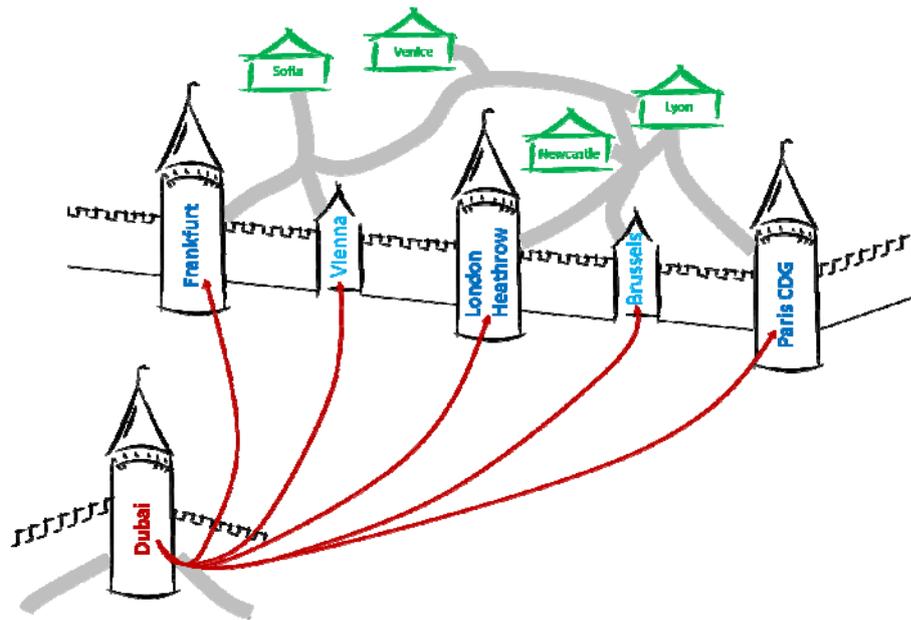
- 3.12. New aircraft such as the Airbus A350 XWB and Boeing 787 Dreamliner mark a step-change in aviation, offering a range comparable to existing longhaul aircraft, but carrying as few as 200 passengers at a lower cost per seat kilometre. They have the potential to unlock new longhaul routes that in the past would not have had sufficient volume to be viable. Some have suggested that these will undermine the dominance of hub airports by allowing them to be by-passed.

3.13. Yet, if one considers some of the new routes being launched as a result of the introduction of the 787 – Tokyo-Boston, Tokyo-Denver, Tokyo-San Diego, Tokyo-San Jose, Houston-Auckland and Houston-Lagos – each of these routes is connecting to a hub at one or both ends, improving the connectivity and thus reinforcing – rather than undermining – the hub. This is partly because these services remain reliant on a proportion of premium passengers – and thus need to draw on the critical mass of demand, both in terms of population and economic profile, offered by a hub airport.

Hubs and ‘Hub-nots’: hub competition is intensifying

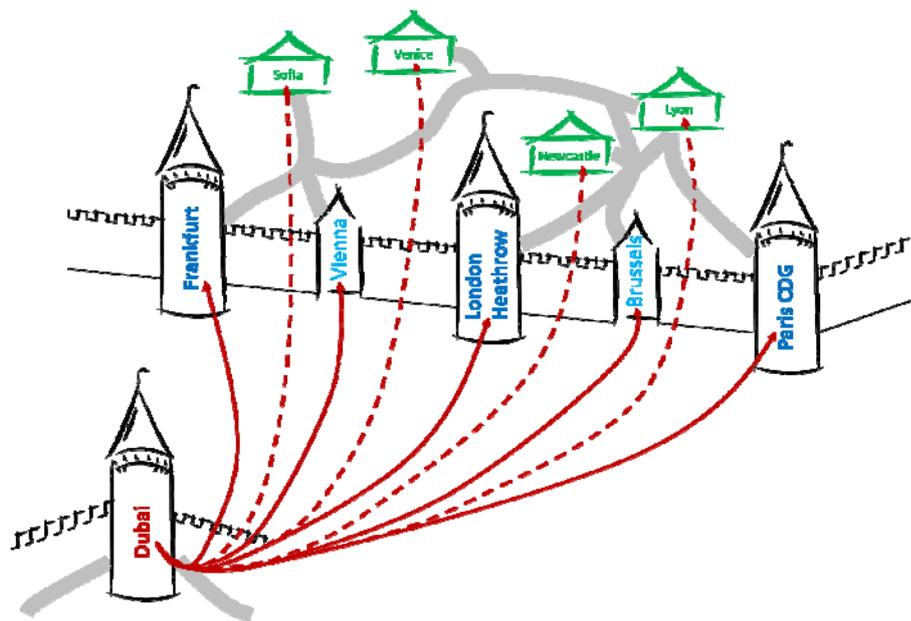
- 3.14. Taking these trends together, a picture of increased competition between hubs (and their anchor carriers) is emerging – not only within but also between regions, as illustrated in Figure 3 below. Previously each world region – such as Europe – was effectively a fortress, access to which was only possible by entering through a gateway hub in that region.
- 3.15. Today, aircraft like the 787 and the rise of new, ambitious, rapidly expanding hubs such as those in the Persian Gulf, mean that hubs from other regions are able to penetrate the fortress and directly serve secondary European cities. At the same time, the largest European hubs are in turn serving secondary cities in regions such as North America, South Asia and the Far East.
- 3.16. This means hubs in Europe are now competing more directly, not just against each other, but against hubs in other parts of the world, in providing access to primary and secondary destinations both in Europe and beyond.
- 3.17. The result of this intense hub competition is an increasing division between the ‘hubs’ and ‘hub-nots’ – as only the most effective hubs, able to offer the optimal passenger experience and a truly global reach survive as a class of ‘superhubs’, while others are left by the wayside.

Figure 3: How hubs in different regions are now directly competing with each other



Traditionally first and second-tier hubs served as the longhaul gateways to their world region (e.g. Europe). Secondary cities could only be reached via hubs in their region.

As such, hubs were for the most part only competing against hubs in the same region.



Today the largest hubs are directly serving the secondary cities in other world regions, by-passing the traditional regional gateways. By reaching into the backyards of other hubs, more than ever hubs in different regions are competing for traffic from the same secondary cities.

Out of this intense global competition between hubs, a smaller number of superhubs are emerging. Smaller, less competitive hubs are being marginalised.

London and the UK cannot be complacent about hosting a hub in the future

- 3.18. In this world of superhubs, London cannot assume that it will play host to one if it does not have an airport with sufficient capacity to cater for a competitive level of hub demand.
- 3.19. London boasts a unique catchment area, with a substantial volume of people and businesses with a high propensity to travel, including significant premium traffic. This will, in the short-term, ensure that London can still maintain a suite of longhaul routes, particularly to the primary destinations around the globe. This will primarily include established, profitable destinations such as New York. But as growth on such routes devours more frequencies, it is the less established destinations, such as those to key emerging markets which will be squeezed out, if launched at all.
- 3.20. The very real risk is that if London's connectivity fails to keep pace with hub demand and is unable to accommodate new routes, then business, trade and inward investment will begin to look elsewhere.

The Discussion Paper scenarios: they are not mutually exclusive

- 3.21. The shape of the industry and the likelihood of future consolidation, the trends in European aviation and the introduction of new aircraft all point to a world broadly in line with Future scenario 1, with a few European superhubs dominating Europe's longhaul connectivity.
- 3.22. But this does not contradict the premise of Future scenario 2. Even if the *relative* importance of European hubs were to reduce in the face of growing hubs in Asia, there would always be a role for European hubs in providing access to the European market from every world region. Many markets cannot be served via Asian hubs and there are those for which Europe – and London particularly so – is well-placed, not least linking North America with Europe, Africa and much of Asia. But again, the net result will be more intense competition between hubs and the emergence of a handful of superhubs – both in Europe and beyond – dominating global longhaul connectivity.
- 3.23. As for Future scenario 3, the challenges of making the low-cost airline model support any sort of hub-type airport model mean this scenario lacks credibility. For the reasons addressed above, low-cost carriers, self-connecting and loose partnerships will always be severely limited in the extent to which they will be able to underpin longhaul connectivity.

KEY CONCLUSION

Hubbing will remain key but focused on fewer, globally competitive hubs

4. The Options for Delivering Hub Connectivity

Alternative models for delivering hub connectivity: how best to configure the new capacity the UK needs

- 4.1. We need to consider the different models that have been put forward for facilitating hub operations, namely a hub at a single site or dispersing capacity across a number of locations:
- **Single site**
This approach sees the UK respond to its need for hub capacity with a single hub airport able to meet Government forecasts of more than 170m passengers per annum (mppa) by 2050¹⁰.
 - **Dispersed expansion**
The approach is that expansion at multiple London airports would allow them to compete and for each to take on hub characteristics. The most oft discussed version is '2-2-2' (two runways at each of Heathrow, Gatwick and Stansted) though '3-2-2' and '3-2-1' are variants also mentioned¹¹.

A further variant of this is 'Heathwick', where Heathrow and Gatwick are joined by a high speed rail link to facilitate transfer traffic across the two sites. Also considered is growth at airports outside London and the southeast,
- 4.2. This analysis explores the ability of each approach to meet the requirements with regards to: competition and choice, connectivity, airline needs, infrastructure delivery and environmental impacts. It also considers the lessons from elsewhere.
- 4.3. It is absolutely essential that in looking for what might seemingly appear to be easier options in political or planning terms, the connectivity requisite for the UK's future growth and prosperity is not compromised.

Competition and choice

A hub airport has no perfect competitors

- 4.4. Competition is not an end in itself, but is useful insofar as what it can deliver, in particular: *passenger choice, improved service and keen pricing*. Hub airports, by their very nature have no perfect competitors:
- Hubs compete to some extent with the non-hub airports in their wider region, but the range of destinations (especially longhaul) and the higher yields they can offer airlines limit the competitive dynamic. Price competition between airports should also not be overstated; for longhaul routes, typically airport charges constitute no more than 10% of total airline operating costs.

- Hubs compete with hub airports in other regions but this is limited to transfer traffic between third regions, given each hub has its distinct O/D market.
- This is why most hubs airports are regulated (or state owned) because that ensures improved service (usually underpinned by investment) and keen pricing.

Dispersed expansion is not the panacea for airport competition

4.5. The discussion paper links dispersed expansion to improved competition. But for true competition in the provision of airport capacity, two key criteria¹² must be met:

- Credible as an attractive alternative offering
Gatwick and Stansted need to be at least as attractive as Heathrow, if not more so – to overcome its brand, global connectivity, yield and surface access advantages. Even with significant sums spent on infrastructure, it would be very challenging to achieve this. This will be explored further in section 4.49 below.
- Low barriers to entry
A truly competitive market requires low barriers to entry – i.e. for other actors to be able to set up airports in competition serving a similar catchment. But the UK's track record on delivering new airport capacity is abysmal. Without the potential for new entrants, it is not a competitive market but an oligopoly, a panacea neither for airlines nor passengers.

4.6. It is difficult to see how the "domestic competition advantages" cited for dispersed expansion will materialise or how the customer proposition is enhanced. Moreover, by focusing wholly on domestic competition, this would undermine our international competitiveness, with no UK airport able to compete effectively with hubs abroad.

Passenger choice best served by competition between airlines not airports

4.7. Choice is paramount in meeting the needs of the consumer and is best underpinned by a competitive market. In industries with high fixed infrastructure costs, consumer choice is best served by competition between service providers rather than infrastructure providers. Competition has a key role to play between airlines operating at an airport – with choice supporting improved service and keen pricing. By contrast, infrastructure provision is often treated as a monopoly, as with rail and telecoms in the UK and, in many countries, for airports. *[See evidence: N]*

An effective single hub ensures meaningful passenger choice

- 4.8. Providing choice between different non-hub airports is of limited value: offered a similar assortment of shorthaul routes, passenger preference is driven largely by catchment – i.e. the non-hub airport they can most easily reach.
- 4.9. Choice between airports can be meaningful when different types of airport offer the consumer a different destination proposition: the choice between a hub airport with a comprehensive shorthaul and longhaul network and a more local non-hub airport with a selection of popular routes, mostly shorthaul and leisure focused.

4.10. An effective hub airport ensures passengers have this choice.

Heathrow lacks the capacity to encourage airline competition and choice

4.11. Heathrow's severe capacity constraints have weakened competition between airlines, reduced choice and helped push air fares up. It also allowed the airport operator, BAA, to become complacent about the service and facilities it offered.

4.12. The regulatory response was the break-up of BAA. This partly addressed the symptom, but not the fundamental problem: that Heathrow lacks the runway capacity to foster airline competition. Gatwick and Stansted both have spare capacity and Gatwick has set out to transform its passenger offering; yet even with its efforts, Gatwick have been unable to attract anything but a handful of spillover routes from Heathrow: they are simply not meaningful competitors to Heathrow.

Better regulation, not imaginary competition, moderates a hub

4.13. It remains the role of regulators to ensure that the UK's hub airport is operated in the interests of passengers. If their success to date has been mixed, it is perhaps the regulatory framework that needs reforming. Certainly, there is scope for a better balance to be struck between the needs of passengers, freight customers, airlines and airport operator - as well as the wider economic and connectivity needs of the UK. This must be given serious consideration in a future aviation strategy.

Connectivity

An effective single hub maximises the connectivity benefits

4.14. An independent forecast has been produced¹³ of the number of destinations and frequencies served from London airports in 2050 under three scenarios:

- 'Maximum use' of existing infrastructure (i.e. no expansion)
- Dispersed Expansion '2-2-2' (i.e. a new runway at each of Gatwick and Stansted)
- a 4-runway hub (whether at or replacing Heathrow)

4.15. The methodology is relatively conservative and uses the DfT 2013 forecasts as their starting point. More detail is available but the key findings are set out below. [\[See evidence: O\]](#)

4.16. **If we do nothing, the number of destinations served by Heathrow will diminish.** A few new destinations in key longhaul markets will be secured at the expense of other less profitable routes.

4.17. **A new 4-runway hub will offer a dramatic improvement in connectivity.** It will allow a quadrupling of destinations in emerging markets like China and South America, 50% more destinations in the US and restoration of previously lost domestic connections to the hub.

Table 3: Number of destinations served from Heathrow/new hub in scenarios

HUB airport	Existing 2013	Existing 2050	2-2-2 2050	4-runway hub 2050
China	3	6	6	14
South America	3	5	5	13
USA	22	23	23	33
Domestic	7	6	6	16
Worldwide	171	140	140	299
Total frequencies	4,714	4,850	4,850	9,226

- 4.18. **The connectivity offered by 2-2-2 dispersed expansion will be inadequate to meet our economic needs.** A new 4-runway hub would mean London serving 20% more destinations than under dispersed expansion (2-2-2), around 40% more destinations in the US and 160% more destinations in South America.

Table 4: Number of destinations served from London airports system in scenarios

LONDON system	Existing 2013	Existing 2050	2-2-2 2050	4-runway hub 2050
China	3	6	6	14
South America	3	5	5	13
USA	26	26	26	36
Domestic	15	13	14	17
Worldwide	385	322	358	435
Total frequencies	10,133	12,201	15,598	16,576

- 4.19. The system capacity in 2-2-2 and 4-runway hub scenarios is broadly similar, reflected in the similar total number of frequencies. But in the 4-runway hub scenario, that capacity is much more effectively used; in particular it offers the wide range of longhaul connectivity that only an effective hub airport can support. By contrast, under 2-2-2 dispersed expansion, access to key emerging markets will be severely curtailed and the associated opportunities for trade, investment and inbound tourism.

UK regional airports do not provide sufficient longhaul connectivity

- 4.20. Regional airports have an important role in supporting connectivity and economic activity in their hinterlands; they will continue to do so in the future. A strong regional airport policy is welcome – but it is not a substitute for an effective hub airport and the connectivity, particularly longhaul, it can offer.
- 4.21. According to 2011 CAA data, there were eight regional airports with scheduled longhaul flights:
- Only Manchester, Birmingham and Glasgow have three or more longhaul routes;

- The 22 destinations served are a mixture of outbound leisure, VFR (visiting friends and relatives) and feeder connections to foreign hubs;
 - Singapore is the only Far East route (served from Manchester via Munich);
 - No points in India, Sub-Saharan Africa or Latin America are served.
- 4.22. The development of superhubs as described in section 3.14 above will likely see more routes linking them to UK regional airports but a step-change in longhaul connectivity for regional airports is highly unlikely. *[See evidence: P]*

The connectivity needs of the UK regions are best served by connecting into the hub

- 4.23. The hub airport needs to serve the whole country; it can achieve this through:
- Excellent surface access, including direct high speed rail services;
 - Plenty of capacity, so a wide range of regional airports can be directly linked.
- 4.24. If this is not provided, the UK regions will increasingly connect through foreign hubs, eroding their access both to London and the global aviation network; moreover, it will further reduce UK connectivity while supporting the connectivity of economic rivals, to the serious long-term detriment of the national economy.

Airline needs

Airlines cannot be relied on to move if not unambiguously in their interests

- 4.25. Airlines operate in a market with wafer-thin margins¹⁴ – partly a result of the legal barriers to cross-border consolidation (that simply do not apply to most industries). In this context, as privately owned entities in a competitive market, they will always look to ensure the viability and maximise the profitability of their flights.
- 4.26. Some set out grand visions of how airlines will voluntarily act in different ways to comply with UK aviation strategy – and in particular, move to a different airport; but airlines cannot and will not move if not unambiguously in their economic interest.

Dispersed expansion means airlines choosing to move to airports even if it undermines their profitability

- 4.27. The dispersed expansion model relies on attracting airlines to Gatwick and Stansted while Heathrow remains open. The problem is that Heathrow as the existing hub, albeit very imperfect, has the better global connectivity and the brand. It will continue to attract the critical mass of passengers (both high value O/D and substantial transfer flows). This is an even greater problem under 3-2-2, where a third runway reduces (but not eliminates) Heathrow's capacity constraints: it is wholly implausible to think of Gatwick or Stansted as any sort of competitor for an expanded Heathrow.

4.28. Airlines will be hugely reluctant to leave Heathrow if it undermines their competitiveness and the viability of their services:

- Yields for airlines on flights out of Heathrow remain significantly higher than for Gatwick and Stansted – and why, for example, US airlines at Gatwick paid tens of millions of pounds for slots at Heathrow to switch following the US-EU Open Skies deal. [\[See evidence: Q\]](#)
- Heathrow is an asset degraded by its severe capacity constraints; by choosing to move out, an airline will help address those constraints – but with the airline’s rivals, those who did not switch, left to reap the benefits. This is a kind of ‘reverse prisoners’ dilemma’, where the first mover disbenefits.

4.29. The economic drivers that tend to keep airlines in the primary airport are considered in detail by de Neufville¹⁵.

Dispersed expansion will erode valuable inter-alliance transfer traffic

4.30. In the context of the airline industry’s wafer thin margins, the transfer traffic at a hub remains key to the viability of very many routes and frequencies.

4.31. The discussion paper suggests moving an alliance en masse, on the basis that inter-alliance traffic is minimal – drawing on analysis undertaken by the CAA and set out in *Figure 4.13* of Discussion Paper 04. But this does not fully reflect the realities:

- There is significant variation in the share of transfer traffic between routes – and indeed individual flights (as per section 2.18 above) which is masked in *Figure 4.13*. While for Oneworld as a whole, on average 42% of passengers are connecting at Heathrow, for the daily British Airways flights to Hyderabad, that figure is nearer 80%, to take one example. The loss of any transfer traffic from such a route is likely to have a disproportionately large effect on its viability.
- The analysis presents a significant number of inter-alliance transfers as switchable. If a passenger chooses not to stay within an alliance, it will often be a deliberate choice. The very significant risk is that if their preferred transfer option at the London hub was removed, they would just as easily switch to a rival hub abroad. [\[See evidence: R\]](#)
- By including direct (O/D) passengers, *Figure 4.13* underplays the extent to which a significant proportion of the transfer traffic will be risked. [\[See evidence: S\]](#)
 - » For Virgin Atlantic, Skyteam and Other aligned, the overwhelming majority connect from a different carrier (and are assumed lost in this analysis).
 - » For Star Alliance, half connect from a different carrier (including the switchable traffic); the data pre-dates the loss of Bmi from the alliance¹⁶.
 - » For Oneworld, as the largest grouping, the low share connecting from a different carrier still represents a substantial number of passengers.

- 4.32. Focusing solely on the transfer traffic loses sight of the fact that the hub operation is underpinned by both O/D and transfer traffic; the higher yields offered by the former are no less attractive to airlines than the additional volumes resulting from the latter.

Alliances are even more challenging to move than airlines

- 4.33. Even if an airline were convinced to sacrifice its inter-alliance transfer traffic for the sake of UK Government policy, moving a whole alliance would be deeply challenging. As explained in section 3.3 above, alliances will only act in concert when it is in the interest of each member airline to do so.

- 4.34. For example, the Skyteam carriers invested in their first ever dedicated alliance-branded lounge, which opened at Heathrow Terminal 4 in 2009. But the alliance's largest carrier, Delta Airlines, announced in 2013 it will relocate to Terminal 3, to join its new strategic partner, Virgin Atlantic. If an alliance cannot keep airlines together in one terminal, it is naïve to assume they can readily move en masse to another airport.

Gatwick and Stansted will struggle to build a critical mass of transfer traffic or develop a comprehensive longhaul network

- 4.35. Self-connecting has been suggested for airports like Gatwick and Stansted, possibly underpinned by low-cost carriers. But as explained in section 3.8 above, the non-optimised nature of these transfers limits their attractiveness and their ability to support increased connectivity.
- 4.36. Those who suggest that Heathrow and Gatwick/Stansted could specialise in longhaul and shorthaul flights respectively are not appreciating that *both longhaul and shorthaul flights are key to building a critical mass of transfer traffic at a hub*. Airlines would not accept the loss of flows implied and consequences for route viability.
- 4.37. Offering fifth freedom rights may attract a rapidly expanding carrier from outside the EU to establish a base at Gatwick or Stansted, eager to tap into the attractive London O/D market, even though at a disadvantage to Heathrow operators. However, it is unlikely that they would focus on more than a handful of the most lucrative primary routes – i.e. likely already served from Heathrow. *[See evidence: T]*

A split site will not enable airlines to attract transfer passengers

- 4.38. For a split site solution to meet airlines' needs and attract passengers, it would have overcome very significant obstacles:
- A super-fast, high frequency link is required, implying very significant construction and operational costs (especially if need for maglev train speeds).
 - The link needs to be airside, while meeting UK border security requirements.
 - The inefficiencies at each end – with multiple terminals poorly laid out – will add to the total time required to move people and luggage; the minimum connection times (MCTs) at Heathrow are already amongst the worst in Europe: 60 minutes

within a terminal and 90 minutes between terminals.

4.39. Even taking the most optimistic view on overcoming these obstacles, the MCT for a transfer between Heathrow and Gatwick will be over 2 hours. This is simply not competitive with rival airports and airlines able to offer passengers a hassle-free connection of less than an hour on a single site.

4.40. A split site is neither a compelling nor a competitive proposition for airlines or passengers. It will not grow hub airport capacity nor the connectivity it supports.

A new hub: attracting airlines means Heathrow cannot be a competitor

4.41. If it is clear that a single effective hub airport is the optimal solution, it is also clear that Heathrow's runway capacity and space constraints leave it unable to serve as an effective hub airport – and its urban location will mean it never can be. A new hub airport on a single site will be required if the UK is to secure the connectivity that will support its future economic growth and prosperity.

4.42. A new hub airport must be developed with its attractiveness to airlines firmly in mind, including extensive surface access links, world-class tailored facilities for the airlines and their passengers and a competitive charging regime.

4.43. For precisely the reasons that Gatwick and Stansted would struggle to compete with Heathrow in the dispersed model, a new hub airport for London would require a significant reduction in Heathrow's scale and scope. *[See evidence: U]*

An anchor carrier for a new hub is feasible, whether BA or another

4.44. An effective hub airport needs to be anchored by a single airline (or airline group), able to ensure the optimisation of the hub, as has been set out in section 3.5 above. British Airways as the anchor airline at Heathrow will, like other carriers, have a decision to make. Their public posturing to date has been that they would not move.

4.45. Following the shrinkage of Heathrow, the new hub would be the only multi-runway airport in the southeast – and the only location able to accommodate the full network of routes BA operates at Heathrow – as well as meeting suppressed demand and future growth. BA could choose to downsize, dismantle their hub operations in London and cede their market-leading position in what will remain one of Europe's most valuable O/D markets. This is unlikely.

4.46. In any case, if BA did withdraw from hub operations in London, that vacuum would be filled by others. The value of London's O/D market – and the proven history of hub operations in London and the southeast – would attract the interest of the major international airline groups, whether EU-based or, perhaps more likely, an ambitious emerging markets-based carrier looking for a significant European presence – possibly in conjunction with Virgin Atlantic, as the UK's second longhaul carrier.

4.47. Appropriate corporate structures could be established if rules around nationality of ownership need to be addressed. The timeframes to deliver a new hub airport would

ensure that such arrangements could be planned several years before the airport opened. *[See evidence: V]*

- 4.48. *Therefore, there is every reason to expect that there will be an anchor airline ready to underpin the development of a new hub airport* – whether British Airways or another carrier – given the inherent attractiveness of the London market and the absence of alternatives if Heathrow is reduced in scale and scope.

Infrastructure delivery

Expansion across multiple live airport sites faces particular challenges

- 4.49. There are significant challenges in the delivery of dispersed expansion.
- As with a new hub airport on a single site, a development consent order (DCO) or hybrid bill would be the likely approvals route, with a timescale at least as long. However, the environmental disbenefits are spread over several sites – and a much wider area – attracting increased opposition, with greater consenting risks, particular compared to a single site located away from populated areas.
 - If pursued as a single hybrid bill or DCO, the 5-year time limit for the compulsory acquisition of land would mean that expansion at Gatwick and Stansted (and Heathrow under 3-2-2) would have to be done simultaneously, potentially eroding the benefits of a phased development.
 - If pursued via separate hybrid bills or DCOs for each phase, each consenting stage would present separate opportunities for objection and legal challenge. There would be a significant risk that such opposition – possibly followed by an ebbing away of political will – would put a halt to subsequent phases, leaving the dispersed expansion strategy in limbo.
 - It is also worth noting the significant risks and complexities in constructing on a live airport site (which must remain operational during construction) - for example, as seen in the construction of Terminal 5 at Heathrow.

Expansion at multiple sites could require more costly surface access

- 4.50. A second runway at Gatwick entails more than doubling passengers traffic over current levels; at Stansted, a four-fold increase could be expected. Even assuming a large increase in the number of transfer passengers, this implies a step-change in surface access requirements for both airports. If airport expansion is not to place very severe strain on the road network, rail will have a key role to play. However, both Gatwick and Stansted face very significant rail capacity challenges. *[See evidence: W]*
- 4.51. Committing significant expenditure for surface access for multiple airports – particularly for rail links – could make the surface access infrastructure for dispersed expansion more costly than for a single site.

Environmental impacts

Keeping Heathrow as today is unacceptable for noise

- 4.52. Any solution that maintains Heathrow at its existing size will not be able to avoid the dire noise and air quality impacts suffered by hundreds of thousands of local residents every day.
- 4.53. Nearly a third of the European population affected by aviation noise are as a direct result of Heathrow – 766,000 in total at 55db L_{den} – a situation that is increasingly untenable both in terms of the quality of life impacts and the restrictions it entails for aircraft movements (not least night flying). Local air quality currently exceeds European NO₂ limits at several locations around the airport.
- 4.54. By contrast, a new hub airport, built away from densely populated areas would allow Heathrow to be substantially reduced in scale and enable a dramatic reduction in the populations affected by noise in London and the southeast. That dispersed expansion singularly fails to do this is a significant flaw in the approach.

The lessons from elsewhere

Dispersed expansion in London has been tried – and failed

- 4.55. Developing Gatwick as an alternative to Heathrow is not a new idea; it was explicit Government policy to create a ‘Second Force’ in UK aviation starting from the 1970s. The policy ultimately failed. This was in spite of the greater Governmental intervention that was possible at the time through ‘traffic distribution rules’ that severely restricted access to Heathrow for many carriers. *[See evidence: X]*

There exist today no comparable multi-hub systems in one city region

- 4.56. Where two major airports serve the same city – for example Tokyo or Shanghai – it is because one is almost exclusively focused on a very large, distinct domestic market.

New York is not a model for dispersed expansion

- 4.57. New York is most often cited as the exemplar of a multi-hub system in a single city; but only Newark comes closest to a hub, with 40% transfer traffic, though it suffers from severe capacity constraints. La Guardia is restricted by law to short-range destinations (primarily in the Eastern US and Canada).
- 4.58. JFK has established itself as the main transatlantic gateway to the US, but is focused on O/D traffic with transfer traffic of just 17%. Moreover, JFK lacks a significant anchor carrier; Delta and American, the two largest international carriers at JFK, together account for less than a third of international passenger traffic and focus their transfer flows on their primary hubs at Atlanta and Chicago respectively. The largest airline at JFK, JetBlue, is primarily a shorthaul low-cost airline. *[See evidence: Y]*
- 4.59. But, even as an airport system with one hub and two notable non-hub airports, New

York is not a model to be followed. Capacity constraints mean around a quarter of flights at the three New York airports do not depart on time¹⁷. Delays at JFK averaged 67 minutes in 2011; according to the US Federal Aviation Administration, a third of all US aviation delays have their origins in the New York airports system¹⁸.

- 4.60. The lack of resilience in the New York airports system is only in part due to the severe runway capacity constraints at its airports. The proximity of several multi-runway airports creates significant overlap in the airspace of the airports; this is a major constraint that inhibits operations at all three airports¹⁹. The distance between JFK and Newark is similar to that between Heathrow and Gatwick and raises concerns that effective operation of two runways at each of Heathrow and Gatwick could be unworkable.
- 4.61. The sub-optimal configuration of its airports system has helped ensure that the city punches below its weight in terms of its global connectivity. While the historic strength of New York across the Atlantic is evident in Table 5 below, its weakness to the Far East and South America is striking. There are rival North American airports with comparable, if not better, connectivity to these regions. A victim of its constraints, it is likely that the New York airports will be eclipsed by others better configured to tap into the rapid growth in these emerging economies.

Table 5: Longhaul destinations from New York (Summer 2013)

	JFK only	Newark only	Both JFK and Newark	NY airports system
Europe	16	8	23	47
Africa	7	0	0	7
Middle East	7	0	1	8
South Asia	3	2	1	6
Far East	5	0	5	10
South America	6	0	5	11
Total	44	10	35	89

- 4.62. If the argument for dispersed expansion is the ability to maximise connectivity across several airports, this is not borne out by New York. Of the 89 longhaul destinations served from New York, 79 are served from JFK: Newark contributes just 10 additional destinations.

Frankfurt and Munich serve distinct catchments so are not comparable

- 4.63. The Discussion paper mentions the example of Frankfurt and Munich as an example of a multi-hub system; this is very different from a dispersed expansion model because i) the two airports have geographically separated primary catchment areas (each with the demand profile to support a hub) and ii) they are anchored by the same airline (Lufthansa). Neither would apply to the dispersed expansion model.

A single hub vs. dispersed expansion – a summary

4.64. The table below summarises the key differences between the two models:

Table 6: Overview of single hub vs. dispersed expansion

	Single hub	Dispersed expansion
Competition and choice	Maximises passenger choice and promotes airline competition	Limits passenger choice while airport competition is illusory
Connectivity	Meets UK economic need » 54% increase in longhaul destinations across London system including key emerging markets	Falls short in terms of need » Reductions in longhaul destinations across London system over today
Airline needs	Heathrow ceases to be the airport it is today; conditions at new hub strongly encourage airlines to move	Heathrow remains as today, difficult for Gatwick or Stansted to compete; not in airlines' economic interest to move
Infrastructure delivery	Challenging due to scale of enterprise	Challenging due to impacts on multiple sites with risk that the strategy only partially delivered
Environmental	New hub scenario would end dire noise impacts at Heathrow	Heathrow remains so dire noise impacts continue unabated
International examples	Effective hub in airports system serving large city: e.g. Paris CDG	None

KEY CONCLUSION

The capacity and global connectivity that the UK requires can only be provided with a new single, effective hub airport serving London

APPENDIX: Airports Commission questions presented in Discussion Paper 04

[including the section of this document in which they are addressed]

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? [4.14]

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? [3.21]

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? [3]

What are the impacts on airlines and passengers of the fact that the wave system at Heathrow operates under capacity constraints? [2.11 & 2.15]

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? [2.10 & 3.14]

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. [2.21 & 4.14 & 4.51]

Do focal airports and non-focal airports bring different kinds of connectivity and, if so, which users benefit the most in each case? [2.18 & 2.24 & 4.9 & 4.14]

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? [4.4]

To what extent do transfer passengers benefit UK airports and the UK economy? [2.1 & 2.18]

Is there any evidence that the UK (or individual countries and regions within the UK) are disadvantaged by using overseas focal airports? [2.24]

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? [2.2]

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? [2.2 & 4.20]

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? [4.27]

Endnotes

¹ *Networks in Aviation*, Philipp Goedeking, 2010 – see chapter 2.3

² Includes planned improvements up until 2015

³ York Aviation, extracted from CAA data, 2010

⁴ *Speech by Colin Matthews, CEO, Heathrow Airport at Transport Times conference*, 18 April 2012

⁵ *UK Airport Statistics 2011*, CAA

⁶ “*Gatwick still in the red despite passenger growth*”, Evening Standard, 25 June 2013

⁷ This excludes shorthaul Mediterranean destinations (outside Europe) – primarily leisure destinations in Egypt and Morocco.

⁸ Two of the routes are spillover frequencies from Heathrow, each 2-3 flights per week, which the airlines in question launched to supplement their daily Heathrow flights (in the absence of extra available slots there); the other two routes are operated by Vietnam Airlines who tried and failed to get Heathrow slots (see [Evidence: Q](#)).

⁹ This includes check-in, gate, security, baggage handling and retail staff and support functions at the airport and usually many of the staff who enable the flight itself, including cabin crew, maintenance, servicing and the airline support functions, for both UK-based and foreign airlines.

¹⁰ These forecasts are for a (theoretical) unconstrained Heathrow hub airport.

¹¹ ‘3-2-2’ is three runways at Heathrow, two at Gatwick and two at Stansted; ‘3-2-1’ is similar, but with one runway at Stansted.

¹² This is a subset of the ‘Porter Five Forces Analysis’ of industry competition; its application to the airport market is elaborated on in: *European Hub Airport Development in the face of Increasing Competition*, Annika Paul, June 2013

¹³ *London Airports Route Networks in 2050*, York Aviation, June 2013

¹⁴ “*Global airline profit projections upgraded, but margins remain 'razor thin'*”, Travel Weekly, 3 June 2013

¹⁵ *Management of Multi-Airport Systems: a Development Strategy*, Richard de Neufville for Journal of Air Transport Management, June 1995

¹⁶ Bmi (British Midland International), the largest Star Alliance carrier at Heathrow, was acquired by Oneworld-member British Airways in April 2012, and as such this is not reflected in the 2011 data presented by the CAA; this suggests the Star Alliance figures for connections within an alliance (and the allegedly switchable) are in fact significantly lower today.

¹⁷ *2013 Year-to-Date data*, US Bureau of Transport Statistics

¹⁸ “*N.Y. Airports Account for Half of All Flight Delays*”, New York Times, 27 January 2012

¹⁹ *The Future of the New York Region’s Airports*, Jeffrey M. Zupan, Richard E. Barone and Matthew H. Lee for Regional Plan Association, January 2011