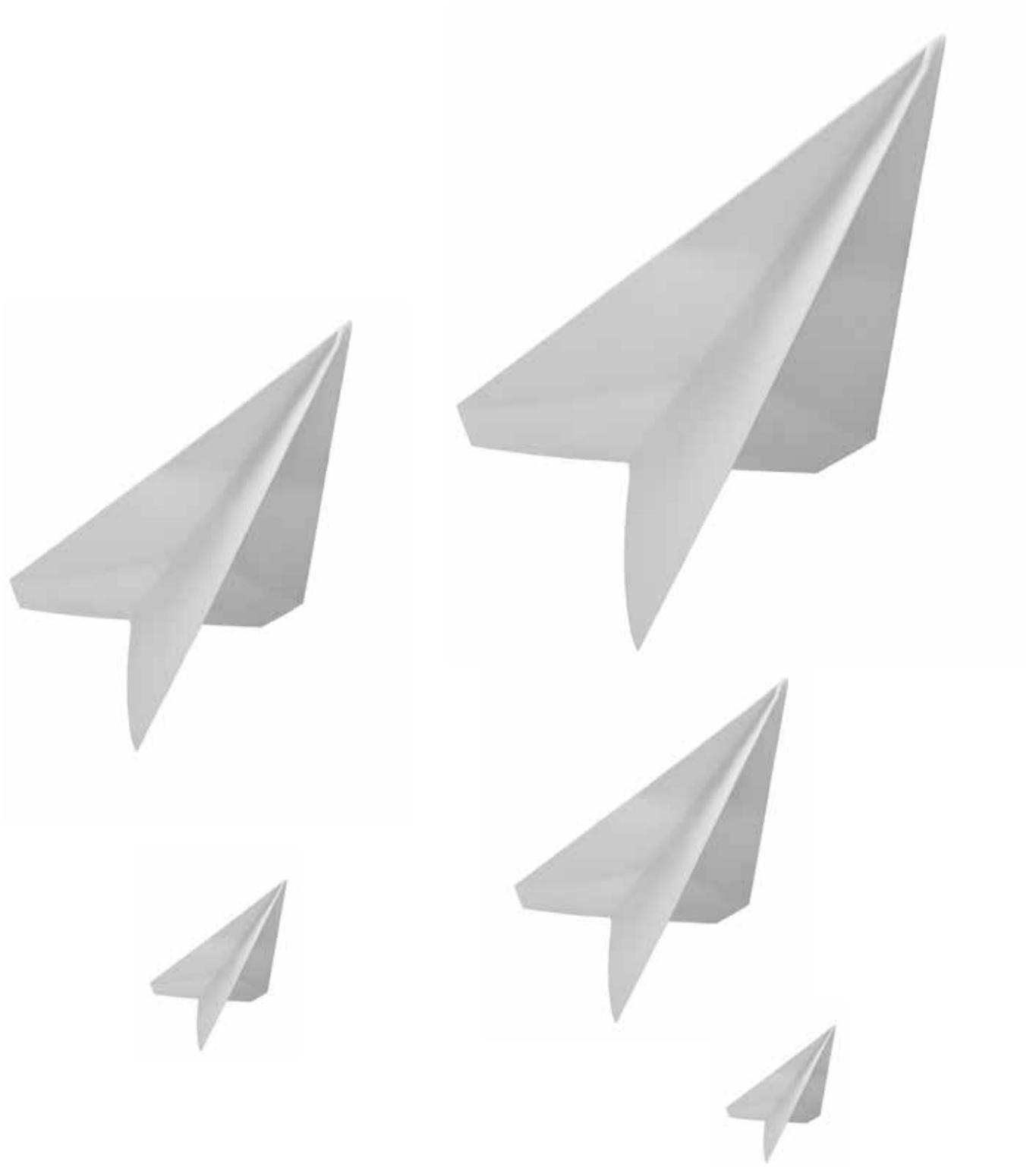


Bigger and Quieter

The right answer for aviation

Tim Leunig



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Executive Summary

Although some people genuinely enjoy flying, flying is best seen as a means, not an end. It is necessary for business, necessary for those who wish to see family or friends, or simply to see the world. It is also necessary for time-sensitive cargo shipments. The long-term growth in incomes, at home and abroad, means that more people will want to fly in the future. Furthermore, the government's Committee on Climate Change has said that aviation can increase by 60% without imperilling our global warming targets. In this context this report argues that it is sensible to increase aviation capacity in the South East.

More specifically, it is sensible to increase hub capacity. A hub airport draws in passengers from a range of places in order to reach a critical mass of passengers to make flights to other destinations economic. If 15 people in 20 different places in Europe all want to get to a particular Chinese city then there is enough demand in aggregate for a non-stop service. It is better for Britain if that flight leaves from Britain rather than another European hub. This gives British people a cost and convenience advantage over all others, and it also makes Britain the obvious place for people from that Chinese city to set up their European headquarters. Connectivity helps business.

The ideal modern hub airport needs four runways, and must be efficiently designed. It needs to be close to the places people actually start their journeys, while not inflicting unacceptable noise on too many people. Here there is an inherent conflict: an airport that is close to people is convenient but noisy, and airport that is distant is inconvenient but less of a nuisance. The convenience point is particularly important for business travellers making short trips, whether short haul or long haul.

We argue that the first best solution is to build four new parallel runways, arranged in two sets of pairs, immediately to the west of the existing Heathrow airport. These would run above the M25, and Wraysbury reservoir.¹ The Poyle industrial estate and a relatively limited amount of housing would need to be demolished. Clearly the problem with Heathrow at present is noise. Moving the runways west reduces noise over west London, since the planes will be higher over any given place. We will reinforce this noise reduction by banning the noisiest planes. This is not possible in the short run, but could be achieved by 2030, a plausible date for this airport to open.² In addition, narrow bodied planes will be required to land more steeply, as they do in London City. Again, this means that they are further up when they are above any particular place, reducing the amount of noise that reaches the ground. Finally there would be an absolute ban on night flights.³

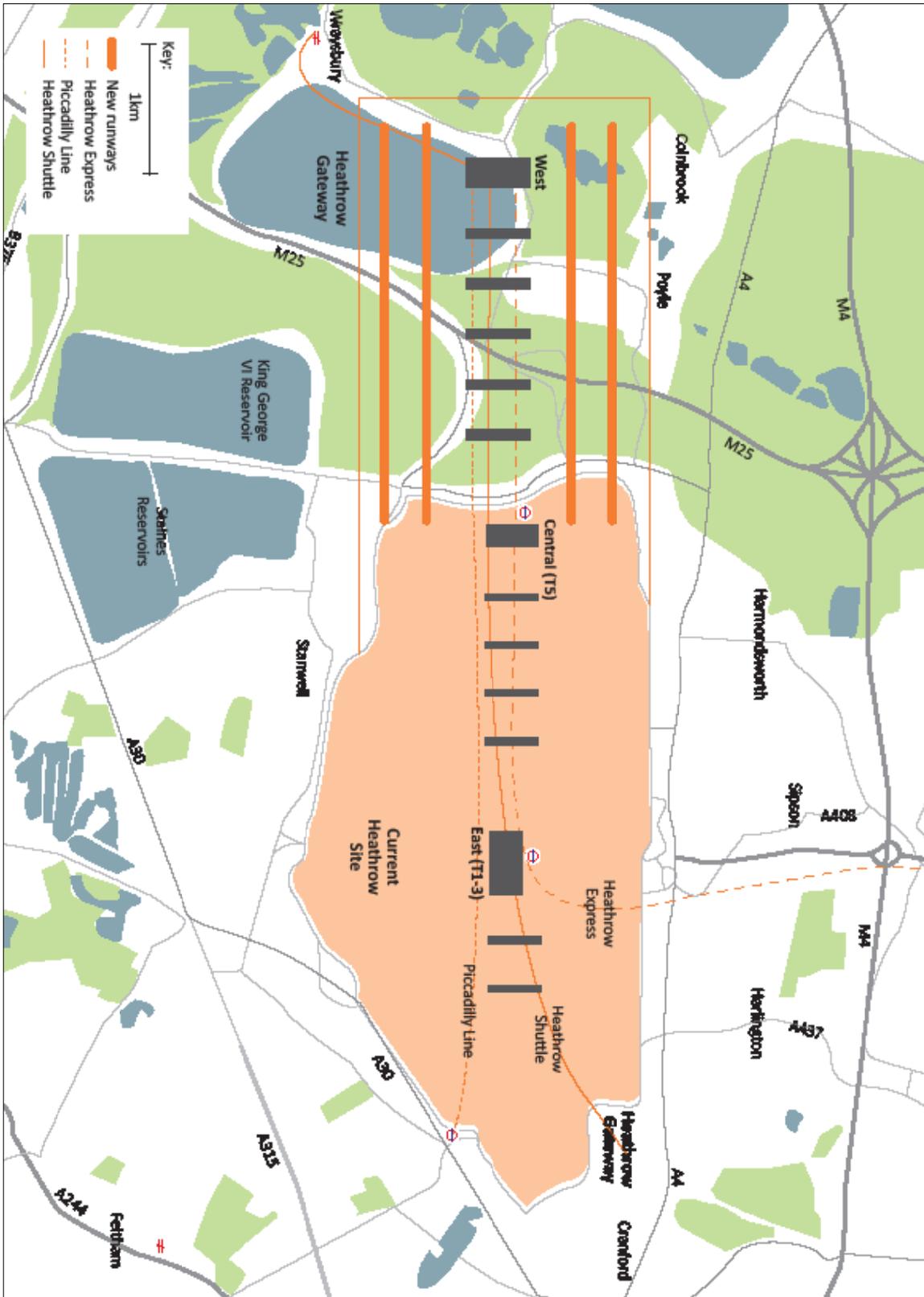
The proposed airport would meet the latest design standards. It would have three terminals, and parallel piers from which planes would depart. Passengers with hand luggage only would not need to enter the terminal, but could instead take a shuttle straight to the pier. This airport is perfect for people travelling on business: they would reach the gate within 20 minutes of arriving at the perimeter of the airport.

1 The reservoir would be filled in, while the runways would go over the top of the M25. This is relatively common.

2 This date assumes that politicians continue to prevaricate, and that the planning system, appeals process and so on remains reasonably slow. Clearly it is possible to build an airport much more quickly if a country wishes to.

3 No scheduled takes offs or landings 2300–0615, and late running take-offs and landings 2300–2400 only on payment of a significant fine.

Map 1 : Current Heathrow site and proposed extension



The airport would reuse all existing terminals except Terminal 4. All existing air traffic control, refuelling lines, maintenance and engineering facilities would remain. The Heathrow Express, Crossrail and Piccadilly Lines would continue to serve the airport, and would be extended to reach the new terminal. The extent to which existing facilities can be reused means that the cost is very low. The exact cost cannot be worked out at this stage, but it is clear that this would be the lowest cost way to provide a hub airport of this size.

The second best place to put such an airport is just south of the current Luton airport. This would have a terminal above the Midland Mainline railway, offering a frequent 20 minute journey to London, as well as direct services to the East Midlands. The airport would also be served by a “Docklands Light Railway” style train, running from Tring to Stevenage via the airport. This means that the airport would be well connected to both the east and west coast mainlines, as well as to the M1 and A1.

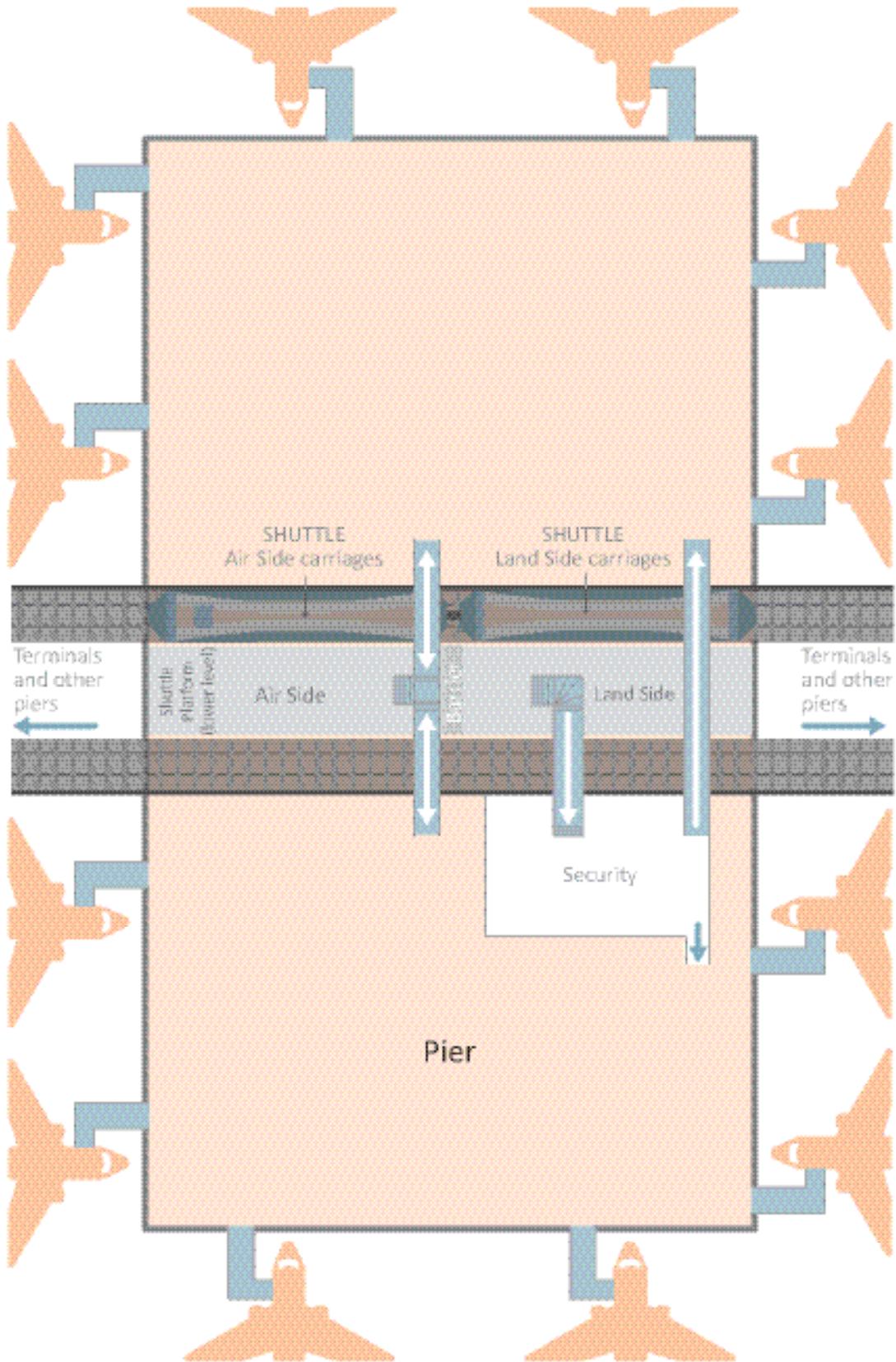
This approach is not as good as Heathrow because it would require the closure of Heathrow to be viable, and of Stansted on air traffic control grounds. As a result the increase in capacity is smaller, and a second runway at Gatwick would be needed to cope with leisure traffic displaced from Stansted. In addition, it would be much more costly to build, as less of the existing infrastructure would be reused, and the area is much hillier. It is possible to level land, but it is not cheap. Terrain also means that it would take longer to build.

The attractions of Gatwick, Stansted and Cliffe are all much weaker. None have a strong enough inherent hinterland, and none can be connected well enough to be as effective as Heathrow. 25% of Heathrow passengers arrive at the airport within 30 minutes of leaving home. This figure is simply not possible for airports in any of these locations. Their distance from the centre also means that most people will have to pay more to reach the airport, whether arriving by public or private transport. An off peak oyster fare to Heathrow is just £2.90 for example, whereas a fare to Fosters proposed airport at Cliffe would cost over ten times as much.⁴

This report shows that we can build a cost-effective hub airport that works for passengers, airlines and those who live nearby. We hope that the Davies Commission will build a consensus that will deliver exactly that outcome.

⁴ We use the Heathrow Express price per mile as a guide to the cost of using a newly constructed, unsubsidised railway to an airport.

Figure 1: Proposed pier design



1

Introduction

Flying is horrible.

Getting to the airport is no fun. Passengers get the choice of arriving preposterously early and wasting a lot of time at the airport, or arriving in the nick of time, with all the stress of knowing that a travel or security delay will lead them to miss their plane, and probably lose their ticket as well.

Airport security is at best tedious. It is pretty much guaranteed that you can't take a bottle of water through, that your toiletries must in a clear bag, and that you have to get your laptop out. Most places want you to remove your belt, and some need you to take you shoes off as well. I was once asked to demonstrate that my electric toothbrush worked, and saw an elderly lady distressed because security opened her bag having detected a teaspoon in her hand luggage. And as for having to taste your own or your partner's breast milk if travelling with an infant...⁵

Airports themselves are dull affairs. Generally uninteresting shops, the absence of natural light, and big crowds do not make for a pleasant place to spend some time. Lounges are a bit hit and miss – and if you get too comfortable, you risk missing your flight.⁶

Once the flight is called you make your way to the gate, which is a very listless place to spend time. Finally, you are boarded by row number, at which point you queue again on the jetway to actually board the plane, or, if you are unlucky you are bussed across the airport because the plane isn't quite in the right place. You then get on the plane, and hope that there will be space in the overhead lockers so that you can put your feet in the space under the seat in front of you. If you are really lucky you will be seated next to an empty seat, if you are unlucky you will be surrounded by badly behaved children, or, occasionally, adults.

You are now expected to sit still for between 1 and 12 hours. You might get a window seat, but in any case the windows are small and there is little to see once you are at 35,000 feet. You might get fed ("chicken or beef?"), or you might be asked to buy a scratchcard. You might get to watch a film on an absurdly small screen, using very poor quality headphones. There is a good chance that the plane will be a bit too hot or a bit too cold for comfort, and cabin air pressure is on the low side for anyone who does not habitually live at altitude.⁷ If you are lucky the flight will be smooth, in which case you will just have the general vibrations of the plane, and the drone of the engines to contend with. If you are unlucky you will get to bounce around a bit, and you will discover that fastening your seat belt is genuinely important for your comfort and safety.

⁵ http://www.direct.gov.uk/en/TravelAndTransport/Publictransport/AirtravelintheUK/DG_078179. The US government guarantees that you will not be asked to taste breast milk for an infant, but the UK government believes that this can pose a security risk. <http://www.tsa.gov/travelers/airtravel/children/formula.shtm>

⁶ Your author was so entertained watching a mouse run around the Lufthansa business class lounge at Frankfurt that he missed his flight to Leipzig, and had to sleep on an ash cloud camp bed on the concourse, as there were no hotel beds within a three hour drive...

⁷ http://www.who.int/ith/mode_of_travel/cab/en/index.html, http://www.rcn.org.uk/development/communities/specialisms/in_flight/news_stories/in_flight_how_much_oxygen_is_enough

On long haul flights it is much better to have a ticket that allows you to turn left as you board the plane, particularly if you are travelling overnight.⁸ Conditions in business class have got much better in recent years, as most long haul business class cabins have been reconfigured to offer flat beds. Strangely some airlines offer the oxymoronic (and in fact moronic) “angled flat” bed, which is like trying to sleep on the side of a hill. A genuine premium product, such as British Airways Club World, offers a bed that is 2 feet 1 inch wide – at its widest, and considerably narrower at its narrowest. The total surface area of the bed is less than one square metre – or about half the size of a standard single bed. People sleep fully clothed, and once you add in vibrations, noise, and so on it is clear that most people would get more sleep in a youth hostel than in Club World. Make no mistake, however: these conditions are far, far better than those found at the back of the plane.

On arrival you queue to deplane, queue for passport control, and if you are unlucky you will be taken aside for strip searching.⁹ Then you wait for your luggage, before heading onwards to your final destination. Of course if you are a connecting passenger you have to do it all again.

Flying, from first to last, is a horrible way to spend time. And yet we do it, time and time again. Rich people do it more than poor people, and people do it for pleasure as well as for business.

And that tells us something very important. Flying matters. We wouldn't do something as unpleasant as flying if it wasn't really, really worth it.

⁸ Your author has never had the privilege of travelling in first class.

⁹ This is more likely if you are female. <http://icinspector.independent.gov.uk/wp-content/uploads/2012/05/Inspection-of-Gatwick-Airport-North-Terminal.pdf>, 6.66.

2

How Will Aviation Change?

Predicting the future is never straightforward, but we can make some reasonable predictions about what is likely to happen.

There are no good substitutes for flying. It is of course possible to replace a face-to-face business meeting with a telephone conversation or videoconference. It is possible to replace a visit to a factory with an uploaded video on YouTube. It is possible to visit an IMAX cinema instead of going to see the Grand Canyon for yourself. But the reality is that none of these are good substitutes for going there yourself. People have been predicting the end of travel since communication became first more rapid, and they have been consistently mistaken. The reality is that the 1866 transatlantic telegraph cable, the telephone, fax, e-mail, and Skype are as much compliments to travel as substitutes for it. When it is easy to talk to another firm on the far side of the world you are more likely to do business with them on a regular basis. But given that you now do business with them regularly, it is much more likely that you will want to visit them once in a while.

Nor is any other form of transport a good substitute for flying on most routes. It is true that upgrading the railway line between Madrid and Barcelona led to a huge shift of travellers from air to rail, but this was in part because the rail journey was spectacularly slow beforehand.¹⁰ Britain's existing rail network is relatively fast by the standards of conventional trains. This means that the government estimates that spending £30 billion on high speed rail would reduce the journey time from London to Scotland by just 40 minutes.¹¹ It is hard to believe that such a small reduction in journey times will lead to a big change in the proportion who choose to fly as opposed to take the train, whatever the promoters of ambitious rail schemes may claim. Furthermore, many of the people who currently fly to Heathrow from within Britain are doing so because they are connecting to another flight at Heathrow. This group may well prefer to fly into Heathrow even if the journey is a little slower.¹²

There is nothing special, economically, about flying. When prices rise, people fly less, and when prices fall, people fly more. Rich people fly more than poor people, and rich countries fly more than poor countries. This is true for both business and leisure travel.

Britain is currently in a recession that has lasted much longer than anyone expected, at least as measured by the time taken to reach pre-recession income levels. Some people have argued that this is the “new normal”, but this seems unlikely. In the long sweep of history, for example, the Great Depression of the 1930s proved to be a relatively short pause. In a developed economy such as that of Britain, growth is caused primarily by rises in human capital, and the

¹⁰ The train previous took over 6 hours to cover the 386 miles, compared with the current 2 hours and 38 minutes.

¹¹ <http://www.dft.gov.uk/news/statements/greening-20120110>, compared with a current time of four hours and ten minutes. It is worth noting that the journey to Edinburgh took just under four hours 20 years ago, using existing rolling stock.

¹² This would be less likely if the high speed train line went to airport.

ingenuity that comes from well-educated people thinking up new ideas and refining existing ones. People entering the labour market are, on the whole, much better educated than those who are now retiring. Our ingenuity may take new forms – those entering the labour market forty years ago did not think of inventing apps – but so long as the ingenuity can be monetised, growth can continue. It is therefore reasonable to expect the income of people in Britain to grow, and with it the demand for travel. For leisure travellers this is likely to happen at all income levels: people who don't fly because they are currently poor will be more likely to fly in future, people who currently fly infrequently will become more likely to fly frequently, and so on. The world is an interesting place, and a few days in Rome, or a week to see the sights of Egypt is something that most people would find interesting and enjoyable. Finally, an increasingly

“The future of aviation is much like it is today. We will be richer, and are therefore more likely to want to fly further, and more often”

large minority will be able to afford to travel in premium economy, or even in business class.¹³

It is even more likely that incomes will grow around the world. Indeed, notwithstanding the terrible recession in developed economies, many

emerging economies have continued to grow, often at rates that would once have been seen as impossible. The low levels of income per head that prevail in countries such as China mean that “copy-cat” developmental growth has the potential to continue for many years before a slowdown to developed country levels of growth becomes inevitable. If future Chinese growth rates average 5% a year, far below current rates, China will be twice as rich in 2026 as it is today and three times as rich as today by 2035. And as more Chinese people become affluent, a higher number will want to travel, for business and pleasure. The same is true for all emerging nations.

For all of these reasons, it is likely that demand for aviation to Britain will rise. Given the role of London as the entry point for international tourists, and given the growth of the global middle class, it is at least plausible that growth in demand for aviation will be greater in and around London than elsewhere. The importance of immigration in the South East also reinforces the demand for air travel from London, as people – many of them British born – wish to visit family who remain overseas.¹⁴

The technical basics of aviation are unlikely to change much either. Planes will continue to consist of a tube with a wing sticking out on both sides and a tail with small wings at the back. The engines will be under the wings, one on either side for smaller planes, and two on either side for the very largest planes. Visually, they will look much like today's planes, and, for that matter, much like the 1954 Boeing Dash-80.

Planes will continue to take off by accelerating down a long straight runway until they reach a critical speed, and they will land by descending gradually in a straight line, until they reach the tarmac.¹⁵ In between they will travel at Mach 0.85, give or take, just as they do today. For the foreseeable future, vertical take offs, jet packs, supersonic travel via outer space, cars that convert to planes, aircraft carrier style launch mechanisms and the like will remain the stuff of science fiction, or at least highly specialised niche markets.

13 A BA long haul Club World seat takes three times the space of an economy seat, but typically sells for more than three times the price.

14 29% of people in Britain were born abroad, or have a parent or grandparent born abroad. <http://www.natcen.ac.uk/media/822956/r105067%20iser%20us%20findings%20report.pdf>

15 Kim Jong-Il built underground runways, for military use, but it seems unlikely that these will catch on more widely.

There will, however, be incremental changes that matter a lot. First off, planes are getting quieter. For example, the A380 and Boeing 787 are much quieter than older designs of planes of a similar size. We shall return to the policy implications of this later.

Second, planes are getting larger. This is most obvious in the case of the “double decker” Airbus A380, which in economy only configuration can take 853 people, around 200 more than a Boeing 747-400. Even the Boeing 737, the workhorse of the skies, has grown over its lifetime. The 1968 737-100 had a maximum capacity of 124 people, compared with up to 215 for a 737-900 or later. The forthcoming 737 Max will be slightly larger still. Larger planes mean more people can fly without any rise in the number of flights, but this cannot lead to an increase in the number of destinations served.

Finally the range of planes of any given size is getting longer. The initial 737s could travel 1,540 miles, while the newest ones have a range of up to 5,510 miles.¹⁶ This means that small, narrow bodied planes can now fly transatlantic, or from Europe to the Middle East.¹⁷ This increases the range of destinations that are economically feasible, since it is only necessary to find around 140 people who want to fly from A to B for the service to profitable.¹⁸

Increased range is also a feature of mid-sized planes. The most common 767, the -300ER can travel 5,990 miles, far further than the 3,850 miles of the first 767, but far less than the 8,500 of the forthcoming and similar sized 787. The development of the 240-seater 787 means that it will be possible to fly non-stop between anywhere in Europe and anywhere in Asia economically if you can find say 200 people for that route.¹⁹

Taken together, the future of aviation is much like it is today. We will be richer, and are therefore more likely to want to fly further, and more often. The rest of the world will also be richer, and in particular developing countries will be much richer than they are today. The development of more capable aeroplanes means that it will be technically and economically easier to fly to a wider range of destinations. When we add in the (slightly) greater comfort and stability of new designs of planes it is hard to imagine that demand for flying will fall. For that reason it is sensible to expect a rise in demand for aviation, in Britain, and worldwide.

16 These are nautical miles, and assume maximum weight at take-off.

17 There are various scheduled 737 transatlantic flights, usually on a business class only basis. Equally, the longer range of a modern narrow bodied plane has allowed easyjet to offer flights from London to Jordan and Egypt.

18 Crew rostering rules can make it expensive to fly transatlantic however: the economic model of low cost carriers is based on not having to pay for hotel accommodation for staff.

19 The Airbus 350 will offer a range of up to 10,500 miles, sufficient to fly non-stop to Sydney from London or New York. Such flights would take over 20 hours. It is not yet clear if people want to make such journeys without a break, particularly in economy class.

3

The Role of Government

20 Wikipedia lists 61 airports with runways of 1800 metres or more, based on the take-off requirements of a 737–800, http://en.wikipedia.org/wiki/List_of_airports_in_the_United_Kingdom_and_the_British_Crown_Dependencies, <http://www.boeing.com/commercial/airports/acaps/737sec3.pdf>, figure 3.3.46 p. 149. 41 are public, seven private, and 33 are military.

21 http://www.gatwickairport.com/Documents/business_and_community/Gatwick%20master%20plan/2012-07-18-GAL_Masterplan.pdf. Gatwick is already the busiest single runway airport in the world. <http://www.gatwickairport.com/business/about/facts-figures/>

22 They would, of course, need additional terminal space, aircraft parking facilities, and so on.

23 http://en.wikipedia.org/wiki/Busiest_airports_in_the_United_Kingdom_by_total_passenger_traffic; Manchester and Edinburgh also have two runways, and could therefore grow by more.

24 “Support policies within emerging Regional Spatial Strategy which support broad development of JLA.”

25 “Supports the principle of expansion of JLA.”

26 “Supports in principle the expansion”

27 “Council welcomes the increased job and business opportunities to Halton and wider sub region as a result of the expansion of JLA.”

28 In contrast Mouldsworth Parish Council are “Vehemently opposed to any planned activity which threatens to increase traffic over our Parish.” All quotations from http://www.liverpoolairport.com/assets/_files/documents/jul_11/peel__1311087858_LPL_Master_Plan_-_Summary_of_C.pdf

Britain – like almost every country – is littered with airports. The UK has more than 80 airports with runways suitable for jet planes.²⁰ Most have a single runway. Of the single runway airports, Gatwick is the busiest, with around 250,000 aircraft movements and 33 million passengers a year. Gatwick believes that it can grow to serve 40 million passengers as a single runway airport.²¹ At a first approximation, therefore, we can imagine all single runway airports expanding to around 30–40 million passengers per annum without requiring an additional runways.²² This would mean that Manchester and Stansted would broadly double their passenger numbers, while Luton, Edinburgh, Birmingham, Glasgow, Bristol and Liverpool would grow by between four and eight times.²³ Airports such as Southampton or Doncaster Robin Hood could grow even more dramatically.

Expanding such airports is relatively straightforward, practically and politically. Liverpool John Lennon Airport is a good example of what is possible. This airport catered for around 700,000 passengers in 1997, before growing to 5.5m in 2008, falling back slightly since because of the recession. The airport’s Master Plan aims for 12.3m passengers by 2030, which involves an extension of the runway and additional road links. This involves incursions into the green belt and a threat to an ancient woodland. Yet the principal local councils are all in favour, with Liverpool City Council,²⁴ Wirral Metropolitan Council,²⁵ Knowsley Metropolitan Council²⁶ and Halton Borough Council²⁷ favouring expansion in their responses to the consultation on expansion.²⁸ Liverpool John Lennon Airport shows that regional airports are, by and large, able to expand as and when demand exists.

The ability to expand also means high levels of competition between airports in one region. If Liverpool John Lennon offers poor service, then Manchester is able to offer airlines a reasonably local alternative from which to fly. Manchester has the space to accommodate all of Liverpool John Lennon’s flights. We have seen regional airports rise and fall. The sustained rise of Liverpool John Lennon has already been mentioned, but not all airports have been successful. Durham Tees Valley has seen passenger numbers fall from over 900,000 to under 200,000 over the last five years. Cargo traffic has also fallen, in this case by 99.9% since 2000. Plymouth City Airport has been less successful still, and has closed altogether for scheduled passenger traffic.

A combination of high levels of spare capacity, the ability to expand, and competition between airports means that there is no need for new or dramatically altered national aviation policies for regional airports. The market, and local politicians, are together able to ensure reasonable outcomes, appropriate for local circumstances.

The situation is very different in the South East. Broadly speaking, London Heathrow is completely full, while London Gatwick is already the busiest single runway airport in the world. It is full at peak times in peak season. It can expand at less commercially attractive “shoulder” and off-peak times, or if slot allocation rules are reformed to take slots from airlines that use them for only part of the year, in favour of those that use them for all of the year.²⁹ Stansted could roughly double its number of flights, but even an additional 18 million passengers from Stansted would represent an increase of just 14% of current London area passenger numbers. Luton is hampered by having a relatively short runway, at just under 2200 m, making it unsuitable for long haul flights.³⁰ London City has ambitious plans to increase passenger numbers, by a reduction in the number of very small planes, and by installing a taxiway, so that aircraft do not have to taxi along the runway.³¹ Its runway is very short, however, which makes it ill-suited to intercontinental travel.³² It is best seen as a niche player.

With the exception of Stansted, any meaningful expansion of any of these airports requires a new runway.³³ This will not be popular locally, as all of these airports have strong local groups opposed to their expansion. These include HACAN and NoTrag at Heathrow, GACC at Gatwick (supported by Francis Maude, among others),³⁴ SSE at Stansted, LADACAN and CALAE at Luton. Unlike in other regions, no South East council favours a new runway at their local airport.

Nor are there other South East airports that are likely to be able to expand easily. EasyJet has recently started flying from Southend Airport, but this airport has a short runway unsuitable for intercontinental flights, the airport site is small, and the planes take off directly over Southend. There are safety issues concerning the proximity to St Laurence church, a grade I listed building that is within the runway instrument strip.³⁵ Airports like Southend have a niche role, but it is hard to see them as offering major additional capacity for the London region. Nor do they represent a serious competitive threat to the existing core London airports.

Bromley Council have successfully precluded the use of Biggin Hill for scheduled services, demonstrating the local strength of feeling about the airport. It is also about as far from a train station as it is possible to be, while remaining inside the M25, and has poor road access as well. Furthermore, its runway runs broadly North South, which is unhelpful in every way.

The use of RAF Northolt for civilian flights is strongly opposed by local people, and would result in an additional noise corridor over London, hugely raising the number of people who are affected by aircraft noise. The runway would also need realigning to avoid take off conflicts with Heathrow when the wind was from the west. Again, the runway is short, which limits the destinations served.

Finally, Kent International Airport, better known as Manston, also has a pressure group opposed to its expansion, and has proven consistently unprofitable both for the airlines that have tried to fly from there, and for the owners of the airport. The airport is over an hour from London, even with a high speed line for the majority of the route. The airport is currently up for sale.³⁶

As well as existing sites, it would be possible to build a new airport from scratch. Boris Johnson has proposed exactly that, in the Thames Estuary, at Whitstable. Foster and Partners, Halcrow and Volterra economic consultancy proposed a similar airport on the Grain peninsula. Kent County Council, as well as Gravesham Council, are opposed, as are environmental groups.³⁷

29 http://www.gatwickairport.com/Documents/business_and_community/Gatwick%20master%20plan/2012-07-18-GAL_Masterplan.pdf.

30 It is possible to fly long haul from a relatively short runway, but not with a full plane.

31 <http://www.londoncityairport.com/Downloads/MasterPlan.pdf>

32 Excepting the flight to New York, London City serves only Western Europe, and has no flights on Saturday afternoons, or Sunday mornings.

33 London City can expand to 8 million without an additional runway, but as we have noted, this airport has a niche role, and should be seen as complementary to the other London airports.

34 <http://francismaude.com/news.aspx?id=27>

35 <http://www.southendairport.com/airport-facilities/private-corporate-flights/pilots-briefing-pack/#St.Laurence>

36 <http://www.bbc.co.uk/news/uk-england-kent-17301447>

37 http://www.newsshopper.co.uk/news/9704781.Kent_County_Council_opposed_to_Thames_Estuary_airport/; <http://www.bbc.co.uk/news/uk-england-kent-16615423>

The lack of spare capacity and the inability to expand any South Eastern airport of any size means that competitive pressures between airports are weak, and it is difficult for airlines to expand if and as demand supports expansion. This is in stark contrast to the position in the rest of the country.

Since there is nowhere within the South East that wants more airport capacity, the government needs to be involved.³⁸ It needs to make a decision as to whether the South East should have more airport capacity, or whether it should make do with what is there. If government decides that Britain needs more capacity in the South East, only government can decide where that capacity should go. Government does not need to fund the building of the airport, but without government support for the location, funding will not be readily available. In particular, a completely new hub airport is unlikely to attract finance unless the government mandates the closure of Heathrow.

38 Libertarians might argue for private negotiation and compensation, but the issues of hold-up are too great for this to be a sensible proposition.

4

Does Britain Need More Air Capacity in the South East?

Britain will not become impoverished overnight if we fail to build more air capacity in the South East. Failing to do so would, however, make it harder to do business in Britain. Britain would then have to cut its costs in some other way, to retain its competitive position. The absence of direct flights from a Chinese student's home town makes studying at a British university less appealing. To become competitive again the university will have to lower its fees – and then, in turn, lower wages. Otherwise some of those students will choose American or Australian universities, for example. That is the reality, for universities or any other sector: if we make it harder for business to operate, British wages will be lower. Better access for business means more prosperity.

Business certainly states that infrastructure is important. Transport infrastructure was ranked the most important factor by business respondents surveyed by Ernst and Young for the European attractiveness survey.³⁹ The EEF, a lobby group representing manufacturing industry in Britain, has commented on the importance of air travel for face to face meetings, as well as attending trade fairs.⁴⁰ The CBI agree, noting the importance of air freight for high tech, high value added manufacturing.⁴¹ More generally, they note the importance of face to face meetings in a globalised world in which products are made partly in one country and partly in another.⁴² As the Japanese Embassy commented: “to clinch a deal you have to travel; it has to be done face to face”, before continuing “I hope the UK government will re-consider the hold on capacity expansion – it is a real threat to the UK”.⁴³

There is no good way to assess the magnitude of the economic effect of expanding or limiting aviation in the South East on national income. The 2003 White Paper estimated that two new runways in the South East would add £17bn in net economic value, with employment effects of between 56,000 and 117,000.⁴⁴ This – and other estimates – may prove to be correct, or they may prove to be a little or a great deal too high or too low. Frankly our ability to calibrate a general equilibrium economic model is simply not up to making any precise estimate of the size of the effect.⁴⁵ We know that more flights mean higher incomes, and an increased ability to see the world, but the ratio of these factors cannot be assessed even ex post, let alone ex ante.

This report believes that expanding demand for aviation and the failure of the market and local government to provide additional capacity in the south-east make it sensible for national government to consider how and where aviation capacity in the south-east should be expanded. We proceed on that basis.

39 http://www.gatwickairport.com/Documents/business_and_community/8.8%20Publications/GATWICK%20FINAL%20REPORT%20121011.pdf figure 3.3.

40 http://www.gatwickairport.com/Documents/business_and_community/8.8%20Publications/GATWICK%20FINAL%20REPORT%20121011.pdf p. 64

41 http://www.gatwickairport.com/Documents/business_and_community/8.8%20Publications/GATWICK%20FINAL%20REPORT%20121011.pdf p. 81

42 http://www.gatwickairport.com/Documents/business_and_community/8.8%20Publications/GATWICK%20FINAL%20REPORT%20121011.pdf p. 64

43 http://www.gatwickairport.com/Documents/business_and_community/8.8%20Publications/GATWICK%20FINAL%20REPORT%20121011.pdf pp. 81, 106.

44 <http://webarchive.nationalarchives.gov.uk/+http://www.dft.gov.uk/about/strategy/whitepapers/air/utureofairtransportwhite5694.pdf> p. 163

45 Let's be honest: economic modelling is not proving very effective at the moment...

5

Does Britain Need a Hub Airport?

A hub airport is one in which a significant proportion of inbound passengers transfer to other flights, rather than ending their journey at the airport. Some transfers are on a through ticketing basis – for example, flying with British Airways from Belfast to London and then on to Singapore. Others are more ad hoc, and involve the passenger buying two separate tickets – for example, an easyJet ticket from Montpellier to Gatwick, and a Virgin Atlantic ticket from Gatwick to Las Vegas. The Civil Aviation Authority report *Connecting passengers at UK airports* gives good data on the extent and changes over time of hubbing in the UK.⁴⁶

There is no official definition of the necessary number of transfer passengers to define an airport as a hub. More than 20 million people connect each year at airports such as Heathrow and Frankfurt, with slightly fewer than this number connecting at Paris Charles de Gaulle and Amsterdam Schiphol.⁴⁷ These are clearly hub airports. In contrast only 4.5 million people connected at Gatwick, 2 million at Stansted, and 2 million at all other UK airports combined. It is sensible to think of Heathrow as currently Britain's only hub, and Britain is not unusual within Europe in having only one hub airport. Both by definition and in practice all hub airports have more than one runway.⁴⁸ Heathrow is the UK's only airport to have two independent full length runways, which means that its status as Britain's hub cannot currently be challenged in practice.⁴⁹ Most hub airports have four runways, although some have more.⁵⁰ Having more runways makes it easier to land many planes at broadly the same time, before having many planes take off at broadly the same time. This allows people to fly in from a range of destinations, before swapping planes, and flying out again to a wide range of destinations without having to wait too long at the airport.

Many passengers connecting through Heathrow start at a regional British airport, and are flying to their final destination via London. Manchester to Hong Kong, via Heathrow, is the single most common connection in the UK with an estimated 372 people making this connection every day.⁵¹

Although Manchester to Hong Kong via London is the single most common connection, over three quarters of connections at London airports are people flying in from abroad, and flying back out again without ever entering the UK.⁵² These divide roughly equally between those making business trips, those travelling for pleasure, and those visiting friends and family.⁵³

Having people fly from say Dublin to Singapore via London rather than Frankfurt offers limited direct advantage to Britain, particularly if the flight is on non-UK based carriers.⁵⁴ The advantage is instead indirect: if lots of people fly from Dublin to Singapore via London then it increases the chance that flights from London to Dublin and London to Singapore will be viable. This is an important advantage.

46 http://www.caa.co.uk/docs/5/Connecting_Passengers_at_UK_Airports.pdf

47 http://www.caa.co.uk/docs/5/Connecting_Passengers_at_UK_Airports.pdf, table 3-7, p. 15

48 For example, neither of the two busiest single runway airports, Gatwick and San Diego, is a hub.

49 Gatwick has a taxiway that can be used as a runway when the runway is out of action. Manchester has two full length runways, but they are close together and cannot be operating independently. Furthermore, the southern runway does not have full taxiway facilities. Edinburgh and Glasgow Prestwick both have two runways but in each case one runway is relatively short, at around 1800m.

50 For example, Frankfurt, Los Angeles, Madrid, JFK, Paris CDG and Rome have 4, Atlanta has 5, Amsterdam and Detroit have 6, while Chicago and Dallas Fort Worth have 7. Many of those with more than four runways have some that cross, so that not all can be used simultaneously.

51 http://www.caa.co.uk/docs/5/Connecting_Passengers_at_UK_Airports.pdf, table 3-3, p. 11

52 http://www.caa.co.uk/docs/5/Connecting_Passengers_at_UK_Airports.pdf, table 3-1, p. 10

53 http://www.caa.co.uk/docs/5/Connecting_Passengers_at_UK_Airports.pdf, table 2-3, p. 7

54 This is the most popular international origin-destination pair with a London transfer. http://www.caa.co.uk/docs/5/Connecting_Passengers_at_UK_Airports.pdf table 3-3, p. 11. There is a benefit for the UK if the flights are on UK carriers since it means employment for UK based-personnel and is an export.

There are clear examples of routes that are currently viable that would not be viable without hub traffic. 64% of passengers from Mexico City to London do not terminate at London, but instead connect to other destinations. Without those transfer passengers BA, who provide this service, would average just 115 passengers a day, making the service uneconomic. Those wanting to travel to Mexico City would have to go via Paris, Frankfurt or Madrid.⁵⁵

The CAA have listed major routes that would be most likely to disappear without transfer passengers. They are, in order of vulnerability: Mexico City, Lusaka, Beirut, Halifax, Dar-Es-Salaam, Seattle, Phoenix, Chennai, Bangalore, Tripoli, Riyadh, Accra, Ottawa and Dhaka.⁵⁶

Based on IATA data, Frontier economics added Hyderabad, Edmonton, Montreal, Calgary, Vancouver, Ottawa, Luanda, and Buenos Aires.⁵⁷ This list of places divides into two types of places: significant cities in emerging markets, and second tier North American cities. Vulnerable routes are generally long

distance routes. Short haul planes are much smaller, and therefore an airline needs to attract far fewer people to make the service economic. Demand of 115 people per day is not sufficient to warrant flying to Mexico City, but is sufficient to make a daily flight viable to a European destination using a smaller plane.

Increasing the number of slots available at a London hub airport would therefore facilitate more long haul routes which attract reasonably limited numbers of passengers. For example, Air France has recently announced the first non-stop service between Europe and Wuhan. It will offer three flights a week between Paris and Wuhan, on a 309 seat Boeing 777. It seems unlikely that Air France believe that there are 927 people in Paris who want to fly to Wuhan each week, or 927 people in Wuhan who want to fly to Paris each week. Rather, they believe that demand from all of Europe to and from Wuhan is sufficient that so long as people fly to and from Wuhan via Paris, the flight will be viable.

Britain therefore has a choice. If we do not provide additional capacity, new flights, such as the route to Wuhan, will be indirect. People will start from Britain, fly to Paris and then on to places such as Wuhan. This increases the hassle factor, and makes it more likely that the journey will not seem worthwhile.

The same is true in reverse: Wuhan business people wanting to set up an office in Europe will clearly see Paris as the easiest place to get to. You get on the Air France flight, and you are there. If you set up in London you will have to change planes in Paris to get to your destination, or transfer from the airport to the station, before catching the Eurostar. Britain is then at a disadvantage relative to Paris in attracting those firms, and those jobs. Equally British universities – a major export earner – will clearly find it easier to attract students if students find it easier to get here, and to return home.

Frontier Economics have shown that, taking 2000 as a baseline, UK trade with developing countries has risen by 200% in countries with which we have non-stop service, but only by 20% in other countries. Although there must be an element of chicken and egg here, these differences are stark. They estimate that there are a further 45 routes that would be viable from London, were there

“There are clear examples of routes that are currently viable that would not be viable without hub traffic. 64% of passengers from Mexico City to London do not terminate at London, but instead connect to other destinations”

⁵⁵ Notice that this is of little consequence to those starting from Britain's other regions: connecting at Amsterdam, say, is not materially less convenient than connecting via London. It is London passengers who otherwise do not have to connect who are most affected. Connecting at Amsterdam rather than London reduces UK air passenger duty, and means that the ongoing flight will be on a foreign carrier, and therefore constitutes an import.

⁵⁶ http://www.caa.co.uk/docs/5/Connecting_Passengers_at_UK_Airports.pdf table 7-1, p. 25

⁵⁷ http://www.frontier-economics.com/_library/publications/Connecting%20for%20growth.pdf, table 2.

to be the hub capacity to run those services and complementary short haul connections.⁵⁸

Of course, if Wuhan grows and becomes more prosperous there will be more than 927 people a week who want to fly from Europe to Wuhan. At that point it may be that a London based carrier will decide to replace an existing departure with a flight to Wuhan. But there is at least a chance that Wuhan companies will have already established their offices in Paris by then, and those jobs will remain in France. If we had spare capacity now we could have a flight to Wuhan in addition to our existing flights, and we would be more likely to get the European HQs of companies from Wuhan.

Non-stop flights are particularly important to people travelling for business. If your client is in Wuhan, you have to fly to Wuhan. In contrast, the absence of a non-stop flight from Britain to the Greek island of Skyros still leaves a leisure traveller able to choose between 12 different Greek islands all served by non-stop flights from Britain.⁵⁹ A relatively low proportion of tourists have a strong preference for Skyros over other Greek Islands, so the absence of a direct flight to Skyros is of no great importance. That is not true for business people, who have a set destination in mind.

As well as increasing the range of destinations served, a hub airport increases the number of flights per day on core routes. It is clear, for example, that flights from London to New York would exist even if those flights were restricted to people flying from London to New York. Transfer passengers increase the number of flights, which has two advantages. First, it makes it more likely that people can fly at a time of their choosing. Business people in particular can have strong preferences for one flight time over another, particularly if they are making a relatively short trip.⁶⁰ The Virgin 0930 departure for New York, for example, is well-suited to those living near Heathrow, those staying over locally, who need to do close to a full day's work on arrival. On the other hand it is pretty brutal if you start the day in Exeter, or Norwich. The BA 1130 allows for some work in London before departure, while still allowing the traveller to arrive in the New York office by mid-afternoon. Equally, it is a better time for people starting from further away. And lots of flights home mean that business travellers who have finished what they have to do can go to the airport and get home – assuming that their company has bought them a flexible ticket. The presence of more flights has benefits beyond convenience. First, variations in demand are easier to cope with when there are more flights. If an extra 200 people want to fly from London to New York on the 17 November, perhaps for a trade fair, they will have no difficulty booking a seat. That would be much harder if the London to New York route was served by only one flight a day. Second, transfer passengers make it more likely that there will be sufficient passengers for more than one airline to fly that particular route. This increases competition, and makes it more likely that fares will be affordable. At the time of writing a return to New York, leaving in one week, in economy class, is £845 from London – a competitive market, but £1,306 from Birmingham – a monopolistic market.

We need to be realistic about the potential for the UK to serve as Europe's premier hub. Long haul flights to northern hemisphere destinations involve flying north from Europe, over the North Pole, or close to it. London is closer to North America, and Frankfurt to Asia, but the differences are 400 miles or

58 http://www.frontier-economics.com/_library/publications/Connecting%20for%20growth.pdf, figure 2.

59 Data from www.flightmapping.com. Note that there are no flights to Greek Islands from Heathrow. People who say that we can free up capacity at Heathrow by removing leisure destinations have not usually looked in detail at flight schedules. Only 18% of Heathrow passengers are UK residents flying abroad for leisure. Most are going on holiday to major business destinations, such as New York. <http://www.caa.co.uk/docs/5/Catchment%20area%20analysis%20working%20paper%20-%20FINAL.pdf> figure 8.

60 A friend flew London-New York three times a week when his company was taking over an American firm. He spent Monday, Wednesday and Friday in the New York Office, and Tuesday, Thursday and Saturday in the London office.

fewer. Frankfurt has an advantage because more places in Europe are closer to Frankfurt than to London. As a result, it is more likely that a flight from a random European city will be faster via Frankfurt than via London, because the European flight will be shorter.⁶¹ This is particularly true for flights to Asia, where the long haul leg will be shorter as well, and less likely on flights to the US, where the longer journey to London within Europe is offset at least in part by a shorter journey from London to the US. The reality is, however, that Frankfurt and other continental airports generally have a geographical advantage over London in attracting transfer passengers from within Europe for long haul routes. Against that, London starts the stronger local market, and thus is more likely to be able to offer more flights and thus flights at convenient times. This probably explains our very high share of the New York or Los Angeles transfer market. People travelling from these places are more likely to transfer at London than any other European hub.⁶²

Heathrow offers non-stop service to 82 long haul destinations, compared with 77 from Paris and 75 from Frankfurt. But Heathrow's lead in numbers of seats is huge: 25 million, compared with 14 and 13 million for Paris and Frankfurt.⁶³ Our service based economy, our openness to immigration and multinational corporations, mean that we have a strong inherent demand for aviation, which makes it more likely that the demand will be there for non-stop service. The fact that we have 25 million people travelling to just 82 destinations also implies that there may be many more destinations that would be economic were we to have the slots available in a hub airport.

We can get a sense of the ability of how a successful hub can lead to new routes by looking at the success of other European airports. Frankfurt has a relatively small hinterland of its own, but by aggregating traffic from other places it manages to punch above its weight in terms of destinations. Frankfurt has 35 long haul routes where more than half the passengers are transfers, compared with just 15 for Heathrow. Amsterdam has 27 and Paris 25.⁶⁴ London is clearly punching well below its weight, and could clearly support flights to more long haul destinations were it to have the capacity. The effect is most critical for emerging markets that are not yet wealthy enough to warrant non-stop service to each of the major European airports. London has daily non-stop service to 22 emerging markets, compared with 27 from Frankfurt, and 25 from each of Paris and Amsterdam.⁶⁵ We would expect London to be far in the lead, given that London is much the strongest economy of these four.

Many emerging market destinations have significantly better service to other European airports than to Heathrow. They may have daily service rather than a less frequent service, or they may have some service, rather than none. Although the exact list changes from time to time, Frontier Economics found in September 2011 that Shenyang Taoxian, Nanjing Lukou, Chengdu, Guangzhou, Hanoi, Ho Chi Minh City, Manila, Jakarta, Ekaterinburg, Novosibirsk, Pune, Ufa, Kiev, Marsa Alam, Mallam Aminu Kano, Port Harcourt, Porlamar, Caracas, Bogota, Cali, Lima, Salvador, Belo Horizonte, and Santiago all had materially better connections to another European airport than to London.⁶⁶ Few readers will have heard of all of these places, and even fewer could locate them on a map. But these are places that are capable of supporting non-stop flights to Europe, and which do not have London as their primary point of entry. In some cases another country may have

61 If you start in Rome or Madrid or Athens, for example, there are few final destinations that are shorter via London than Frankfurt.

62 http://www.frontier-economics.com/_library/publications/Connecting%20for%20growth.pdf figure 9

63 http://www.frontier-economics.com/_library/publications/Connecting%20for%20growth.pdf Table 5.

64 http://www.frontier-economics.com/_library/publications/Connecting%20for%20growth.pdf figure 5 multiplied by figure 10.

65 http://www.frontier-economics.com/_library/publications/Connecting%20for%20growth.pdf figure 20

66 http://www.frontier-economics.com/_library/publications/Connecting%20for%20growth.pdf figure 17.

stronger ties – for example between some parts of Latin America and Madrid. But for many it is hard to argue that London is ill-placed to win this traffic, were we to have the hub airport capacity to compete for it. Overall, Frontier Economics estimate that London would serve an additional 16 long haul destinations with daily non-stop service, and 48 additional routes at lower frequencies.⁶⁷ In addition greater capacity is likely to increase the number of flights to relatively poorer served places such as Beijing. Heathrow currently represents just 15% of the seats from the major five European airports to China, and this number is expected to fall rather than rise in future.⁶⁸ London is, however, poorly located to serve as a hub for intra-European flights. Frankfurt is located at the geographical heart of Europe, and it is much more likely that a flight between two places within Europe will be faster via Frankfurt than via London. There are exceptions, of course, but taken as a whole we should never expect London to be an important hub for journeys that start and end within Europe.⁶⁹

Finally, the choice of London, Paris, Amsterdam or Frankfurt makes very little difference to those who are travelling long haul – long haul. If you are travelling Chicago – Nairobi the choice of where in Europe to connect will be determined by flight availability connection times and price, rather than by slight differences in flying times. The same would be true for Toronto – Dubai, or New York – Tel Aviv, to cite the three most common long haul – long haul London connections.⁷⁰ In each case better slot availability will assist London in supporting new destinations.

Hosting a hub airport is not costless. Passengers travelling from outside the UK to another destination outside the UK, via a UK hub airport do not pay air passenger duty, so there is no direct gain to the exchequer from such transit passengers.⁷¹ Extra flights for transfer passengers mean extra noise for those living in and around the airport. These are not trivial objections, but it is best to tackle each directly, rather than rejecting the benefits of more and better connections that a hub airport brings. We shall return to both issues later.

Nor should we be obsessed with a hub at any cost. A 24/7 hub offers few advantages to UK passengers compared with having a – say – 18/7 hub. Someone travelling from Toronto – Dubai might well be happy to transfer at 3am, since the time in London is of no interest to them. But few people arriving in London from Toronto want to get here at 3am, and the number of people who would choose to want to depart at 3am for Dubai is small. There are also serious issues about transport to and from airports at that time – people living adjacent to railways, for example, would not welcome 24 hour operation. It is noticeable that neither Ryanair nor easyJet, both of whom aim for high aircraft intensity, run large numbers of night flights even when they are operating from airports where night flights are permitted. Nor do British Airways or Virgin have any arrivals between 2300 and 0630 at Gatwick. They know that this is not what their customers want. A 24/7 airport is good for the airport operator, but it is not the airport we want or need.

As we have seen, a hub airport is important to increase the number of destinations with non-stop service. Frontier Economics estimate that a better hub would add £1–2bn to trade, although such estimates should be taken with a pinch of salt.⁷² Having one increases the range of destinations that can be served with non-stop flights, making life easier for those people in Britain who want or need to travel. A hub also means more convenient flight times, and will often mean lower fares as well. London is well-placed to be a hub airport, particularly for

67 http://www.frontier-economics.com/_library/publications/Connecting%20for%20growth.pdf p. 47

68 http://www.frontier-economics.com/_library/publications/Connecting%20for%20growth.pdf table 8.

69 For that reason the Frontier Economics analysis of short haul destinations should be treated with caution. http://www.frontier-economics.com/_library/publications/Connecting%20for%20growth.pdf, figure 7 and discussion.

70 http://www.caa.co.uk/docs/5/Connecting_Passengers_at_UK_Airports.pdf table 3-3, p. 11

71 Both the Conservative and Liberal Democrat manifestos and the coalition agreement stated that Britain would replace air passenger duty with a tax on planes. This would overcome this anomaly, but the coalition appears not to be proceeding with this policy. A London hub that attracts passengers from the UK regions will increase tax revenues, however, since Britain will then get long haul APD, rather than just short haul APD when regional passengers transfer at Amsterdam, or another continental airport.

72 http://www.frontier-economics.com/_library/publications/Connecting%20for%20growth.pdf p. 39

long haul routes. It has a large local market – double that of the Paris or Madrid regions, and five or more times that of Amsterdam or Frankfurt. English is a language many people speak, making changing in London attractive.⁷³ Geography means that London is less well placed to be a short haul hub, connecting people whose origins and destinations are both within Europe. A London hub is therefore likely to be dominated by long haul operations, and by large planes.

This report will proceed on the basis that Britain should have a hub airport, and that that hub airport should have spare capacity in order to be able to accommodate the likely changes in demand discussed earlier, and in order to be able to offer a wide and increasing range of destinations. That is not to say that the only expansion of aviation in the South East should be in the form of a hub airport, but it is to say that an expansion of our current hub airport, or the creation of a new hub airport is necessary.

This in turn rules out one of the ideas it is currently put forward in the popular debate: the use of Birmingham as a new London airport. Advocates point out that it is already the case at Birmingham International airport and London Euston are only one hour and ten minutes apart, and that this will fall to as little as 38 minutes if the proposed high-speed train line is built.⁷⁴ This, however, misses the point: Luton is already only 20 minutes away, and Stansted 38 minutes away yet both have spare capacity. It is not the case that London is short of secondary airports some distance away. London is short of hub capacity. The idea that Birmingham, with its relatively short runway, and take-off and landing patterns over heavily populated areas, is some sort of solution for the problem of a lack of hub capacity in London is untenable.⁷⁵

73 http://www.frontier-economics.com/_library/publications/Connecting%20for%20growth.pdf figure 6, measured by regional GDP.

74 <http://www.hs2.org.uk/key-facts#jou>

75 48,000 people are affected by noise at Birmingham airport. http://www.caa.co.uk/docs/589/CAA_InsightNote2_Aviation_Policy_For_The_Environment.pdf

6

What Should a Good Airport Look Like?

76 The new Berlin airport has runways in this configuration, as do Glasgow, Liverpool, Manchester, and Newcastle within the UK, and Paris Charles de Gaulle, Frankfurt and Munich with Europe. Birmingham and Leeds airport's runways run North West – South East, demonstrating that modern aircraft are sufficiently versatile to ignore this recommendation when necessary, while Amsterdam has runways in all directions.

77 International regulations for new airports say that planes may begin to turn one nautical mile from the end of the runway.

78 For example, Foster and Partners Estuary airport, Berlin Brandenburg, Malpensa, Hong Kong, Dubai, etc. The interested reader can look at Logan (Boston) and Schiphol (Amsterdam) for more unusual runway configurations that exist at older airports.

79 Required runway lengths for take offs are longer than those necessary for landings

80 3km is sufficient for a Boeing 747 to take off with the maximum permitted payload. Few planes take off in these conditions, and a 2.5km runway is sufficient for a 747 to take off at 90% of maximum weight. See Boeing 747 technical details graph 3.3.5 available from <http://www.boeing.com/commercial/airports/acaps/7474sec3.pdf>. The Airbus A380 is designed to take off within the same runway parameters as the 747, and it is overwhelmingly likely that this will be true of all future aircraft. A 2.5km runway would therefore be feasible, but a 3km runway adds flexibility.

81 The distance is between runway centres. CAA regulations, http://www.gatwickairport.com/Documents/business_and_community/Gatwick%20master%20plan/2012-07-18-GAL_Masterplan.pdf, section 10.3.5

It is significantly easier for aeroplanes to take off and land into the wind, and ideally planes prefer to avoid cross winds. For that reason a good airport has runways that run with the prevailing wind direction. In the case of Britain that means that runways should run east-west, or south west – north east, or somewhere in between. All of London's current five airports have runways aligned in this way, as does the Foster and Partners proposed new London airport on the Isle of Grain.⁷⁶

In general runways should be parallel to each other. This allows planes due to land on one runway to approach without getting in the way of planes due to land on another runway. There is one line of descending planes per runway, parallel to each other. The same is true for take offs, although planes diverge from the runway axis relatively rapidly after take-off.⁷⁷ Modern airport designs always have parallel runways.⁷⁸

A hub airport needs to have runways that are sufficiently long to allow all designs of planes to take off.⁷⁹ A runway needs to be longer if the airport is at altitude, or if the area is prone to very high temperatures, or high humidity. In the case of Britain, a runway of 3km is comfortably sufficient to allow the take-off of any existing or likely future plane, at any plausible load factor.⁸⁰

The distance between runways is crucial. There are advantages and disadvantages to having runways close to each other, or further apart. Having runways closer together reduces taxiing time significantly. This is convenient for passengers: the whole point of flying is a speedy journey. Reducing taxiing times also reduces an airport's environmental footprint, as plane engines are designed for flying at 650mph, not driving round an airport at 20mph. Having the runways close together also narrows the width of the noise footprint, which is particularly important if the airport is near a major population centre.

In contrast placing runways further apart gives the airport more flexibility. In particular, two "close spaced" runways cannot be used independently: for example, landing a large plane would create sufficient wind disturbance that it would be impossible to land a small plane on the nearby "close spaced" runway at the same time. The vortices from the large plane would bounce the small plane all over the place.

The best practice approach for a four runway airport is to have two pairs of close spaced runways, with a significant gap – at least 1,035m – between the two pairs.⁸¹ At that point it becomes possible to use two runways for landings, and

two for take offs, at any given point. The CAA requires close spaced runways to be 380m apart, although Atlanta airport, for example, has the close spaced northern runways 340m apart.⁸² It is usual to use the outer runways for landings, and the inner runways for take offs.⁸³

The best location for the terminals is then in between the two sets of runways. This reduces the land needed for the airport, and reduces taxiing time. The best airport design is known colloquially as a “toast rack”.⁸⁴ This consists of a number of parallel “piers” at right angles to the runways. Planes dock at the piers, for passengers to embark and disembark. Both taxiing and congestion are reduced because planes can access either set of runways from any position on any pier, without having to taxi around a terminal or other obstacle.⁸⁵ Passengers transfer between the terminal and pier via walkway, moving walkway, automated shuttle, or similar, with buses as a last resort. The space needed for terminal and pier facilities mean that the two wide spaced runways are often built more than 1,035 metres apart. It is imperative that passengers are able to move easily and swiftly around the airport: offering good transfer times is important for a successful hub airport.

The ratio of airport stands and terminal facilities to runway space depends on the average size of planes. Larger long haul planes have to sit further apart at the terminal or pier, as their wings are significantly wider. Furthermore, they tend to sit at the stand for much longer. It takes longer for passengers to embark and disembark, and longer to board and unload luggage and cargo. It takes longer to clean, and restock the plane, and longer to refuel it. Furthermore, long haul scheduling has to allow much longer at the airport in case of prior delays including from adverse winds, and because the optimal departure and arrival times are much more specific. Finally, if an airline has a 737 at a “loose end” for a few hours it can consider scheduling an additional flight to a relatively close destination. A Qantas plane in London, in contrast, has no ability to do a short journey with an Airbus A380, even if it was ready to go a little earlier. The plane can be moved off the pier, but it has to stay in the airport. For all of these reasons an airport with a high proportion of long haul traffic will need a lot of land for aircraft stands, and piers. In contrast an airport with a high proportion of small commuter planes will need less land for these items, even if the number of departures is similar. Finally long haul passengers are more likely to need significant terminal facilities. People flying to Australia are more likely to have luggage than people flying a short distance, and they are more likely to arrive at the airport early, and need feeding, or simply somewhere to be. Gate space also needs to be commensurate with the size of the plane being loaded. For all of these reasons, a London hub airport is likely to need more terminal space, and more pier and gate space, than a US airport with a similar number of flights, given the lower proportion of commuter flights from London than from a typical US airport.

In order to further facilitate efficient movement of planes around the airport, it is useful to have a parallel taxi way between each of the pairs of close spaced runways. This allows a plane to land on the outer runway, and immediately pull off the landing runway onto the taxi way, via a rapid exit taxiway.⁸⁶ This frees up the landing runway for the next plane. The previous plane waits on the taxi way until it is given permission to cross the inner (take-off) runway and proceed directly to the terminal or pier.

82 CAA document CAP 168 Licensing of Aerodromes <http://www.caa.co.uk/application.aspx?catid=33&pagetype=65&appid=11&mode=detail&id=232>

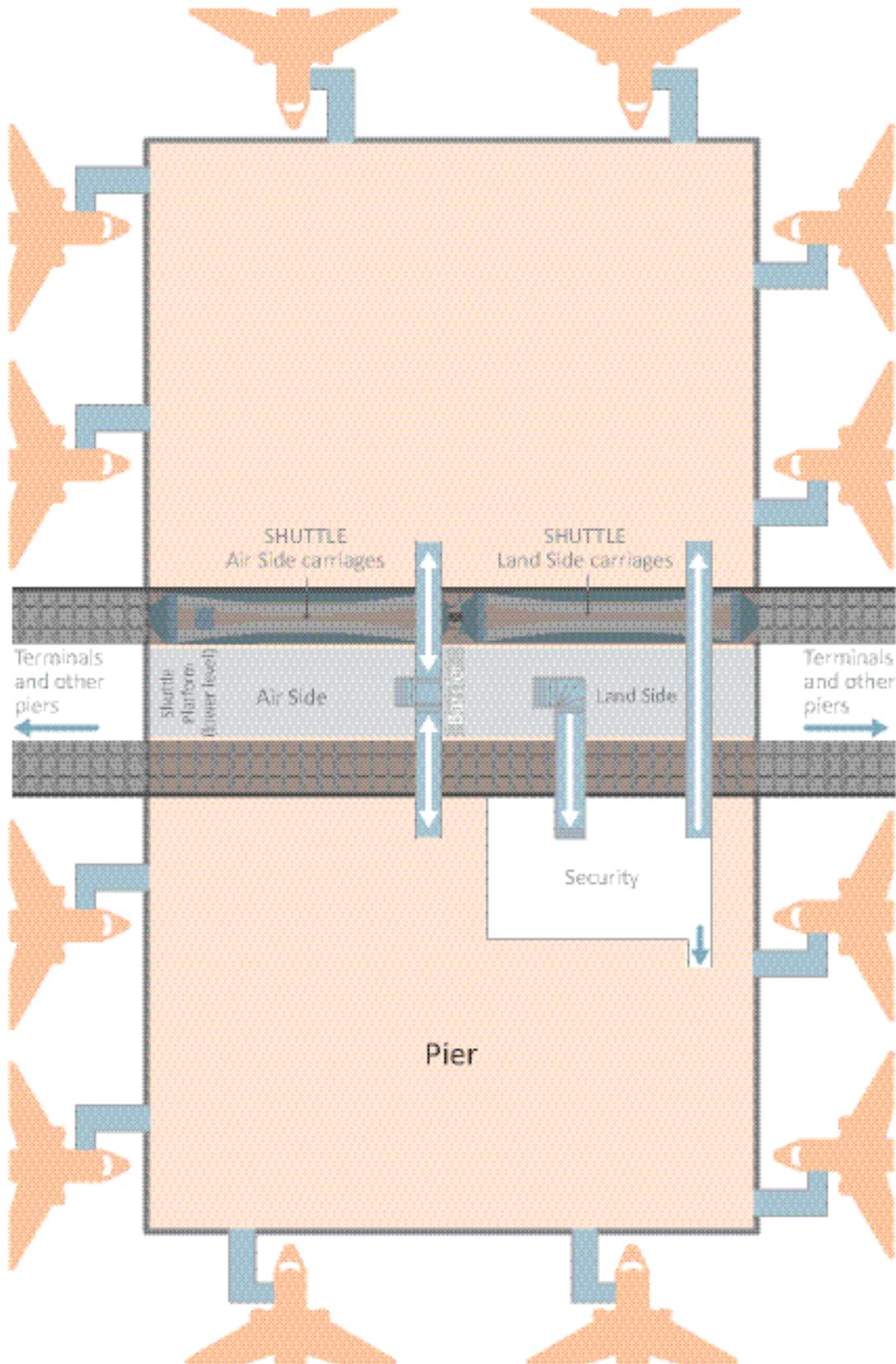
83 This is because it is safer to have landed aircraft cross the departure runway to get to the terminal than vice versa.

84 http://www.baa.com/static/BAA_Airports/Downloads/PDF/Heathrow_CIP_2010.pdf

85 A good mock-up of Heathrow's gradual transition to a pier based airport can be found here: <http://im.media.ft.com/content/images/ea079178-598b-11e1-8d36-00144feabdc0.img?width=961&height=726&title=&desc=>

86 <http://www.caa.co.uk/docs/33/CAP168.PDF>, p. 6

Figure 1: Proposed pier design



We now have a good sense of what the ideal hub airport for London should look like. It should have four parallel runways, running broadly east west, grouped as two sets of two. The terminals and piers should be in between, and should be extensive compared with typical US provision.

It is worth emphasising that this is not a theoretical idea, but an airport plan that has been demonstrated as effective in many places. For example, Hartsfield–Jackson airport at Atlanta is the busiest in the world, by both the number of flights, and the number of passengers. Until the fifth runway opened in 2006, Atlanta conformed to the pattern outlined here: four parallel runways, running east west, with two close runways close spaced to the north of the terminals, and two close spaced to the south. In 2005, as a four runway airport, and with only a handful of night flights, it had 964,000 operations, and served 83.6 million passengers.

Atlanta airport in 2005 thus had twice as many flights as Heathrow.⁸⁷ Since Atlanta was full in 2005 it makes sense to think of the sensible capacity of a four runway airport as being around 850,000 movements a year. Given the average number of people on a flight from Heathrow, such an airport would be able to cater for 12.1m passengers per year, a rise of around 52m from current levels. That is likely to prove sufficient for Britain's needs for some time. Agreeing a location for such an airport would, therefore, allow us to end the aviation debate for at least a generation.

We therefore see the challenge as finding a sensible location for a four runway airport, based on the airport design outlined here. As we have noted, CAA regulations state that the two wide runways must be at least 1035m apart, while the close coupled pairs must be 380m apart.⁸⁸ Taking into account space needed between the edge of the runway and the airport perimeter tells us that the airport needs to be a minimum of 2,095m from North to South, and at least 3.4 km from East to West, to accommodate the 3km runways and runway overrun areas.⁸⁹ In addition, some space is needed for cargo, maintenance, and so on, but this can be added in almost any dimension, according to the site under consideration. Clearly a larger site is easier to work with, but this is a reasonable definition of the minimum feasible size.

This discussion also tells us that the notion of connecting Heathrow and Gatwick to become a single hub makes no sense. For a start, both airports are full at peak times, and both are expected to be completely full by 2030. Connecting two airports that are individually full clearly does not create additional capacity. That is, in and of itself, sufficient reason to dismiss the idea.

The cost of connecting the two places with a sealed, air side, rail connector will also be extremely high. The two airports are 25 miles apart, and approximately half of the distance currently has residential housing and other forms of development on it. As the Crossrail project shows, the cost of tunnelling is very high – at around £1bn per mile.⁹⁰ It seems likely, therefore, that a direct high speed train would cost around £15bn, as an order of magnitude. Plans to build a railway next to the M25/M23 fail to note that much of this land is built on already, that it would require every motorway junction to be re-ordered, and that the motorway is not straight enough for high speed trains, particularly at the M25/M23 junction.⁹¹ Nor is it clear that the project would appeal to people who wanted to change planes. As anyone who has ever changed planes will tell

87 964,000 compared with 480,000. Both airports have a handful of night flights, but broadly the same core operating hours.

88 In each case, distances are given between runway centres.

89 This assumes the use of EMAS areas. Cheaper alternatives are available if the location is larger.

90 <http://www.ft.com/cms/s/0/4934f824-ea3d-11e1-984b-00144feab49a.html>

91 <http://glaconservatives.co.uk/wp-content/uploads/downloads/2012/03/VirtualHub.pdf>

92 While I was writing this paper one person wrote to me with plans for an underground maglev train that would go from Heathrow to Luton to Stansted to London City and then on to Gatwick before returning to Heathrow. The cost of such a project was not disclosed.

you, it is bad enough having to change terminals. The idea that travellers will be willing to move from terminal to station, wait for a train, take the train to another airport, enter another terminal, and find their way to their next flight seems heroically optimistic. It seems even more optimistic that their luggage will manage this sort of connection in a prompt and efficient manner. The notion of connecting two airports together like this to form a single hub has never been attempted anywhere in the world, for good reason. It seems overwhelmingly likely that passengers would choose Paris, Amsterdam or Frankfurt in preference to “Heathwick”.⁹² This idea is a non-starter.

7

Principles Behind Good Airport Location

The best location for an airport is at the end of the road on the day you want to fly, and nowhere near where you live on every other day. This conflict lies at the heart of aviation policy: people want to fly from an airport that is close to hand, but equally an airport close to hand is noisy. That is the trade-off.

We can see this with London Heathrow. Both Gatwick and Stansted airports have spare capacity, and therefore any airline currently flying from Heathrow could, if it chose, fly from those airports instead.⁹³ In some cases there is a chicken and egg element: if a flight has a large number of transfer passengers, then that flight must leave from the same airport as the flights with which it connects. Yet there are many airlines with very few connecting passengers who continue to use Heathrow. The CAA state that the Skyteam airline alliance has just 400,000 connecting passengers a year.⁹⁴ With around 300 departures per week from Heathrow this implies about a dozen connecting passengers per flight.⁹⁵ Given that some will have more connecting passengers, and some fewer, it must be the case that some have very few connecting passengers at all. Yet Skyteam airlines choose to fly from Heathrow, telling us that their customers prefer Heathrow to either Gatwick or Stansted.⁹⁶

It is not the case that passengers prefer to fly from Heathrow because it is a particularly fine airport. On the contrary, Heathrow is more famous for “Heathrow Hassle” than anything else.⁹⁷ Rather, people prefer to fly from Heathrow because it is easy to get to. Londoners have the Heathrow Express and Heathrow Connect services from Paddington, as well a direct tube connection.⁹⁸ The Heathrow Express is quick but relatively expensive, while the tube offers an amazing value proposition. A traveller arriving at Heathrow after 9.30 can pay £8.50 to get to Central London and then have unlimited travel on the bus and underground for the rest of the day. Londoners flying from Heathrow pay a stunningly low £2.90 off-peak on Oyster, or a still reasonable £4.80 at peak time, no matter where in London they start their journey. For many west Londoners Heathrow is a minicab journey away, or they can be dropped off by family or friends. For those outside London Heathrow has weak rail links, but good coach links to more than 500 destinations.⁹⁹ It is adjacent to the M25, which is both a blessing and a curse for connectivity.

All airports have a natural catchment area, and Heathrow has the strongest catchment area of any London airport. Affluent people travel most often, and central and west London and the area to the west of London are the most affluent

93 The runways at Luton and City are shorter, and unsuited to long distance wide bodied planes.

94 http://www.caa.co.uk/docs/5/Connecting_Passengers_at_UK_Airports.pdf, table 3-5, p. 13.

95 400,000/(15,860 departures + 15,860 take-offs) = 12.6. Skyteam departure information from Skyteam press office, Netherlands.

96 Skyteam also have a significant presence at London City Airport.

97 <http://www.ft.com/cms/s/0/3974450a-92ab-11e1-b6e2-00144feab49a.html>

98 The Heathrow Connect service is expected to be replaced by Crossrail services

99 The rail links to the West country are being improved, coach details can be found here: <http://www.heathrowairport.com/transport-and-directions/buses-and-coaches/coaches>

areas in Britain. From a traveller perspective Heathrow is the best placed airport in the London area. 25% of Heathrow business travellers arrive at the airport within 30 minutes of starting their journey, whereas the equivalent figures for other airports are Gatwick 3%, Luton 12% and Stansted 2%.¹⁰⁰ The CAA report that access is particularly important for business travellers.¹⁰¹

The remaining airports all have their strengths and weaknesses as locations. Gatwick is currently London's second busiest airport, but as we have just seen it does not have Heathrow's natural hinterland. It is located to the south of London. South London is not as affluent as west London, and fewer people live to the south of London than to the west or north. Gatwick is the natural airport for Kent and Sussex, as well as for south London, but this does not represent a particularly large market as a proportion of either the South East or the country as a whole. The Gatwick Express runs non-stop to London, although the journey time is around twice that of the Heathrow Express, reflecting the greater distance of Gatwick to London. In addition, it has slower, cheaper services, including the Thameslink service that connects through the centre of London. The Thameslink upgrade permits more trains to Gatwick, and perhaps faster trains as well. Against that, there are competing demands for the slots, and much of the route remains tortuous, particularly in South London. It is theoretically possible to run direct trains from as far as Leeds to Gatwick, via the Thameslink route, but this has never been done, and the different power systems required en-route make it unlikely that this will be attempted anytime soon.¹⁰² There is no cheap rail-based method of getting to Gatwick, akin to the tube to Heathrow. Gatwick is on the M23, but the greater distance means that minicab and taxi fares are significantly higher from Gatwick than from Heathrow. The journey time is just over an hour from central London.¹⁰³

Stansted has a relatively weak hinterland. It is well placed for East Anglia and towards Lincoln, but this region does not have a large population. Stansted also has a rail connection, but it is much worse than those to Heathrow or Gatwick. The track has four lines only for the first three miles from Liverpool Street Station, after which it has only two tracks for the remaining 34 miles.¹⁰⁴ This means that express trains cannot pass slower trains as easily, which is why Stansted Express trains are particularly slow in peak times, when there are more commuter trains. It is also a relatively twisty line, which reduces track speeds, and it has 19 level crossings on the route. It would be possible to upgrade the line, but the costs of moving from two tracks to four would be very high, as the track bed would need to be widened. This is a very expensive operation, particularly in urban areas, where significant numbers of houses would need to be demolished. Straightening the track in urban areas to facilitate higher speeds also runs into the same cost issues. Finally, while upgrading the track would offer an improved service to the airport, there would be relatively little benefit beyond. This is because the track then goes to Cambridge, which is already well served by fast trains to London that travel via Hitchin and the fast East Coast main line. The train to Stansted is also relatively expensive, and again there is no cheap rail-based option equivalent to the tube to Heathrow. It is possible to catch a non-stop train from (say) Birmingham to Stansted, but the journey is circuitous, and takes longer than travelling to London, catching the tube, and travelling out again.¹⁰⁵ Even the non-stop service from Peterborough to Stansted takes 1 hour and 22 minutes,

100 <http://www.caa.co.uk/docs/5/Catchment%20area%20analysis%20working%20paper%20-%20FINAL.pdf>, figure 7

101 <http://www.caa.co.uk/docs/5/Catchment%20area%20analysis%20working%20paper%20-%20FINAL.pdf>, figures A4-7.

102 The Midland mainline is not currently electrified, whereas the northern segment of the Thameslink is overhead electric, and the southern segment is third rail electric. A train would therefore need three separate power systems to make the journey. This will reduce to two once the Midland mainline is electrified, but it is hard to see long distance high speed trains being equipped with third rail electric systems in addition.

103 EasyBus state that it takes 65 minutes. <http://www.easybus.co.uk/london-gatwick>

104 Indeed, the tunnel from Stansted Mountfitchet to Stansted Airport has only a single line, which must be used by trains travelling in both directions. <http://www.trackmaps.co.uk/trackmaps/product.asp?productid=1&shopcategory=2>

105 3 hours 18 minutes, around 30 minutes slower than via London. www.thetrainline.com

106 This is the Birmingham service.

and is only hourly.¹⁰⁶ Thus although Stansted is to the north of London, and most of Britain is to the north of London, Stansted is not well-placed as an airport to serve the rest of the country. Stansted is on the M11, but is further out still than Gatwick, with road transport taking around 75 minutes.¹⁰⁷ There is a dual carriageway (M11/A14) north to Huntingdon and beyond, but the population within an hour is limited.¹⁰⁸

Luton is on the reasonably high quality Midland Mainline, and has four tracks and reasonably fast trains. The problem is that the line does not actually go to the airport. Trains arrive instead at “Luton Airport Parkway”, from where the traveller has to catch a bus (£1.50). The train is fast – 21 minutes, but then you have to wait for the bus, and travel to the airport. The bus goes every ten minutes, and takes ten minutes, so you will be lucky to get to the airport within 40 minutes of leaving St Pancras. In addition to the fast service to St Pancras, Luton is served by Thameslink trains that travel into the centre of London, and ultimately across London and south towards Gatwick. Again, these trains have to connect to the bus at Luton Airport Parkway station. Once again there is no low cost rail-based way to get to London. The line from Luton airport parkway station north goes to Leicester, Derby, Nottingham, Sheffield, Leeds and Doncaster, but of these potential destinations there is currently non-stop service only from Leicester and Nottingham. Luton is on the M1, and the journey from Central London takes around 80 minutes.¹⁰⁹ Being on the M1 means that Luton has good road connections to the Midlands and North. This explains why even now it has more passengers within 30 minutes than Gatwick or Stansted.¹¹⁰

The final location to consider is the estuary plans. Boris Johnson originally proposed an airport in the estuary itself, near Whitstable, while Foster and Partners, Volterra and Halcrow have jointly proposed a new airport on and adjacent to the Grain peninsula.¹¹¹ We discount the original Johnson proposal, and consider instead the Foster proposal, given that the Mayor himself is now a supporter of the latter option.¹¹² This airport does not have a strong natural hinterland in terms of the number of regular travellers who live in the vicinity. Fosters propose connecting it to central London via high speed rail, with limited slower rail connections to Waterloo and Cannon Street using existing infrastructure where possible.¹¹³ Building a high speed line is very expensive, and the ticket price to use the service is likely to be high. This will be true directly if the service costs have to be covered by the fares, or indirectly if the cost of construction is covered by airport landing fees. Surface access by road is particularly weak, with many pressure points nearby, including the Dartford Bridge and tunnel, and the A2 at Bluewater, as well as the absence of primary routes on the Grain peninsula itself. That in turn means that new routes are required, with all the cost and disruption involved. It is also worth noting that people have only a limited ability to move into the hinterland of the proposed new airport, owing to relatively low levels of existing housing in the area.¹¹⁴ An application to build over the rest of North West Kent seems unlikely to be successful, even if the airport is built.

It is, of course, possible to improve access to any airport. All rail and road links can be improved, but the realities are that is costly to do, and sometimes prohibitively costly. There are also substantial planning issues, and a genuine loss of land involved in building all surface level roads and railways. Furthermore, it is hard to see Heathrow’s position as having the strongest natural hinterland

107 <http://www.easybus.co.uk/london-stansted>

108 Ipswich, Peterborough, Southend and Thetford, for example, is all over 1 hour from Stansted, according to Google mapping.

109 <http://www.easybus.co.uk/london-luton>

110 <http://www.caa.co.uk/docs/5/Catchment%20area%20analysis%20working%20paper%20-%20FINAL.pdf>, figure 7

111 The Mayor’s plans have some similarities with the earlier “Marinair” proposals, while a four runway airport at Cliffe, close to Grain, was included in the 2003 White paper on aviation, <http://www.caa.co.uk/docs/33/FutureDevOfAirTransport.pdf>.

112 <http://www.standard.co.uk/news/mayor/boris-johnson-thrilled-by-fosters-new-plan-for-thames-island-airport-6428147.html>

113 The Waterloo and Cannon Street services would be half-hourly, and would take 50 minutes, owing to the limited number of available train paths.

114 Grain is on a peninsula, and therefore has a natural hinterland only to the south-west. This area has limited housing, and poor road links. Sevenoaks, for example, is 24 miles south west from the Foster site as the crow flies, but Google Maps reports the journey time as 52 minutes. It would of course be possible to build over the area between Gravesend and the Medway towns, and into the area between the A2 and M20 to the South East, but it is hard to see any appetite for such a plan.

changing any time soon. West London has been the richest part of London for as long as it has existed, and Surrey, Berkshire, Buckinghamshire and so on are also affluent places, where many people who want and need to fly, live. Of the remaining airports, Luton has most potential. If the Luton Parkway – Airport link can be sorted out, it would be possible to offer a fast connection to London, and it is also possible to offer through trains to many cities in the Midlands, and beyond. Luton is also better placed than any existing airport for much of the rest of the country, simply by dint of being north and slightly west of London.

In this report, therefore, we look first at the possibilities for Heathrow, and then at Luton, before turning to other existing and proposed sites.

8

Airports and Noise

Noise is an objective measure in that we can take a decibel reading of the noise of a plane flying overhead. The level of noise is determined by the noisiness of the plane, the distance from and angle to the plane, and by the transmission of the noise from air to ground. Transmission is affected by the nature of the noise – engine noise transmits differently to airframe noise – and by the weather, most obviously wind, as well as the terrain, and so on. The nature of the noise matters too for its acceptability: the noise of an aircraft is less pleasant than the noise of a waterfall, but more pleasant than the noise of a toucan.¹¹⁵ Individuals have different tolerances for noise. This creates one advantage to developing existing airport sites, since people who have chosen to live near them are likely to be less aircraft noise averse than those who have chosen to live elsewhere.¹¹⁶ Someone who has chosen to pay £795,000 for a three bedroom flat in the Heathrow flight path at Kew clearly has many options as to where they live.¹¹⁷

The noise of the plane in the air will vary with the weather – for example, flaps will have to be deployed differently according to the headwind, and a strong crosswind will “wobble” the plane, increasing the noise. These sorts of issues mean that noise modelling is a complex science. The results are usually expressed as noise contours, which take into account the noise and quantity of planes overhead. That is a good approach, but it is worth stressing the qualitative difference of night flights. Having one plane overhead per hour during the day would not be considered unreasonable to most people, but it is understandable that most people would object to having one plane overhead every hour throughout the night.

There are a number of core noise principles that are worth setting out. First, the noise of the plane in the air matters. A noisier plane is not only noisier in itself, but also means that the noise footprint is wider, so that more people are affected. In general smaller planes are quieter than larger planes, and newer designs quieter than older designs.

Second, the height of the plane above the ground matters. For example, received noise from a particular plane is much greater over Hounslow than over Richmond simply because the plane is lower over Hounslow.

Third, the nature of the descent affects the level of noise. For descents, a “continuous descent approach” is usually quietest, as it keeps the plane higher, for longer.¹¹⁸ In addition, changing angles requires flaps and so on be activated, which increases airframe noise. Speed also matters: if the engines are producing more thrust, the level of noise is higher.¹¹⁹ Lowering the undercarriage also increases noise, as the undercarriage is not at all aerodynamic.

115 <http://www.mytoos.com/noise.shtml> has recordings of both aircraft and toucans, for comparison. No doubt toucan lovers will disagree. That said, ringed parakeets, which have become indigenous in west London in recent years, are described as a noise nuisance by the Friends of Richmond Park, and by DEFRA, while one council tenant was taken to court over the excessive noise of their parrot. <https://secure.fera.defra.gov.uk/nonnativespecies/factsheet/downloadFactsheet.cfm?speciesid=2886>, http://www.frp.org.uk/pdf/frp/2_Parakeets_Summer_2006.pdf; <http://www.dailymail.co.uk/home/article-433443/Sparky-anti-social-parrot-lands-owner-court.html>

116 This is less clear in the case of social housing tenants, who have considerably less choice of location. Leunig, Right to Move, Policy Exchange, sets out the best way to approach this particular issue: <http://www.policyexchange.org.uk/images/publications/the%20right%20to%20move%20-%20jan%2009.pdf>

117 <http://www.hallettsestateagentskew.com/sales/3870658>

118 <http://www.heathrowairport.com/noise/what-we-do-about-it/measures-already-in-place/arrival-procedures>

119 For this reason it would be possible to reduce noise by fitting planes with larger wings. This would provide more lift, which would allow steeper ascents. It would also allow less engine power on descents, as the plane could essentially “glide” in to land. Unfortunately larger wings are heavier in themselves, and require stronger structures to support them, which therefore means that more fuel is needed to fly any given distance. Such an approach would, therefore, be an environmentally and financially expensive way to reduce noise.

The noise of ascents also varies with the extent of the thrust. There is a trade-off here: greater thrust is noisier, but it gets the plane to a high altitude more quickly.¹²⁰ So more thrust means more noise immediately around the airport, but a smaller noise footprint. The weather also matters: a decent breeze creates lift, and reduces the need for thrust for any given ascent path.

Policy makers cannot alter the weather, but as we shall see in our discussion of Heathrow, there is much that can be done to reduce the problems of noise for those who live near airports.

¹²⁰ Greater thrust increases fuel burn, which raises CO₂ emission levels.

9

Heathrow

Introduction

We have seen that airlines currently prefer to fly from Heathrow, because people prefer to fly from Heathrow. It has the strongest natural economic hinterland, and good quality formal and informal transport connections, particularly to London.

The biggest problem with Heathrow as a location is noise.¹²¹ Planes arriving and departing at Heathrow are no noisier than those landing at other airports, but more people live in the flight paths, owing to Heathrow's location. Heathrow is responsible for 28% of total European airport noise nuisance.¹²² Estimates for the number of people affected vary from 700,000 to as high as 2 million, depending on the study and the level of noise taken as sufficient to cause a nuisance.¹²³

We propose the following strategies to reduce the extent of Heathrow noise nuisance. We will set out each idea in more detail subsequently.

First, planes vary by noise level, and we should announce a complete ban on the noisiest aircraft at all times in 2030, when the new airport opens. This cannot be implemented overnight, as airlines need to adjust their fleets, but it can be implemented in the medium term.

Second, we can land planes further to the west. This means that they are higher over any part of West London on their descent.¹²⁴ This can have a big effect on noise levels on the ground.¹²⁵

Third, we can land narrow bodied planes more steeply, as we do already at London City. Again, this means that they are higher over any part of West London on their descent.¹²⁶ We discuss the certification, training and international regulatory issues below.

Fourth, and in the context of additional runways, we can make the "night period" longer, and ban flights in that period, absolutely.

The idea is for the government to offer west London a new deal.¹²⁷ The noise nuisance from each aircraft will be reduced, massively. But the quid pro quo is that there will be more planes. The net effect is to radically lower the level of noise for the vast majority of people in and around the airport.

Offering a new deal depends on having a plan that makes Heathrow into an effective hub, with sufficient capacity for the future, while delivering lower noise levels. Before we set out our proposal, we discuss the idea of building a third runway at Heathrow.

Is a third runway the answer?

There is no doubt that business, in general, supports a third runway. The British Chambers of Commerce and the CBI have publically favoured the scheme in the past, as has the TUC.¹²⁸ The previous government authorised a third runway.

121 We consider local pollution issues later in this chapter.

122 http://www.caa.co.uk/docs/589/CAA_InsightNote2_Aviation_Policy_For_The_Environment.pdf

123 http://www.london.gov.uk/sites/default/files/Heathrow%20airport%20-%20Final%20version_0.pdf, <http://news.bbc.co.uk/1/hi/england/london/7074906.stm>, <http://webarchive.nationalarchives.gov.uk/+http://www.dft.gov.uk/pgr/aviation/environmentalissues/Anase/>

124 Planes overwhelmingly land from the east, owing to prevailing wind directions.

125 http://www.caa.co.uk/docs/589/CAA_InsightNote2_Aviation_Policy_For_The_Environment.pdf

126 Planes overwhelmingly land from the east, owing to prevailing wind directions.

127 We discuss the issues for Windsor later.

128 <http://webarchive.nationalarchives.gov.uk/20090313112001/http://www.dft.gov.uk/pgr/aviation/heathrowconsultations/heathrowdecision/decisiondocument/decisiondoc.pdf>

The proposed third runway, as approved by the government in 2009, was for a 2200m runway located to the north of Heathrow, at Sipson.¹²⁹ The runway would be approximately a mile to the north of the existing northern runway. The number of permitted movements would rise from 480,000 to 605,000.¹³⁰

Compared to a comprehensively redesigned, four runway airport – discussed below – there are a number of limitations to this scheme. First, the previously approved runway was short, and could only be used for small and medium aircraft. Although this would free up space on the main runways, having a short runway would mean a less flexible airport, with a lower ratio of passengers to aircraft movements than longer runways would enable. A longer runway would add both capacity and operational flexibility, but at the expense of higher noise levels per plane.

Second, the number of movements would increase by only a quarter, rather than the one half that you might expect from moving from a two to a three runway airport. Few people see a 605,000 movement airport as a long-term solution. It would, for example, offer less capacity than Amsterdam, Paris or Frankfurt.

Third, the airport would have none of the advantages of an efficient, well-designed “toast rack” airport. The new runway would have its own terminal, which reduces operational flexibility, since flights have to be assigned to a runway in advance, rather than being able to land according to runway availability. From the passenger perspective the distance between terminals are likely imply slower transfer times than at an airport that conforms to modern design standards. Many long haul to short haul transfer passengers would often involve making the awkward journey from one of the current terminals to the new terminal 6, while remaining airside.¹³¹ It is likely that transferring planes at Paris or Frankfurt will be smoother and more reliable. Heathrow would be a less popular than other competing European hubs.

Runway three also offers a relatively low ratio of additional services to additional noise. This is because the noise footprint will be significantly larger with a third runway than without. First, the runway is located considerably to the north, which means an entirely new set of people will be directly under the flight path. These are people who have deliberately chosen to buy or rent houses that are not directly under the flight path.

A third runway would provide some much-needed extra capacity. But it is a much less attractive option than a well-designed four runway airport.

The Heathrow proposal

This report proposes a four runway Heathrow airport, with unprecedented noise mitigation measures, as the most appropriate long-term solution. The runways would be 3km long, grouped as two close coupled pairs, aligned east-west, and located immediately to the west of the current airport. The existing runways would cease to operate as runways. The new runways would extend across the M25, the Poyle industrial estate, and the northern part of Wraysbury reservoir. Some residential housing in Stanwell Moor would be demolished. The two pairs of close spaced runways would be around 380m apart, while the distance between the sets of runways would be 1,035m.¹³² The most northerly runway would be level with the current northern runway, with the most southerly approximately 300m south of the current southern runway.¹³³ The airport would

129 Good maps are available here: http://www.hillingdon.gov.uk/media/pdf/g/1/heathrow_consultation_map.pdf, http://news.bbc.co.uk/1/hi/uk_politics/7721317.stm#map and <https://maps.google.co.uk/maps/ms?ie=UTF8&hl=en&msa=0&msid=107279255646165449244.0004418b973759b8eb8f4&ll=51.470424,-0.487604&spn=0.025022,0.071068&t=h&z=14>

130 Using the third runway to its fullest capacity would add a further 100,000 flights, at the expense of a significant increase in noise contours. <http://web.archive.nationalarchives.gov.uk/20090313112001/http://www.dft.gov.uk/pgr/aviation/heathrowconsultations/heathrowdecision/decisiondocument/decisiondoc.pdf> para 53.

131 An airside passenger is one who is outside the United Kingdom, meaning that they have already passed passport control if leaving, have not yet passed passport control if they are entering. Transfer passengers generally remain airside, in that they travel from gate to gate without passing through passport control. The alternative to being airside is to be landside.

132 These are CAA requirements. We note however that Atlanta’s northern two runways operate successfully while being separated by 340m. We would therefore ask the CAA to conduct an analysis of Atlanta’s runways to see whether 340m distances would be possible. The closer the runways, the narrower the width of the noise envelope. Distances are measured from runway centres, as is standard in aerodrome design. The airport would probably be ILS Cat IIIC to allow landings in zero visibility, reducing operational delays further.

133 The airport site would be approximately 2km from North to South.

134 Atlanta airport had 964,858 movements in 2005, when it was a four runway airport. http://atlanta-airport.com/Airport/ATL/operation_statistics.aspx. The implied passenger numbers are based on the current average passenger per movement for Heathrow.

135 Broadly speaking landing a small plane behind a large one is difficult, owing to turbulence issues. Landing wide bodied and narrow bodied planes on separate runways, as proposed here, may lead to an additional 50,000 movements without causing congestion. That would imply 900,000 movements and 128m passengers. The average size of plane has risen over time. If this trend continues that the maximum number of passengers would also rise for any given level of movements.

136 Heathrow currently has capacity for 480,000 movements, compared with 660,000 at Frankfurt, 710,000 at Paris and 600,000 at Amsterdam. The runway pattern would be more coherent than at Frankfurt and Amsterdam, reducing likely delays and taxi time, while the terminal design is much more coherent than at Paris CDG, again reducing likely delays on the ground. http://www.gatwickairport.com/Documents/business_and_community/8.8%20Publications/GATWICK%20FINAL%20REPORT%20121011.pdf, table 4.4.

137 Heathrow, Gatwick, Stansted, Luton and City together served 127m passengers in 2010. http://en.wikipedia.org/wiki/World%27s_busiest_city_airport_systems_by_passenger_traffic

138 Thames Water have previously proposed a new reservoir near Abingdon. A reservoir just a quarter that size would fully replace Wraysbury. <http://news.bbc.co.uk/1/hi/england/5343646.stm>. The Wraysbury reservoir is typically 15m deep. An alternative approach would be to increase the height of the other reservoirs in the area.

139 The best approach would be to place the runways above the existing M25, although the M25 could be relocated and lowered if that was advantageous for any reason. In any case, a cutting with a runway on top is much cheaper to build than a bona-fide deep tunnel.

cover the area between the proposed runways and the current site, and would have three terminals and a modern “toast rack” configuration. The southern half of Wraysbury reservoir would be used as a “Heathrow Gateway”, including an underground car park. There would be a smaller Gateway located at the North East of the current site. A light rail shuttle would run every two minutes between the two Gateways, calling at the three terminals and each of the piers en route.

The airport would have twice the capacity of the current Heathrow, implying a maximum of around 960,000 movements and 140m passengers.¹³⁴ Heathrow is currently too full to operate smoothly, so a sensible working maximum would be 850,000 movements, and 121m passengers.¹³⁵ That is sufficient capacity to make Heathrow Europe’s premier hub.¹³⁶ In the short run the extent to which Heathrow moved towards these numbers would depend on the extent to which airlines and passengers move from other London airports to Heathrow.¹³⁷ This proposal would also mark the end of Heathrow’s expansion: there would be no feasible further expansion, technically or socially.

It is not technically difficult to construct such an airport. The area to the west of Heathrow is very flat. The Wraysbury reservoir would need to be replaced by a new reservoir elsewhere, and then the northern half filled ready to have the airport built on top.¹³⁸ The runways would run above the M25, as happens at Atlanta, Paris Charles de Gaulle, Manchester and other airports.¹³⁹ The project would obviously be a large one, but there is nothing novel or challenging about it in engineering terms. This means that it would be relatively cost effective to build, especially as much of the infrastructure is in place already. Clearly an accurate assessment of the construction costs would require a detailed engineering study, but early indications suggest a cost – as an order of magnitude – of around £10bn. Whatever the final figure, the presence of so much existing airport infrastructure and transport links mean that this will be the cheapest hub airport proposal.

We will now set out how the proposal works as an airport, then move on to discuss the proposed noise abatement strategies, before discussing in more detail how it could be built, and who would be affected.

How the airport would work: airline perspective.

We begin by looking at the airport from an airline perspective. The airport will consist of two sets of close coupled runways, with terminal facilities in between. Planes will land on the outer two runways, and take off from the inner two runways, in accordance with international best practice. There will be a taxi way between each set of close coupled runways, so that planes can move off the landing runway immediately, via a rapid exit taxiway, freeing up the runway for the next landing. This is the best approach, combining safety and efficiency.

At any given point, one arrivals runway would be used for narrow bodied planes, and the other for wide bodied planes. This is efficient, in that it is relatively hard to land a narrow bodied plane behind a wide-body, as a wide-bodied plane creates turbulence that can be a problem for smaller planes. The only exception would be for the first 90 minutes of each day, when almost all arrivals are long haul, wide-bodied planes. The take-off runway used would be determined primarily by destination: planes turning to the north would use the north runway; planes turning to the south would use the south runway. There are fewer technical issues mixing large and small aircraft for departure. The airport

will meet international best practice, and will build on existing developments in that Terminal 5, and now Terminal 2, are based on the toast rack design.¹⁴⁰

Since Heathrow caters primarily for large, wide bodied planes it needs a lot of apron, pier and terminal space. Long haul planes are physically long and have wide wings, even relative to the number of passengers carried.¹⁴¹ As a result, significant gaps are required between jetways, and between piers.¹⁴² For that reason, the proposal involves using the area between the new runways, as well as the area between the existing runways, as aircraft stands.

There will be three terminals: west, central and east. Heathrow West is new, to be located 3 km due west of the current Terminal 5, and thus at the western end of the new runways.

Terminal 5 becomes Heathrow Central, and will find itself at the eastern end of the new runways. Terminals 1, 2 and 3 would be renamed Heathrow East. Terminal 4 would close: it is not in a sensible location as it is, and would be in a poor location for the new airport. It is also a relatively old terminal now, and will need rebuilding in any case by the time this airport opens. The area between each of the three terminals would have parallel aircraft piers, along the lines of the current terminals 5b and 5c, and the redeveloped Terminal 2 complex. The piers to the west of the central terminal are designated the western piers, while the piers to the east are designated the eastern piers. Aircraft can access all terminals and all piers from both sets of runways, reducing congestion. With the current airport and the western extension available it is unlikely that the airport will suffer from on ground congestion. This makes for smoother operations, fewer delays, and less local pollution.

Since the airport would use all of the current site, as well as the extension site, there is also plenty of room for maintenance and other necessary auxiliary functions. There are no likely air traffic control reasons why this proposal would not work. On the contrary, South East airspace is already constructed around Heathrow being where it is, and 4km makes no meaningful difference. Moving west reduces the potential for conflicts with London City, although there is an increase in the potential for conflicts with RAF Northolt and perhaps Farnborough. The Northolt runway runs South East-North West and would not fit well with the new Heathrow location. It would need to realign its runway, if it was to continue as an airport. We note, however, that the RAF are currently considering closing the airport altogether, as it is little used. Some flight paths into and out of Farnborough may need remapping, owing to its location and runway orientation.

How the airport would work: passenger perspective

Passengers divide into three types, departing, arriving and transfer. We look at each in turn. Passengers arrive at the airport by rail and road. Rail passengers can arrive via the Heathrow Express, Crossrail or Piccadilly line. All arrive from central London, and will call at the East, Central and West terminals in turn.¹⁴³ The Heathrow Express and Crossrail services will connect with the High Speed Line

“Heathrow is currently too full to operate smoothly, so a sensible working maximum would be 850,000 movements, and 121m passengers. That is sufficient capacity to make Heathrow Europe’s premier hub”

140 <http://www.ft.com/cms/s/0/7af0a4d8-58cc-11e1-b9c6-00144feabdc0.html>

141 Multiplying length by wingspan and dividing by maximum seating capacity gives 6.7m² for the largest 737, compared with 8.7m² for the largest 777. The double decker A380 reverses this trend, taking up 6.8m² per passenger.

142 The distance between two piers must be at least twice the length of the longest plane, plus the wingspan, so that planes can move between them, plus operating tolerances.

143 The government has proposed a new direct train line to Reading. One option would be for the Heathrow Express to continue from the West terminal back to the Western Mainline and on to Reading. We note an alternative, and radically cheaper proposal later.

144 Upgrades to tube lines are typically based on 28–32 trains per hour, but we need to subtract 6 per hour for services from Central London to Uxbridge. <http://www.tfl.gov.uk/corporate/projectsandschemes/18091.aspx>. The current journey time is 51 minutes, and existing tube upgrade plans assume a 20% reduction in journey times. It may be possible to reduce this further, in the light of the importance of the Heathrow connection. <http://www.tfl.gov.uk/corporate/projectsandschemes/18098.aspx>. The journey to Central terminal would take a further four minutes, with a further four minutes more for Heathrow West.

145 <http://www.crossrail.co.uk/journey-time-calculator>. Note that Crossrail is currently planned to go to Terminal 4 rather than terminal 5. It would serve terminal 5 (aka Heathrow Central) and Heathrow West instead. Notice that this is as quick as getting to the Foster airport, via Stratford.

146 Existing roads will be used for airport service traffic.

147 The area is approximately 1km square, and observation of car parks in the Heathrow area suggests 21 m² per car, including circulation roads, or 47,000 cars per 1km². Taking into account the need for entry and exit routes for cars and passengers implies 40,000 cars per level. One option is simply to level the base of the existing reservoir, and have a single car parking level. Equally, it may be sensible to excavate the reservoir further, using the material to fill the northern end of the reservoir. In those circumstances we would have a multi-level underground car park, with around 40,000 cars per level. It is clear that the airport will be able to offer both short and long stay parking on-site, without the need for tedious shuttle buses to the airport.

148 Low traffic levels to Wraybury mean that it currently has a half hourly stopping service, taking around 45 minutes to reach Waterloo. It is likely that a quarterly hourly service, calling at fewer stations, would be warranted, cutting journey times to around 35 minutes. A small additional section of line on the north side of Staines station's northern platform would allow a Staines – Wraybury shuttle service to connect with the other six trains per hour in each direction that currently stop at Staines. The land is currently available, and the existing platform, stairs, lifts etc, are all already in the right places

to Birmingham at Old Oak Common, as currently planned. The Piccadilly line train is already scheduled for an upgrade, and will offer 24 trains an hour, taking 36 minutes from Heathrow East to Piccadilly Circus.¹⁴⁴ The journey from Canary Wharf to Heathrow East will take 39 minutes.¹⁴⁵ Transport for London have not announced a date for the Piccadilly Line upgrade, but it will obviously take place before 2030.

There would be no direct access to the terminals for road traffic.¹⁴⁶ Instead there will be two “Heathrow Gateways”. The principal access point would be the West Gateway, complemented by a more minor East Gateway. The West Gateway will be located south of the West terminal, adjacent to the M25, on the southern part of the current Wraybury reservoir. This part of the reservoir would not be filled in. Instead the reservoir bed would be used either as single storey or multi-storey underground car parking, with an expected capacity of 40,000 cars per level.¹⁴⁷ This would include parking for both staff and passenger cars. The car park would then be covered, to create a surface level area containing zones for car rental, bus and coach station, and taxi, minicab, valet parking and private car drop off and collection area. In addition, it will have a rail connection from Wraybury station to Windsor, Richmond, Clapham Junction, and Waterloo, and thus increase the range of places with good access to the airport via public transport.¹⁴⁸ With small and feasible changes it would also be possible to provide direct services from Wraybury to Reading, Woking, and other stations on the South West Trains network.¹⁴⁹

The more minor East Gateway will be at the north east of the current airport, adjacent to the A4, in the car parking area next to the current Heathrow Premier Inn. The East Gateway would have car and taxi drop off and collection points, valet parking drop off, and local bus stops, but only very limited on-site parking. It would not have a coach or bus station, or car rental facilities.

The two Heathrow Gateways would be connected by a driverless light rail transit system. Given the size of the airport, this would be akin to the Docklands Light Railway, rather than the Gatwick inter-terminal shuttle, or the current Terminal 5 shuttles that take passengers from Terminal 5 to the Terminal 5 piers. This will start above ground at Wraybury station, and stop at each of the Gateway zones before travelling into the airport, where it would stop at each of the terminals and piers, before proceeding to the Heathrow East Gateway. The shuttle will depart at least every two minutes and would be free to use.¹⁵⁰ It guarantees a seamless journey from either Gateway to the relevant part of the airport.

Passengers with luggage to check in would take the Heathrow Express, Crossrail or tube, or the Heathrow Shuttle to any terminal convenient for their pier.¹⁵¹ Someone arriving from Central London might choose the East terminal, while someone arriving from the west might choose the west terminal. Others might choose a terminal near their pier. The Heathrow Express, Crossrail, Tube and Shuttle will all give real time information about queues at security in each terminal, allowing passengers to make intelligent choices as to where to get off. This helps reduce the longest queues, since passengers will naturally head for the places with the shortest queues, thus evening out the pressure on security. The only group of passengers who would be obliged to use a particular terminal would be those who needed assistance from their airline, or access to lounges located in a specific

place. Otherwise people are welcome to go to the terminal with their favourite restaurant, the best view, or any other criteria they wish to use.

Having dropped their bags, and passed through security, passengers would then be in airside, and in a terminal. They would be able to use the terminal facilities, or travel, airside, on the shuttle to their pier, or even to another terminal. Note that it is possible to travel airside as well as landside on every shuttle. This is because each shuttle has two sets of carriages: airside and landside. The platforms will also be divided by a glass screen, keeping the airside and landside passengers separate. The airside doors will not open at the Gateway stops.

The procedure is even more flexible for passengers departing with hand luggage only. As well as being able to follow the route outlined for passengers with luggage to check, they will be able to bypass the terminal altogether, and head straight to the pier. This is because the shuttle stops at all piers, and the piers will accept incoming landside passengers. Passengers arriving by Heathrow Express, Crossrail or tube can switch to the shuttle at the East Terminal, while passengers arriving at the Gateways will already be on the shuttle. The shuttle will give the times at security for each pier, reducing the chance that people will choose a pier with temporarily long queues.¹⁵² If there are long queues at the pier from which your plane departs it would be possible to pass security at a terminal or another pier, and reboard the shuttle to travel on to your departure pier. Regular travellers will soon work out the fastest way around the airport, although infrequent travellers will probably prefer to go to the terminal.

Allowing passengers to proceed straight to the pier is an important innovation for a business airport. Those who fly from London City will tell you that the best thing about that airport is that check-in is very, very quick. The straight to pier option aims to replicate that at Heathrow. The target would be that anyone arriving at either Gateway, or by tube, Crossrail or Heathrow Express, can get to the gate within 20 minutes of arriving at the airport if they are arriving with only hand luggage. In essence, each pier is a mini-airport, with all the speed that a small airport offers.

The piers will have relatively limited facilities, similar to those at the current Heathrow terminal five piers. As well as security, they will have toilets, fresh drinking water, and vending machines. It is likely that the airport will choose to provide a café and a limited range of shops.¹⁵³ The “straight to pier” option is primarily for the business traveller who has rolled out of bed or come straight from a meeting, and just wants to get on the plane and go. Those who want to use the facilities of the terminal – including aircraft lounges, a greater range of shops, and so on – are welcome to use the terminal facilities. These terminals will be quieter, since fewer people will pass through them, making them more restful places than is typically the case.

Passengers leaving the airport will follow the same process in reverse. Those who have luggage must proceed to the terminals via the airside section of the shuttle, where they will pass through immigration and collect their bags, before boarding the train or tube to London, or taking the landside element of the shuttle to their Gateway. Those with hand luggage only can pass through immigration at the pier, and take the landside section of the shuttle to their Gateway, or to a terminal for rapid connection to train or tube.¹⁵⁴ Notice that the shuttle system works much

to be used. There is also a set of points crossing the up and down lines to Wraysbury in the relevant place, making this a very cheap project. Trackmaps, p. 19, <http://www.trackmaps.co.uk/trackmaps/product.asp?productid=1&shopcategory=2>.

149 The insertion of a small loop to the west of Staines station would allow trains to travel directly from the Wraysbury/Heathrow Gateway station to Egham, and on to Reading or Woking, or any place on the South West trains mainline. The necessary land is currently the Elmsleigh Shopping centre car park, which could be rebuilt above the rail line as necessary. The two-track route west of Staines is currently underused, so there are plenty of train paths available. It is 27 miles from Reading to Wraysbury station, implying that a non-stop train would take around 27 minutes. This could either supplement the proposed new Reading-Heathrow line, but it might well be sensible to have it in lieu of that proposal. If the proposed new Reading-Heathrow link matches the Heathrow Express average speed, the journey will take 27 minutes, demonstrating that the Wraysbury link is a plausible alternative. Using it in lieu of the proposed new line would save close to £500m.

150 As noted, upgraded tube lines are typically based on 28–32 trains per hour <http://www.tfl.gov.uk/corporate/projectsandschemes/18091.aspx>, so a two minute frequency is straightforward to provide. It is likely that the system would use the moving block signalling system already used on the Docklands Light Railway, Jubilee lines, etc.

151 By the time this airport opens almost everyone will check in online or via smart phones. The Heathrow Express, Crossrail, tube, and Heathrow Shuttle would all provide free wifi to facilitate this. Check in desks would be provided in the terminals for the handful of people who had not checked in prior to arrival, needed to change their tickets, and so on.

152 Passport control will be bi-directional, as say at Copenhagen airport, which can result in temporary queues if a large plane has landed, and more passport officers are dealing with arriving passengers.

153 Terminal 5 pier C, for example, has a café, a branch of WH Smiths, and a Boots Chemist.

better than most airports for people departing by bus, coach or rental car, since the shuttle will take them straight to these places. No more will passengers have to walk some distance to Heathrow Central Bus station, or catch a shuttle bus to a rental car depot or distant car park. The shuttle will take you straight from the pier. Those without luggage should be out of the airport within fifteen minutes of stepping off of the plane, every time.

This airside shuttle system makes Heathrow the perfect airport for transfers. It will not matter whether you are transferring between flights operated by the same airline, or changing to another airline: you simply deplane, ignore security, get on the airside section of the shuttle and proceed to the pier from which your next flight is departing, quickly and easily, while remaining airside at all times. The typical time, gate to gate, would be under ten minutes.¹⁵⁵ This allows passengers to create easy ad hoc transfers across airlines, which is important for the viability of new routes. If your flight times mean you have longer at the airport, you can use the airside shuttle to travel to the terminal, where you can use the facilities, lounges, and so on, before using the airside shuttle to move to your departure pier in due course.

To further improve the desirability to passengers of using Heathrow as a hub, the airport will guarantee that so long as there is one hour between your scheduled arrival and departure, and so long as the passenger reports to transfers on deplaning, you will make your connection or the airport will arrange for you to travel on a subsequent plane, at no cost to you. This will give the airport an incentive to make transfers work.¹⁵⁶

Which airlines will want to use the extra capacity?

It is likely that the additional capacity will prove popular with airlines. It is easy to imagine, for example, that British Airways and Virgin will consider consolidating some or all of their services from Heathrow, by reducing or eliminating their Gatwick operations.¹⁵⁷ In British Airways case this has the potential to allow more BA long haul to BA short haul connections. In Virgin's case this would allow what is still a reasonably small fleet to be consolidated at one airport, with benefits in terms of flexibility. There might also be some additional transfer passengers. In both cases they would be more likely to pick up non-aligned transfers, simply because Heathrow will be a good place to transfer, with lots of flights, and easy transfers. Both airlines may also try to increase their aggregate size, as well as transferring planes from one base to another.

The second group of airlines that are likely to be attracted by the additional capacity are those wanting to start new routes from emerging centres. This would include BA and Virgin, but it would also include, for example, the various Asian airlines who would be able to acquire a relevant number of slots for the first time. In some cases the newcomers will be airlines that start between now and the airport opening. It is also possible that an ambitious airline, such as Emirates, may want to establish a European base, and actually base planes at Heathrow.¹⁵⁸

The final airline who might be attracted by the availability of slots is easyJet. They have shown an increasing determination to attract business passengers, and to fly from core airports. It is at least possible that easyJet would want to base some planes at Heathrow.¹⁵⁹ This could increase the range of destinations served from Heathrow, and provide feeder traffic for new long haul destinations that require hub traffic to be economic.

154 If there is a long queue for security at their pier, perhaps because more than one plane has arrived, or because they have arrived on an A380, they can catch the shuttle to an adjoining pier or terminal. The times at security will be displayed in the piers, allowing people to make sensible decisions. The A380 security delay is less likely than it may seem at first, because very large planes are usually used on long distance routes, where a lower proportion of passengers will be travelling hand luggage only. It is therefore not likely that hand luggage only passengers will experience security delays at the piers.

155 This time would be slightly higher if your arrival plane docks at a terminal building, as these involve more walking to the shuttle.

156 The cost will be borne by the airport if the problem is with the airport, or air traffic control. The cost will be passed on to the airlines if their plane arrived at the approach stack late. Agreeing to this system will be a prerequisite for landing rights. In reality most of the payments between airlines will self-cancel, but airlines that are more often late will be net losers. This is a good incentive system for everyone – including those who are not transferring.

157 This would require them to have a fully Heathrow compliant fleet.

158 Such a move would require regulatory approval.

159 Their fleet is already 100% Heathrow compliant, making it a relatively low risk thing to do.

Making the proposal work for West London residents

This proposal works for airlines and for passengers, but it has to work for people in and around the airport as well. Heathrow directly employs 76,000 people, many of whom live in West London.¹⁶⁰ This proposal clearly works for them, as they get to keep their jobs.¹⁶¹ A bigger airport is likely to mean more jobs, which is also good for other people in the area looking for work.

As we mentioned earlier, the big downside of Heathrow for West London is noise. First off, it is important that planning guidelines act against building additional housing too close to the airport. It is surprising that so much new housing has been permitted so near to Heathrow in recent years. We now outline how a combination of the new location, quieter planes, steeper descents, and an end to night flights can make a new Heathrow work for London.¹⁶² We look at each of these three issues in turn, but we begin with a short explanation of how noise is measured in aviation.

Aircraft noise is measured in decibels, which is a logarithmic scale.¹⁶³ Planes are then categorised into quota count (“QC”) bands, according to their noise level.¹⁶⁴ Planes are tested separately for take-off and landing. Each additional 3dB of noise moves a plane up one QC band. 3dB is the critical level because a rise of 3dB represents an approximate doubling of noise, in line with the logarithmic scale, as measured by the power of the acoustic intensity. Since moving up one band represents a doubling, the bands are ¼, ½, 1, 2, 4, 8 and 16, where band 1 covers planes with noise in the decibel range 90–92.9, and so on.

Quota counts were devised in 1993 as a means to reduce the noise nuisance from night flights at Heathrow. Planes with a QC of 8 or 16 cannot take off or land between 2300 and 0700, while planes with a QC of 4 cannot take off or land between 2330 and 0600.¹⁶⁵ Subject to these rules, Heathrow is allowed 3250 night movements, whose planes must not exceed 5100 QC points in aggregate, in each of the summer and winter seasons.¹⁶⁶ Thus if Heathrow allows too many planes with a QC code of 2 to arrive, it will use up its permitted QC quota before it uses up its movement quota. The airport therefore has a moderate incentive to attract low noise planes in the quota period, defined as 2330–0600.

We can and should go much further in refusing to allow the noisiest planes to arrive and depart from Heathrow. We propose new restrictions on noise classes that would apply at all times. All planes would have to be QC 0.5 or lower on arrival, and narrow bodied departures should be QC1 or lower, while wide-bodied departures should be QC2 or lower. As Heathrow airport states, “The aircraft fleet mix is the single most important factor in determining the size of this [noise] contour.”¹⁶⁷ This proposal alone will radically reduce the noise of planes arriving and departing from Heathrow.

It is worth commenting on which planes would be allowed, and which would not be allowed. This will demonstrate that the plan is feasible by the point at which the new airport would open, even though it cannot be introduced overnight or even in the short run.¹⁶⁸

Acceptable aircraft types include the Airbus A319, A320, A321, A330 and A380 as well as Boeing 737s Next Gen (-600 series, and later), the 757,¹⁶⁹ the 787 Dreamliner, as well as most small regional jets, such as the Embraer ERJ. All current and likely future configurations of these aeroplane designs would be permitted. In addition, some variants of the Airbus A340, older Boeing 737s (“Classics”),

160 Since Heathrow directly employs 76,000 people it is not clear that West London would be better off without the airport. http://www.hacan.org.uk/news/press_releases.php?id=283

161 Were the airport to move to, say, Cliffe, workers with airport specific skills would have the choice of commuting or moving. This choice is particularly awkward for those who have spouses in work in West London, children in school, or family nearby. House prices are much higher in Central London, the obvious “half way between” location, while Medway only has about 120,000 houses in total.

162 The first two are identified by the CAA as effective ways to reduce noise. http://www.caa.co.uk/docs/589/CAA_InsightNote2_Aviation_Policy_For_The_Environment.pdf, p. 32

163 <http://en.wikipedia.org/wiki/Decibel>

164 http://en.wikipedia.org/wiki/Quota_Count_system

165 There are some exemptions in the case of delays etc.

166 Full details can be found here: http://www.ead.eurocontrol.int/eadbasic/pamslight-4A21DDEBDFE548E65B62C2809AFC1C0/7FE5QZZF3FXUS/EN/SUP/NON_AIRAC/010-2012/EG_SUP_2012_10_en_2012-03-22.pdf

167 http://www.heathrowairport.com/static/Heathrow/Downloads/PDF/Consultation_Document.pdf, para 4.19.

168 This section is based on NATS publication SUP 010/2012 “London Heathrow, Gatwick and London Stansted airports noise restrictions notice 2012.” This is available from www.ais.org.uk/. Registration is required but free. There are around 1500 lines of data, each relating to a different version of a commercial aircraft.

169 Excepting those with the rare RR RB211-535C engine

as well as some 767, and 777, would be allowed, depending largely on engine fitted. No version of the Airbus A300, A310 or Boeing 747 would be permitted, however, including the forthcoming 747-8.¹⁷⁰ It is possible, and perhaps even probable, that hush kits could be designed and fitted to some existing planes to make them quiet enough to meet this new standard.

These lists tell us two things. First, it is perfectly possible to run a modern hub airport with this constraint. We have core short haul planes – A319/320/321 as well as modern versions of the 737, and a good selection of long haul planes, including the Airbus A330, the giant A380, and the forthcoming Boeing 787 Dreamliner, as well as some versions of existing planes, such as the 757, 767, 777 and A340. This is a wide enough selection of planes for airlines to choose between.

We can also see that many noisier planes will disappear from the skies over West London. The noisier versions of the 737, 757, 767 and 777 will be replaced by quieter versions of the same, or by entirely new planes. But the most important deletion will be the 747, jumbo jet. This has been an important plane historically, but it is now an old design that is being phased out of passenger service. There are other planes, including the 787 Dreamliner and Airbus A380 that can take

“Plane fleets cannot be changed overnight, but airports cannot be built overnight. It would be reasonable for government to announce that it will require the QC codes suggested here by the time the new Heathrow airport opened”

the place of the 747. Note too that the rise in the number of slots will allow airlines to run two flights using (say) 787 aircraft, instead of one 747 flight, if they prefer.

Individual airlines cannot have a veto over this policy, but it is worth setting out the effect on the major airlines using London Heathrow. Major carriers

based outside the UK will have no difficulties. The likes of Lufthansa and Singapore Airlines, for example, are likely to have sufficient “Heathrow compliant” planes without having to change their fleet. Large airlines regularly order new planes, and can ensure that the new planes are Heathrow compliant, and use those for Heathrow routes, redeploying existing planes on other routes as necessary.

Smaller foreign carriers that have only one type of plane may have to take action if their one plane type is not compliant. For example, Kenya Airlines flies non-compliant Trent engine 777s. It may be that Rolls Royce will be able to produce a hush kit that would make this plane quiet enough to operate. Otherwise Kenya Airlines has a choice: it can use an alternative airport, such as Gatwick, or it can replace at least one of its planes.¹⁷¹ One option would be to swap planes with another airline that does not fly to Heathrow and which that currently uses Heathrow compliant GE-engined 777s, making a side payment as necessary.

There are, of course, two major British airlines who fly from Heathrow: Virgin and British Airways. Virgin’s website records that their Heathrow fleet currently consists of four 747-400s, six A340-300 and nineteen A340-600 planes from Heathrow, with Gatwick using nine Boeing 747-400s.¹⁷² The A340-300s are compliant, but are being phased out, while the A340-600s and 747s are not compliant. Against that, Virgin has ordered six A380s, ten A330s, and 15 787 Dreamliners, all of which are compliant.¹⁷³ It is not yet clear whether these planes will replace or supplement the existing fleet. Since Virgin also fly from Gatwick and Manchester there is no

170 QC 1 on arrival.

171 These planes were manufactured in 2007, and will therefore still be flying at the relevant point.

172 http://www.virgin-atlantic.com/tridion/images/factsheetfleetofaircraft_tcm5-426050.pdf; <http://www.flightradar24.com/data/airplanes/virgin-atlantic-airways-vir>

173 <http://www.virgin-atlantic.com/en/gb/allaboutus/ourfleet/index.jsp?type=10>

need for their entire fleet to be Heathrow compliant. Taken as a whole, and given that Virgin also have options over a further six A380s, and 24 787s it is likely that they will have a compliant fleet in time for the new airport to open without taking further action.

BA is “the world’s largest operator of the Boeing 747”, with 57 in the fleet.¹⁷⁴ All are based at Heathrow. 20 are already scheduled for replacement, and the other 37 would have to be replaced, or moved to Gatwick routes, if BA retained operations at Gatwick. These aeroplanes are relatively old, and may well be replaced in the 2020s in any case. BA also has 52 777s, of which 27 are compliant and 25 are not. 43 are based at Heathrow, leaving BA in need of a further 16 compliant 777s for Heathrow operations, more if it consolidates operations at Heathrow. These aeroplanes are relatively new, with some only just entering service. BA would have two obvious options. First, it could simply sell them, and replace them with compliant aircraft. Second, it could enter into a plane-swap agreement with Iberia. Iberia currently has 19 compliant A340-300s, as well as an order for eight compliant A330s, with options for eight more. These 35 planes are very similar in size to BA’s 25 non-compliant 777s, and a swap may give BA a straightforward and effective way of ensuring fleet compliance. BA have a number of different options therefore, all of which would lead to a Heathrow compliant fleet of a relevant size.

In due course, the maximum permitted QC codes will fall further. The government should devise rules that state that when there is sufficient choice of planes that meet a lower QC code for the airport to be operational, the maximum permitted QC level will fall. This gives airlines an incentive to always order best in class planes for service to Heathrow, in order to ensure that they future proof their fleet.

The QC codes outlined here would be legally binding limits. In addition, Heathrow should continue with their current policy of higher landing charges for noisier planes.¹⁷⁵ It is important that the saving from using a quieter plane is material so that airlines always have an incentive to buy the best in class. In many cases, for example, a particular aeroplane is available with a choice of engines. The 787, for example, is available with a choice of General Electric or Rolls Royce engines. Both are rated QC 0.5 on departure, but the Rolls Royce engine is 0.5 on arrival, whereas the General Electric engine is QC 1. If the charge for flying a Rolls Royce engined 787 into Heathrow is significantly lower, airlines are more likely to opt for the Rolls Royce engines.¹⁷⁶ Furthermore, knowing that noise is economically important makes it more likely that airframe and engine manufacturers will strive to build low noise planes as they will be easier to sell. This will benefit not only residents in West London, but people living near airports worldwide.

Plane fleets cannot be changed overnight, but airports cannot be built overnight. The previous discussion shows that it would be reasonable for government to announce that it will require the QC codes suggested here by the time the new Heathrow airport opened.

Planes currently descend to land at Heathrow at an angle of 3 degrees, whereas planes landing at London City land at 5.5 degrees. Landing at a steeper angle means that the plane is higher up at any given distance from the airport, which will – all other things remaining equal – reduce the noise of the plane on the ground. In addition, less thrust is needed, which reduces jet noise, although that is partially

174 http://www.britishairways.com/travel/boeing-747-400/public/en_gb

175 <http://www.heathrowairport.com/noise/what-we-do-about-it/measures-already-in-place/differential-noise-charges>

176 Airlines are also more likely to use 787s rather than 777s, as the former is quieter.

countered by a greater use of flaps, which can increase airframe noise. We anticipate that by the time the new Heathrow airport opens it would be possible to have a standard descent approach for narrow bodied planes of 5.5 degrees.

International agreements allow for steeper descents only in the case of obstacles, and not for noise abatement. This distinction makes no sense: either it is safe to land at a steeper angle or it is not. Experience at London City – where planes land more steeply because of the M25 Queen Elizabeth bridge at Dartford – shows that this descent rate is safe. The international ICAO “rules” are advisory so if the British government, in conjunction with the CAA, decide that a steeper approach is appropriate, the ICAO cannot prevent it.

The largest plane currently landing at London City is the Airbus A318, which successfully lands there despite the short runway.¹⁷⁷ That plane has been specially modified, with a different flap design, and pilots have to be specially trained for the landing. Aviation experts generally seem convinced that existing and future narrow bodied planes will be able to land consistently and safely at that angle by 2030.¹⁷⁸ The landings would be on a constant descent basis, which minimises aircraft thrust and reduces noise.¹⁷⁹ Pilots will have to be trained specifically for Heathrow, but Heathrow is a sufficiently important airport that airlines are likely to be willing to do that in order to be able to fly to the airport. Those airlines that are unwilling to do so can, of course, fly to an alternative London airport.

The effect of moving the runway 3.9 km to the west, combined with a steeper rate of descent means that planes will be radically higher over any given place in London. Narrow bodied planes will be 925m, rather than 260m above Hounslow. This is the height of planes above Wandsworth at present. It is possible to hear existing plane types at Wandsworth, but the noise is a world away from the noise currently prevailing at Hounslow.¹⁸⁰ Once we take out the noisiest planes, it is clear that life for people in Hounslow will be transformed.

The same is true for Richmond, where the height of narrow bodied planes would rise from around 500m to around 1400m, the current height when flying over Peckham. Finally, the altitude of planes above Putney will rise from 800m to 2km, which is surely not a problem.

Moving the airport west, and having a steeper descent for narrow bodied planes is transformational. The noise contours from narrow bodied planes would change radically.

It is not possible to land wide-bodied planes at 5.5 degrees.¹⁸¹ It may be possible to land planes at 3.25 degrees or even 3.5 degrees by 2030, but we assume that wide bodied planes will continue to land at 3 degrees. There is still an improvement in noise over west London, however, because the runways have moved about 4km west. This means that a wide bodied plane over Hounslow would be akin to one currently over Richmond, Richmond would be akin to one currently over Barnes, Barnes becomes Wandsworth, Wandsworth Brixton, and so on. Again, the height benefits are substantial, if not as transformative as with narrow bodied planes. The biggest benefit here is from the restrictions on noise classes – the change in noise is substantial for these planes. So rather than having a noisy plane 500m above them, Richmond will have a much quieter plane 700m above them.

Landing narrow bodied planes at a steeper angle to wide-bodied planes clearly requires the use of separate runways for each type of plane. Since the narrow bodied planes will be higher, people will prefer to be overflown by narrow

177 The BA LCY-JFK flight

178 One expert did not agree, and felt that 4.5 degrees was more realistic.

179 http://www.caa.co.uk/docs/68/Basic_Principles_CDA.pdf. CDA has particular large benefits further from the airport, and also reduces fuel burn.

180 Hounslow is on the 63 dB contour, while Wandsworth is well outside the 57dB contour. <http://assets.dft.gov.uk/publications/noise-exposure-contours/noise-exposure-heathrow-2010.pdf>

181 Emirates have argued that they can begin their descent at 5.5 degrees, before moving to a 3 degree approach for the last section. Although the idea is worth exploring further, one senior pilot commented to me that “with enough training I think I could land a plane like that without loss of life 98 times out of 100”.

bodied planes. For that reason runway alteration should continue. Since it is not practical to swap runways in the middle of the day, the northern runway will be used for narrow bodied landings one day, and for wide-bodied landings the next day. At present people have high levels of noise for half the time, and no noise for half the time. This would be replaced by a tolerable level of noise half the time, and a very low level of noise for the other half of the time.

Moving the runways west also helps west London when take offs are towards the East, as happens in about a quarter of cases. In this case planes will take off along the new runways, and gain height above the current runways, before turning onto an appropriate flight path towards their destination. As such, no-one will be directly underneath the plane for its first five kilometres of ascent. Again, this is a significant benefit to west London. Departures would follow existing flight paths, so unlike the third runway proposal, there is no new group would be under the flight path for the first time.

The increase in the number of slots available makes it much more straightforward to end night flights. There are typically 17 flights that arrive between 2300 and 0615 and three departures. Based on the Heathrow live arrivals system, the first arrival is the 0450 Hong Kong, with other flights arriving between then and 0555 from Chicago, Dammam, Johannesburg, Kuala Lumpur, Lagos and Singapore.¹⁸² In each case the originating airport is open for departures later, so it would be possible for these planes to arrive after 0615.¹⁸³ Planes would typically take off around 40 minutes later, and in no case is the resulting departure time unreasonable.¹⁸⁴ The three night departures are all scheduled for 6am, to Zurich, Vienna and Lisbon. They would depart 15 minutes later instead. Rescheduled arrivals and departures would get the first rights to the additional slots.

Of course, operational difficulties mean that planes sometimes arrive late, or need to depart late because they arrived late or had difficulties at Heathrow. In such circumstances planes would be allowed to arrive or depart between 11pm and midnight, but the carrier would be required to pay a significant fine for each and every occasion that this happens, based on the number of minutes that they were late.¹⁸⁵ This gives airlines an incentive to allow a bit of extra time earlier in the schedule for flights that are due to land at Heathrow just before 11 pm. No planes would be allowed to arrive or depart after midnight: planes arriving after that time would have to divert to an alternative airport, generally Gatwick. Planes that had not departed by that time would be required to wait until the following morning.

Taken together, these changes mean that there would be no or next to no planes arriving or departing between 2300 and 0615. West London will be able to get to sleep earlier, and to sleep in for longer.¹⁸⁶

Does this proposal work for the area west of London?

Moving the airport west is clearly good news for West London, because it means that the airport is further away, and the planes are correspondingly higher. But equally, moving the airport west is, *prima facie*, bad news for the area west of London. (We discuss demolition issues below).

The communities that are potentially most affected by arrivals are Sunnymeads, Datchet, Old Windsor and New Windsor. Since wide-bodied planes will land on their current angle of descent, but land 3km further west, they will be lower above any given place on their descent. Against that, the noisiest planes have

182 <http://www.heathrowairport.com/flight-information/live-flight-arrivals>. Some origins have more than one arrival in this period. The exact list and times will depend on day of week, and daylight saving here and elsewhere. There is also a 2305 arrival from Rome, which could clearly leave five minutes earlier.

183 We have confirmed using live flight departure information that all of these airports are open at these times. In many cases they have European bound flights at around these times.

184 Departure times for a 0615 arrival would be Chicago 1610, Dammam, 2040, Hong Kong 0020, Johannesburg 2015, Kuala Lumpur 0005, Lagos 2320, Singapore 0010.

185 No fine would be levied if the arriving plane reached British airspace at the relevant time, and was delayed owing to being held in a queue by air traffic control. Equally, no fine would be levied if the plane was ready to taxi back from the gate in time, but was held for airport operating reasons. In those cases the fine would be paid by the airport.

186 There will be exceptions for force majeure, for example at the end of the ash cloud episode.

been eliminated, so the effect on total noise is ambiguous. More planes will be noticeable, but fewer planes will be exceptionally loud.

The position is different for narrow bodied planes, since they would be descending at a steeper angle. Planes within 6km of the start of the current runway will be lower than at present, but planes more than that distance away will be higher than at present. Datchet is 6km west of Heathrow: places between Datchet and Heathrow will have lower aircraft, while places west of Datchet will experience less noise. In particular, Windsor, the largest place to the west, will get less noise from narrow bodied arrivals than at present. The elimination of the noisiest planes has a smaller effect in the case of narrow bodied planes, most of which meet the proposed target in any case.

Far more people live west of the proposed northern runway than west of the proposed southern runway. For that reason, narrow bodied easterly arrivals would always land on the northern runway, and wide-bodied planes on the southern runway, rather than alternating as would be the case for arrivals over west London. Although this may seem unfair to those living due west of the southern runway, we need to remember that planes only arrive from the west around a quarter of the time.

Departures would take place along very carefully controlled corridors. Departures from the Northern runway would climb south of Datchet, before travelling in the corridor between Windsor and Slough, above Eton, Eton Wick and Dorney. We need to recall that the noisiest planes will have been eliminated, so while planes will be lower, they will not necessarily be louder.

Planes departing from the southern runway would fly over the most northerly tip of Old Windsor, before continuing either south of Windsor itself, or turning south to fly over Virginia Water and broadly along the M25.

Some properties west of London will be adversely affected, particularly those close to the new airport perimeter. In the first instance, Heathrow would fit noise baffles along the airport perimeter, on both sides. This will reduce the noise for Colnbrook and Stanwell. Where noise meets unacceptable levels, Heathrow would be required to either purchase the property, or to fit sound insulation.¹⁸⁷ The London City Airport scheme, which has lower thresholds for financial assistance, stands as the obvious model to follow.

Finally, some properties need to be demolished. We work on the basis that the new Northern runway will be exactly in line with the current Northern runway, although clearly detailed technical survey work would be required before the exact position was confirmed. On that basis, the new airport extension would require the demolition of a limited number of the houses to the south of the Bath Road in Poyle, the industrial estate and landfill centre south of Poyle, the majority of Stanwell Moor and a small number of houses at the northern edge of Stanwell. In addition, at most of Coppermill Road, the row of houses to the west of Wraysbury Reservoir would be demolished, as well as some at the northern end of the reservoir. In total, around 710 properties would need to be demolished. This compares with the 700 that would need to be demolished to construct the proposed third runway, and the 1400 that would need to be demolished to construct Foster and Partners proposed airport on the Isle of Grain.¹⁸⁸ No grade one listed buildings would need to be demolished, moved, or otherwise altered. Again, this contrasts with both the third runway and Foster proposals, which

¹⁸⁷ The airport could rent or resell the houses, as appropriate.

¹⁸⁸ <http://news.bbc.co.uk/1/hi/uk/4731948.stm>, Private conversation, Foster + Partners.

both have a grade one listed church in the airport zone. Nine grade two listed buildings would need to be demolished: this is a relatively low number for an area of this size.¹⁸⁹ Compulsory purchase should never be undertaken lightly, and compensation should be generous to those who will need to leave their homes in due course.

In addition to demolition, some areas with importance for nature would be destroyed. The Wraysbury reservoir itself is a Site of Special Scientific Interest and a Ramsar convention site. Natural England report it to be in good condition, and that it is an important location for a range of wildfowl.¹⁹⁰ This is therefore a significant issue, and one that must be comprehensively and genuinely addressed. The government's new Major Infrastructure and Environment Unit would be useful in this context, since its express role is to assist those proposing major infrastructure projects with assistance of this type.¹⁹¹ There are four other major reservoirs close by: the Queen Mother, King George VI, and both Staines reservoirs. In addition, Wraysbury has a number of gravel pits in the area, all of which are now filled, and whose "habitat conditions are suitable to support a high diversity of breeding bird species".¹⁹² These would all be unaffected, as would the Bedfont and Thorpe Park lakes, Virginia Water, and the Queen Mary, Queen Elizabeth and Island Barn reservoirs that lie within a five mile radius. The Wraysbury reservoir does not, therefore, provide a unique and irreplaceable habitat in the area. It would be a requirement to work with Natural England to ensure that neighbouring reservoirs offer appropriate sites for different types of birds currently using Wraysbury Reservoir, as necessary. In addition, there is a small, nine hectare, area which is designated as a site of special scientific interest as an area of open moorland. Since it is sandwiched between the M25, the Wraysbury reservoir and the Poyle industrial estate it does not meet most people's definition of an "open moorland". Natural England reports that access is difficult, and that it is in an unfavourable condition. They note that "Negative indicators include greater than 25% litter".¹⁹³ While any loss of a site of special scientific interest is to be regretted, this particular site appears to be of relatively low value. There is also a tiny (0.29 ha, about 50m square) orchard that is a biodiversity action plan priority habitat.¹⁹⁴

Local pollution issues

Local air pollution matters, and is wrongly neglected. Moore and Newey provide an excellent analysis of the issue in their recent Policy Exchange paper.¹⁹⁵ London has some of the worst local air conditions in the country.¹⁹⁶ The Greater London Authority has produced an excellent map that shows the worst affected areas within London very clearly.¹⁹⁷

Inner London is worst affected, but Heathrow is the worst affected place in outer London. The problem is primarily roads: the North Circular, the A2 to the Blackwall tunnel, and the M4 can be seen as clearly on a map of NO_x levels as on an A-Z map. This tells us two things. First, it is important that we cure the NO_x problem whatever happens at Heathrow. Even if we shut Heathrow tomorrow, we need a solution to NO_x. Second, the best solution to NO_x is to sort out car-produced NO_x.¹⁹⁸ A forthcoming paper by Leunig set out how government can reframe VED to achieve exactly that outcome.¹⁹⁹ Although the effects would take some time to work through, it is likely that NO_x emissions from cars would

189 <http://www.britishlistedbuildings.co.uk/map>. The number of grade two listed buildings in Britain is very high indeed, and it is hard to believe that there is anywhere where it is possible to build anything the size of an airport without demolishing some grade two listed buildings.

190 http://www.sssi.naturalengland.org.uk/special/sssi/unit_details.cfm?situnt_id=1023938

191 <http://www.parliament.uk/briefing-papers/SN05041>

192 The quote is taken from the most recent Natural England report into the pits, <http://www.sssi.naturalengland.org.uk/special/sssi/reportAction.cfm?report=sdr13&category=S&reference=1004168>

193 <http://www.sssi.naturalengland.org.uk/special/sssi/reportAction.cfm?report=sdr13&category=S&reference=1001792>, unit 1.

194 LOND0418 <http://www.natureonthemap.naturalengland.org.uk/identify.aspx>

195 <http://www.policyexchange.org.uk/images/publications/something%20in%20the%20air.pdf>

196 <http://www.policyexchange.org.uk/images/publications/something%20in%20the%20air.pdf> map 1.2

197 <http://www.london.gov.uk/thelondonplan/images/maps-diagrams/jpg/map-4a-2.jpg>

198 Within London, after road based transport, the next biggest source of NO_x is domestic gas, with airports equal to rail as a source of NO_x, http://www.caa.co.uk/docs/589/CAA_InsightNote2_Aviation_Policy_For_The_Environment.pdf, figure 11, page 40.

199 Leunig, *Vehicle Excise Duty*, CentreForum, forthcoming 2012.

fall by well over 50% by the time the new Heathrow opened, were the policy recommendations set out in that report to be followed. Broadly speaking this will turn the yellow areas to dark blue, and the red areas to light blue. In short, the problem would be largely solved.

This will have a large effect at Heathrow. This would be strengthened by increasing the number and speed of tube services to Heathrow, making the tube more desirable compared with road based transport for travel to and from Heathrow. The interchanges between the shuttles and the train and tube will also encourage modal shift: it will no longer be easier to get a taxi than the tube or train. Train access from Reading (and beyond) and from Richmond (and beyond) will also help modal shift. The ending of direct access to terminals 1–3 for passenger traffic, via the tunnel, will also reduce emissions on the airport site. Moving the bus and coach station to the Western Gateway reduces their contribution to emissions on the main site, as does eliminating inter-terminal airside bus transfers, and bus transfers to car hire depots. All of these, in aggregate, are likely to reduce local NO_x levels sufficiently for the issue to stop being a problem.

Aircraft do emit NO_x, and indeed “Ground-level aircraft operations emit large amounts of NO_x” but the proportion of total NO_x in and around Heathrow that come from aircraft is typically between 5 and 20%.²⁰⁰ Only on the airport site itself, where EU limits do not apply, does the proportion of NO_x attributed to aircraft reach 25% of overall levels. Including all airport sources of NO_x raises this proportion to 33% of overall levels on the airport itself.²⁰¹

As we have stated, it is likely that tackling NO_x emissions from cars will solve the NO_x problem across London, making it overwhelmingly likely that no Heathrow or airport specific action would be needed. Nevertheless, there are two actions that Heathrow would be able to take as necessary, and which may be worth doing in any case. The first is to use electric vehicles for on-airport operations. The big downsides to electric vehicles are limited range, energy consumption issues at speed and limited recharging points. None are a major issue at an airport. Airport vehicles travel relatively few miles a day, rarely travel at high speeds, and it would be easy to install rapid three phase recharging points in many places. Both the cost and effect would be small, but if NO_x remains an issue it would be worthwhile. There would also be a beneficial effect on CO₂ emissions.

A more ambitious approach would be to tow taxiing aircraft with electric vehicles. Electric engines are characterised by high levels of torque, relative to power. This means that they are good at pulling heavy weights, but often have low top speeds. This makes them theoretically ideal for pulling aircraft around an airport. Research is underway in this area, and may offer significant benefits in the medium term.²⁰²

How to do it

The initial requirements are two-fold. First, a decision has to be taken in principle. The fastest approach would be for the Davies Commission to support the proposal outlined in this report in its interim report, and for all major political parties to endorse it in their next manifestos. As such it could be the first bill of the next parliament, and would pass unopposed since all parties would support it.²⁰³

200 http://www.caa.co.uk/docs/589/CAA_InsightNote2_Aviation_Policy_For_The_Environment.pdf, p. 39 <http://www.london.gov.uk/moderngov/mgConvert2PDF.aspx?ID=6457>

201 http://www.heathrowairport.com/static/Heathrow/Downloads/PDF/air-quality-strategy_LHR.pdf, pp. 22–23

202 <http://www.economist.com/node/21562895?fsrc=scn/tw/te/pe/preparingfortakeoff>

203 Given that airports seem to be a political football this is unlikely. Prior to the last election Labour supported expanding Heathrow and now oppose it, the Conservatives opposed it and now support it, while the Liberal Democrats have consistently opposed all increases in aviation capacity in the South East.

The second requirement is for detailed plans to be drawn up. Above all this means a site survey, as well as detailed noise modelling to ascertain the precise optimal location of the runways. The Heathrow Express, Crossrail, Piccadilly line and shuttle routes have to be agreed. Decisions have to be taken on whether they should go under the M25, or whether the M25 should go under them. Issues of compensation have to be worked out, and offers made. All of this can happen in parallel with building a political consensus, if that consensus looks likely to emerge. At this stage an alternative reservoir site needs to be located.²⁰⁴ The proposals would obviously need planning permission, and would be considered by the government's new Major Infrastructure Planning Unit. This is designed to offer a "fast track system for decision making on major infrastructure projects".²⁰⁵

The construction work would take place in broadly the following manner. The first step would be to build and fill the new reservoir, allowing Wraysbury to be drained. At this point the existing buildings on the new site can be demolished, and the tunnels for the new Heathrow Shuttle, Heathrow Express, Crossrail and Piccadilly line extensions can be excavated.²⁰⁶ In each case the spoil will go towards levelling the site as necessary, including filling the Northern part of the reservoir. The southern part of the reservoir can be levelled at an appropriate depth, and the Gateway constructed, including access from the M25. The Gateway and Shuttle should open as soon as complete, to serve the existing airport. This will allow road access to existing terminals to be removed.²⁰⁷ Once road access to terminal 5 has been removed the new site is completely available for the final levelling and building. At this point, runways, taxiways, the new West terminal and the western piers can be built, along with allied infrastructure such as baggage handling, fuelling supplies, and so on. It is much easier to build these than it was to build either terminal 5 or the redevelopment of terminal 2, as it is not situated in the middle of an airport. The next stage is to open the new terminals, at which any significant remodelling of existing infrastructure can be undertaken.²⁰⁸ The airport can then open as a full, four runway airport.

Costs

It is not possible to estimate the costs with any degree of certainty without a full engineering appraisal. That is well outside the scope of this report. Nevertheless, we can say that Fosters estimate the cost of their airport at £20bn, excluding transport links. In this case the cost must be radically lower, because so much of the airport already exists. Two of the three terminals are in place, and many of the piers at which the aircraft will dock. In addition, the maintenance and engineering facilities are already in place, along with basic items such as air traffic control, fire services, refuelling facilities, and so on.²⁰⁹ In addition, the main rail and road infrastructure to the site already exists, with only short extensions and remodellings required. Ad hoc estimates from aviation experts suggest that the total cost would be around £10bn.

There is no case for any government subsidy, in any shape or form. All of the costs, including M25 remodelling, extending the Piccadilly line, and so on, should be met by travellers. In the case of the Piccadilly line extension, however, Transport for London stand to gain additional farebox revenue from the additional passengers. Similarly, the South West Trains franchise would become more valuable, once they can offer direct service to Heathrow from Waterloo,

204 As we noted earlier, Thames Water have previously applied to build a reservoir at Abingdon. A reservoir on that site of a quarter the size of Thames Water's earlier proposal would suffice. Alternatively another site could be found. Another option would be to raise the height of the other reservoirs in the area, the Queen Mother, King George VI and Staines.

205 <http://www.communities.gov.uk/news/corporate/1626220>

206 The Heathrow Express and Crossrail trains will use the same line.

207 Note that opening the shuttle allows the area currently occupied by car parking and bus station in the centre of terminals 1–3 to be redeveloped.

208 The most likely remodelling is to terminal 5, which is relatively far north, and may be too close to one of the new runways.

209 Installing basic items such as a fuel line are not trivial. The Heathrow and Gatwick fuel lines start at the Esso Fawley site, near Southampton, and travel via Alton in Hampshire. Although only 1 foot in diameter, the fuel is pumped at a remarkably high pressure of around 1400 psi. <http://www.linewatch.co.uk/map-PDF/map-ESSO.pdf>

Clapham Junction, Reading, and other points on their network. The government will therefore receive a higher premium from operators when the franchise is offered. It is likely that the cost of extending the Piccadilly Line and the small changes to the railway at Staines can be covered by government, and comfortably recouped from additional fares.²¹⁰

Conclusion

This report shows that it is possible to expand Heathrow to make it a world-class hub, while significantly reducing the noise nuisance over West London. The proposal is cost-effective, because so much infrastructure is already in place. It also causes the lowest level of general economic disruption to the wider economy, in that fewer people and companies lose good access to an airport, of any likely airport expansion scenario. It is therefore likely to score highly on any formal cost benefit analysis.

²¹⁰ Notice that this leaves the government better off, because there is no need to spend £500m on the new line from Reading to the old Heathrow. This money can be put towards other transport projects, or to any other government spending priority, including deficit reduction, or tax cuts.

10

Luton

We mentioned earlier that, excepting Heathrow, Luton is broadly speaking the best located London airport. It is close to a high quality, four track rail line that goes to and through London, as well as directly to a number of important cities in the Midlands. It is also close to the M1, which has good claim to being Britain's most important road. It is on the right side of London for much of the country. Luton also has a good sized workforce in the town itself, which is useful for staffing the airport. We therefore need to think about whether Luton airport can be expanded.

Luton airport is not well configured at present to be a major international airport. It has one, short, runway, and no full length taxiway. The terminal is to the north, with car parking in between. Planes have to taxi past the car park, and then round the edge of the terminal, since most gates are on the north side of the terminal, away from the runway. Like most airports, Luton has grown in an ad hoc way over time and the result is an operational mess. The airport is surrounded by Luton itself to the North and West, but has land available to the east and south.

A plan for Luton

There is room to fit a four runway hub airport in the gap between Luton and Harpenden, with the noise footprint sitting between Berkhamsted to the west and Stevenage to the east.

In many ways the best location of a hub Luton airport would be between the M1 and the railway line, a little to the south and west of the current airport. This would allow direct access to the airport from the west by road, and from the east by rail. Furthermore, moving the airport a little to the west would reduce the noise impact on Stevenage. The existing airport would then close, and the land redeveloped.

That location, however, has two disadvantages. First, it is hilly, and although hills can be flattened it is not cheap to do so.²¹¹ Second, the site is currently occupied by Luton Hoo, a grade 1 listed building. Having a grade 1 listed building in the way did not stop the previous government approving the third runway, and the Foster and Partners plan for an airport at Cliffe involve them moving a grade 1 listed church at Grain. This, ultimately, is a question for government: if a hub is to be built at Luton, is it better to preserve Luton Hoo, or have more noise over Stevenage and a worse road connection? There are no sites of special scientific interest in the relevant area, although there are a number of pockets of ancient woodlands which are biodiversity action plan priority habitats.²¹²

If a four runway Luton Hub is built on the Luton Hoo site it would follow the same principles as set out for the Heathrow proposal. It would have four runways,

211 <http://www.getamap.ordnancesurveyleisure.co.uk/> gives contour lines for the area

212 <http://www.natureonthemap.naturalengland.org.uk/map.aspx?m=bap>

operating as two close spaced pairs, running broadly east-west.²¹³ In this case the airport would have two terminals: west and east. West would be adjoining the M1, and would serve road based traffic, while the east terminal would be above or adjoining the Midland Main Line rail route, and would serve those arriving by rail.

The airport would then have piers between the terminals, with additional piers to the west as necessary. Again, it would be a modern toast rack airport and operationally efficient.

The existing Luton Airport Parking station would close, and be replaced by a new Luton Airport Station approximately 2km further south. Having the airport on the mainline, rather than served by a spur is a massive advantage because it eliminates the need for an expensive graded rail interchange, or for trains to cross tracks, which reduces capacity. Being on the mainline also makes it possible for a large number of trains to call at the airport, as part of longer journeys. The journey time is likely to be 20 minutes from Kings Cross – St Pancras, with fast trains every five minutes. Some of these trains would terminate at St Pancras, while others would continue through central London connecting with Crossrail at Farringdon, and with South East London suburban services at London Bridge, before travelling on to Croydon, Gatwick, and Brighton.

The Midland Mainline, despite its name, is not the principal rail route to the Midlands or the North. The two track section around Market Harborough limits the number of trains north of the airport. A sensible strategy would be to run frequent trains to Leeds, Doncaster and Nottingham. All would call at Leicester, while the Doncaster trains would add Chesterfield, Sheffield and Rotherham, with the Leeds trains also calling at Derby and Wakefield.²¹⁴

As with the Heathrow proposal, the Luton hub would have a shuttle connecting the two terminals to each other, and to the piers in between. The shuttle would start at Tring station on the West Coast Main Line, travel to Luton West terminal above the M1, to the piers, to the East terminal above the Midland Mainline, and then on to the A1(M) and the East Coast Mainline, which are conveniently close together between Stevenage and Knebworth.²¹⁵ The Shuttle would run every five minutes from Tring to Stevenage/Knebworth, with additional shuttles within the airport to ensure a two minute service with the airport. It is 15km from Tring to the airport, and 13km from the airport to Stevenage/Knebworth. It would be straightforward to engineer a line to give a sub-10 minute journey time from either end of the line to the airport.²¹⁶ With a maximum wait of five minutes, a passenger arriving on either the west coast mainline or the east coast mainline would be at the airport within 15 minutes of arriving at either Tring of the Stevenage/Knebworth interchange. In each case the rail/shuttle interchange would be designed for rapid transfers: the ideal arrangement is to have the shuttle running above the current rail lines, at right angles, with ramps from the shuttle platforms down to the mainline platforms.

Again, the shuttle would have airside and landside sections, with the airside sections remaining sealed outside of the airport. The shuttle would be driverless, although like the Docklands Light Railway would need a member of staff on board for contingencies. Again, it would provide real time information on security queues at the terminal and piers.

As before, hand luggage customers would be able to proceed straight to the pier, without entering a terminal. Any hand luggage passengers should be able

213 The closer the runways are to due east-west, the lower the air traffic control issues with Heathrow.

214 It is possible to run trains direct to Manchester, Birmingham, Worcester, Peterborough, York, Edinburgh and Glasgow, but the routes are convoluted and slow, and the train paths would not be available to make this practical.

215 The line would be built to light rail standards. As the Docklands light railway shows, this makes it easier to go round corners, and to go up and down relatively steep gradients. This in turn reduces the cost, as fewer cuttings and elevated sections are needed. This is important as the area is hilly.

216 This requires an average speed of 56mph, which is within the capabilities of a modern tube train, for example.

to get from Tring or Stevenage/Knebworth to their gate within 30 minutes. The journey time from Birmingham to Tring would be 60 minutes, based on current rail speeds, while the journey time from Manchester would be 1 hour 45 minutes. Adding 15 minutes for the shuttle shows that a Luton hub would work very well for Birmingham and Manchester, and for other places on the West Coast Main Line.²¹⁷

If this exact site is simply too expensive, or if the existence of Luton Hoo precludes its use, then the expansion of Luton should take place immediately south of the existing airport. The location would then be similar to that proposed by Luton airport in 2002 in their technically coherent plan to become a two runway airport.²¹⁸ This involved extending the current runway east, and building another runway 1450m to the south. As we have noted, wide spaced runways need to be 1035m apart, and narrow runways 380m apart. It is therefore possible to have four runways with a total spacing from 1 to 4 of 1795m.

The airport would be the same operationally, except that it would have one very large terminal above the railway line, at the western end of the runways, and a motorway spur running from the M1 to the terminal.²¹⁹ The piers would then be to the east of the terminal. The shuttle would run from Tring to Stevenage, calling at the terminal and piers, as before. Connections to London and the North would remain impressive.

The advantages of this site are that it does not require the demolition of a grade I listed building, that the area is flatter, and that the existing runway, control towers, and so on can be incorporated. The cost savings are not that great however, since the existing runway would need to be extended, and three runways, all taxiways, and the terminal and piers built from scratch. Against that, there are greater noise issues for Stevenage, although these can be ameliorated by controls over QC classes, as outlined earlier. Again, there are no sites of special scientific interest, and the amount of woodland affected would be slightly lower.

Should we build a Luton airport hub?

Luton could be built instead of, or as well as, a Heathrow hub. Given that we have identified Luton as the second best location for an airport, it follows that if additional runways are not built at Heathrow, for whatever reason, then the Luton hub should be built. It is well placed for London, and well-placed for much of the rest of the country. The airport would be more expensive to build than Heathrow, both because of terrain, and because more of Heathrow is in place already. A figure of £20bn seems plausible. A four runway Luton would almost certainly require the closure of Stansted, on air traffic control grounds, which adds to the costs, since the owners would need to be compensated.

It is sensible to expand Heathrow first, but since a four runway Heathrow represents the final size and shape of Heathrow, Luton should be kept in mind as an additional hub airport if and when Heathrow is full. New York has two hub airports, in JFK and Newark Liberty, as well as a local airport.²²⁰ Nevertheless, it takes a very big city to warrant two hubs, and this is more than a generation

“Given that we have identified Luton as the second best location for an airport, it follows that if no more runways are built at the Heathrow hub, for whatever reason, then the Luton hub should be built”

²¹⁷ It would be possible to extend the shuttle to meet HS2 at Wendover, but the advantages seem less clear cut. An additional stop on a high speed line reduces capacity and increases journey times for those who do not want to stop there. In addition, Wendover is further from Luton, so the time saving from travelling from Birmingham to Wendover would be partly lost travelling further on the airport shuttle. For that reason we terminate the shuttle at Tring.

²¹⁸ http://www.pavan.org.uk/Documents/2_runway_proposal.pdf, p. 27, figure 5.1

²¹⁹ The Foster scheme for the Estuary airport is for a single terminal airport.

²²⁰ Were London to have demand sufficient to use eight runways, having two hubs rather than one would not be a large loss.

away. A two hub London would also require massive progress on decarbonisation that is not currently in sight. As such, the area needed for the airport should be reserved, but no further action taken at Luton if Heathrow is to be expanded as outlined here.

In time, it may make sense for Luton to expand to become a two runway airport, but in a way that is consistent with becoming a four runway airport later.²²¹ This would be done by building two of the four runways initially, while leaving space to build the other two as needed. Terminal and piers would also be built in a way that allows expansion.

It makes less sense to expand Luton and require Heathrow to close. An expanded Luton will take around 900,000 movements. We have, however, noted that this would require Stansted to close for air traffic control reasons, so this would represent a rise of just 125,000 movements over the current Heathrow, Luton and Stansted combined levels. The only context in which this would make sense is if Gatwick was also allowed to build a second runway. At that point we can imagine the low cost and leisure traffic moving from the current Luton and Stansted to the new Gatwick, and the business oriented traffic moving from Heathrow to Luton. This works on paper, but it is an expensive option, and the level of disruption to existing patterns of business activity are significant.

Conclusion

Luton has advantages and disadvantages as a location. The site has potential, and can be linked well to many places. Against that, it is much harder to build out, and would lead to much more disruption in terms of changing patterns of behaviour than expanding Heathrow. It would be hard to justify a preference for Luton over Heathrow, but the government should be willing to listen to approaches from entrepreneurs interested in taking Luton forward in the medium to longer term.

221 If both airports are to be permitted to grow to four runways, it would be imperative for the runways to be due east west in this scenario, for air traffic control reasons.

11

Gatwick

Gatwick is currently London's second largest airport, and has proven that a one runway airport can service a very large number of flights. This report suggests that Britain needs a four runway airport, and it is hard to see that happening at Gatwick, although Gatwick has put forward plans to be a two runway airport in the past. Gatwick is not in the best location to act as Britain's primary hub. We have already seen how it is able to offer short journey times to a relatively low proportion of its current passengers. Furthermore, it would be hard to build a four runway airport on the current site, even including the area safeguarded for expansion.²²² It would be possible: two northern runways would need to be built where the North terminal currently stands, and the terminal would need to be where the runway currently stands, with the southerly runways located in the area further south, which is currently safeguarded for future expansion. It would be possible to do this: the southern runways would be built, and then the current runway decommissioned. The new terminal would then be built, and the current terminal demolished. The new northern runways would then be built. Doing all of this while running a 35m passenger a year airport would not, however, be easy, and as we noted, the resulting airport would not be well-located for the rest of the country. The cost of building it would also exceed that of the Heathrow plans outlined earlier, because much less infrastructure would be reused.

For all of these reasons, we do not consider Gatwick as the appropriate place for Britain's hub airport. We therefore consider the role of Gatwick in different circumstances.

If Heathrow expands, Gatwick will face increasing competition for its existing business. We have mentioned already that in those circumstances it is possible that either BA or Virgin or both will decide to consolidate their operations at Heathrow, and reduce or even end their Gatwick operations. Very few airlines choose to use more than one airport in a given metropolitan area. Losing BA and Virgin would represent a commercial set back to Gatwick, but it would not in any sense make Gatwick unviable. In this situation, the long-term future for Gatwick is likely to be similar to today: a good quality base for point to point traffic, with an orientation towards leisure travel and short haul flights. Its market is London and the area south and east of London, but without a larger regional hinterland.

Indeed, were BA and Virgin to pull out of Gatwick, Gatwick would then have additional slots at peak times. The obvious company who might want to expand is easyJet. Gatwick has been a big success for easyJet, and it is increased its operations at Gatwick dramatically in recent years. It may be that easyJet would want to grow at Gatwick organically, or it may be that easyJet would be interested

222 http://www.gatwickairport.com/Documents/business_and_community/Gatwick%20master%20plan/2012-07-16-GAL_Masterplan%20-%20Appendix.pdf figure 1.13

in moving planes currently based in Luton or particularly Stansted to Gatwick. Taken as a whole, Gatwick has little to fear in the medium-term from expansion at Heathrow.

Were the government to close Heathrow and expand Luton, then Gatwick would clearly benefit, since this approach would involve closing Stansted as well. Gatwick would then lose two of its core rivals. Given that a big new Luton offers only limited additional capacity over the current capacity at Heathrow, Luton and Stansted, it is clear that this option would all but require a second runway at Gatwick if we wish to raise aggregate aviation capacity. In these circumstances the best solution would be to expand the existing terminal facilities in a piece meal fashion, and to build the new runway to the south, in the land reserved for that purpose. Again, there are no sites of special scientific interest, and only limited woodlands in the relevant area.²²³

In general, there is no national strategic case for a second runway at Gatwick, whatever decision is taken as to where the hub airport should be located. There may, however, be a business case, if the airport owners believe that they can increase traffic. For that reason it remains sensible to continue to safeguard the potential expansion area. Whether a second runway is built should be up to the operators: if they think it would be a useful addition, they should not be prevented from building it once the current agreement not to construct an additional runway prior to 2019 expires. The noise issues would obviously need to be considered, but there are relatively low numbers of people living in the proposed flight path. Again, a combination of restrictive rules on QC levels, and limiting and banning night flights are better ways to deal with noise than constraining an airport from expansion.

223 <http://www.natureonthemap.naturalengland.org.uk/map.aspx?m=bap>

12

Stansted

Stansted airport is currently London's third largest airport, with around 150,000 movements and 18 million passengers.²²⁴ This is a considerable fall from the 24 million five years ago. The airport is served by 14 scheduled airlines, and has service to 164 destinations, with charter airline service to a further seven places.²²⁵ Ryanair have their largest base at Stansted, and they dominate their airport: 117 of the destinations are Ryanair destinations. They alone accounts for 70% of Stansted's scheduled destinations, with easyJet accounting for a further 20% of such destinations. The extent of Stansted's dependence on Ryanair is such that it is plausible that Stansted would close to passenger traffic without Ryanair. The airport is also used for cargo, with British Airways, UPS, FedEx and others using it extensively.

Stansted has plenty of spare capacity, but airlines are not choosing to move to the airport. As we said earlier, it has by far the weakest natural hinterland of any of London's principal airports, and the slowest connections to London. Furthermore those connections are hard to improve, given the nature of the rail line to London.

It would of course be possible to construct a high speed line to London, but this would be very expensive. As we noted earlier, Crossrail is costing around £1bn per mile for the tunnelled sections. The cheapest way to build a significantly faster new rail line would probably be use the Crossrail line from central London to Ilford, briefly tunnelling north east to appear above ground just north of the A12 opposite the King George Hospital. The fact remains, however, that the line would be expensive to build, and given that there are few major places beyond Stansted, this is a lot of railway to build for the likely levels of use. The line to Luton goes on to places such as Leicester, Nottingham and Sheffield: there are no equivalent places for this line to go on to, especially as Cambridge already has a good rail service.

It would also be possible to build a rail link across to the Midlands, with connections to the East and West Coast main lines. The distance from the west coast mainline to Stansted is around 60km as the crow flies. This is too long for a light rail shuttle, and so would have to be built to more expensive heavy rail standards. That increases the expense, and the construction difficulties.

Location and connections, existing and possible, mean that there is no sensible economic case for making Stansted into Britain's hub airport.

The future of Stansted largely depends on the other options chosen. If one airport expands, we will have spare capacity somewhere in the system, and that will allow airlines currently operating at Stansted to consider moving to another airport.

224 <http://www.stanstedairport.com/about-us/stansted-facts-and-figures>

225 <http://www.stanstedairport.com/flight-information/flight-timetables/scheduled-flight-timetable>; <http://www.stanstedairport.com/flight-information/flight-timetables/charter-flight-timetable>

Stansted is the smallest of easyJet's London bases, with 28 destinations, compared with 38 from Luton and 98 for Gatwick. easyJet started at Luton, and is still headquartered there. It created the Gatwick base itself, and that is now its largest base, anywhere on the network. In contrast the Stansted base was inherited when it took over Go airline in 2002, and has not grown in the way of the Gatwick base. It is very plausible that easyJet would decide to concentrate more flights from Gatwick were more slots to become available, or that it would decide to move Stansted flights to Luton were that airport to be transformed.

Ryanair has far more planes based at Stansted, and it is therefore harder for Ryanair to leave Stansted altogether. That said, they already have bases at Luton and Gatwick as well, and Michael O'Leary has shown that he is willing to change airports if he gets a better deal. Although Ryanair usually prefers to use no frills airports, it has shown a willingness to base planes at more traditional airports, if the price is right. For example, Ryanair has a presence at Gatwick, and serves a similar number of destinations from full-service Manchester as from low-cost Liverpool John Lennon airport.²²⁶ It is easy to imagine that Luton might welcome the additional business that Ryanair would bring, and might well be keen to design part of the airport as a low cost airport, in which people walk to the aircraft, and so on.

It would only be feasible for Ryanair to move en bloc if a large number of slots become available. There are three scenarios in which this would be possible. First, if BA and Virgin leave Gatwick to consolidate their operations at Heathrow. Second, if Gatwick build a second runway. In either case Ryanair may consider moving to Gatwick. Third, if Luton gains additional capacity Ryanair may move to Luton.²²⁷ It is hard to imagine Stansted surviving the departure of Ryanair. Stansted is not a sensible location for a hub airport. Decisions about its future are for the airport and airlines themselves to make.

226 Manchester 30, Liverpool 36. <http://www.ryanair.com/en/cheap-flight-destinations>

227 <http://www.luton-airport-guide.co.uk/history.html>; <http://www.standard.co.uk/business/gatwick-could-hit-baa-by-poaching-ryanair-from-stansted-6725224.html>

13

Foster + Partners Proposal For Grain

Foster + Partners, in conjunction with Halcrow engineers and Volterra Partners Economics Consultancy have developed a technically coherent plan for an airport in North Kent.²²⁸ This is the latest in a stream of proposals for an estuary airport. The House of Commons Library have written and made publicly available an excellent report that sets out the plans that have been proposed over the years.²²⁹

Foster + Partners proposed airport would be located at Grain, and would be built half on the Grain peninsula, and half out into the Estuary. The idea is strongly supported by Boris Johnson, who earlier supported an estuary airport near Whitstable. The plan is for a four runway airport, with runways aligned east west, and a toast rack airport in between. It meets all the standard criteria for a well-designed airport, and offers broadly the same capacity as the proposed four runway Heathrow airport. It would, however, operate 24/7.

There are, however, a number of issues, because the location is both a strength and a weakness.²³⁰ There are construction issues. Although the Grain peninsula is sparsely populated, it is not the case that it is unpopulated. Foster's state that 1400 houses would have to be demolished, and that a Grade 1 listed Church of St James would need to move. Moving a structure dating back to the twelfth century is not, of course, straightforward, as twelfth century churches were neither designed nor built to be moved.²³¹ In addition, the village of Allhallows would end up sandwiched between the airport and the adjoining airport industrial complex, and would, to all intents and purposes, become uninhabitable. This is in addition to the 1400 houses already mentioned.²³²

Almost all of the proposed site is a major site of special scientific interest, an international RAMSAR convention bird life area, an internationally designated special protection area and an internationally designated special area of conservation.²³³ The RSPB describe it as a "world class coastal wetland", used by hundreds of thousands of wildfowl and waders.²³⁴ The airport would not only destroy the habitats in the airport zone itself, but over a much wider area. This is because planes and hundreds of thousands of birds are a lethal combination. As a result the whole of the Grain peninsula wetlands area would need to be comprehensively destroyed as a wetland and wading area. No-one disputes the RSPB's claim that "To land planes in a foggy, bird-rich estuary makes it one of the most unsafe locations in the world unless draconian clearance of the flocks that make the Thames their home is undertaken, year after year." Foster's propose to create new habitat areas on the Essex coast, but migrating birds are not easy to relocate.

228 The full presentation is available here. <https://fosterandpartners1.box.com/s/q8qfe9kpspue7e1at5nb>.

229 <http://www.parliament.uk/briefing-papers/SN04920>

230 The House of Commons Library Note has a good summary of responses from interested parties: <http://www.parliament.uk/briefing-papers/SN06144>

231 <http://www.britishlistedbuildings.co.uk/en-172910-church-of-st-james-isle-of-grain>

232 Fosters' airport plan shows Allhallows under the airport, although in their presentation their assured me that it could remain. <https://fosterandpartners1.box.com/s/q8qfe9kpspue7e1at5nb#/s/>

233 <http://www.natureonthemap.naturalengland.org.uk/identify.aspx>

234 <http://www.rspb.org.uk/ourwork/casework/details.aspx?id=tcn:9-304003>

Let us imagine for a moment that these issues were overcome, and ask whether the airport is the right one for the country. The strength of the location is that relatively few people would be affected by noise. No formal noise contours are included in Foster's presentation, but they claim a 95% reduction in the number of people who would find themselves within the 57dB noise corridor. This is a remarkable reduction, and it is worth investigating it further. When planes land from the east, they will clearly come in over the Thames Estuary, which reduces the number of people affected by noise. When landing from the west, however, one might expect a significant noise footprint. The plan to avoid this consists of planes arriving from the North and South, and turning sharply east on arrival. Having planes fly at each other while descending before turning sharply to land is an unusual approach, and may be part of the reason that NATS have been so dismissive of the idea that Foster's plans are even technically feasible.

There is also an issue about who experiences the noise. People who have bought or rented a property near Foster's proposed site have done so in the reasonable expectation that it will be peaceful. Indeed, peaceful could be said to be the defining characteristic of the Grain peninsula. In contrast, someone who has bought or rented a property under the Heathrow flight path did not do so in the expectation that it will be peaceful. We therefore need to be careful in treating the noise that each group experiences as morally equal. This is particularly true given that the proposal is for a 24 hour airport. Subjecting people in North Kent and South Essex to noise right the way through the night is a surprising aspect of the plan.

Next we need to consider whether the airport works for people who want to travel. The plan is to have a "high speed" train from St Pancras to the airport, which will run at ten minute intervals, and take 30 minutes to make the journey. This is a plausible time: the distance is a little over twice the distance from Paddington to Heathrow, so the train will take around twice as long as the Heathrow Express. Note that 25% of Heathrow passengers currently arrive at the airport in 30 minutes or fewer, so having a minimum journey time of 30 minutes, even if you live at St Pancras station, and catch the train without a moment's delay, is a poor outcome. The Heathrow Express currently costs at least £34 return, so a pro rata cost estimate for a ticket to the estuary airport would be around £75. Of course the cost could be subsidised by the airport, but in that case people will end up paying the same amount, but in another way. As the Heathrow Express shows, building and operating an unsubsidised railway is a very expensive proposition. The cost of getting to the airport will certainly be a different order of magnitude to the £2.90 off peak Oyster single fare to Heathrow.

There are indicative plans to supplement the St Pancras service with trains from Waterloo, Cannon Street and Liverpool Street. In each case existing tracks would be used, and since these lines are already heavily used the result is that the service would be every 20 to 30 minutes. In each case the journey time would be 40 to 50 minutes. The overall journey is therefore around an hour, with great annoyance if you just miss a service.²³⁵ These services would not run 24/7, so the only access to and from the airport at night would be via the expensive St Pancras high speed train. People travelling at night would therefore need to get to St Pancras – presumably by night bus, minicab or taxi. More tentatively, Fosters have suggested that Crossrail could be extended to the airport, although this is not included in their costings.

²³⁵ Source for journey times and intervals: Fosters' presentation.

Furthermore, the airport will still only be accessible by public transport from a relatively limited number of places. St Pancras is a reasonable starting point if you live in central London, but it is not helpful to many who live outside of central London. Fosters also propose a semi-orbital railway running from the airport across the top of London and down to Maidenhead, but they are honest enough to admit that the £20bn bill would need to be picked up by the taxpayer, as it would be nowhere near economic. It would not be built in time for the airport to open. It would also only offer a limited number of stations, and would therefore be of use to only a limited number of people. It would clearly be of no use to those living south or south west of London. Fosters confirmed that it would take 90–120 minutes to reach the airport from Surrey, and commented simply that people could move if it was a problem.

The journey to Cliffe is not one that will work well for many by minicab, either, given the distance and inaccessible location of the airport. This is a particular problem for people catching the crucial early morning business flights. A 0615 departure requires you to be at the airport at 0545, which requires you to catch the 0515 train from St Pancras to the airport. Getting to St Pancras to catch the 0515 is not straightforward and in reality most people would have to take a minicab to St Pancras, before catching the train to the airport. The reality is that the estuary airport is in the wrong place, and as a result is slow and expensive to get to: it just doesn't work for business travellers.

Foster's are proud of their vision, and cite the Victorians as inspiration. Foster himself writes in his foreword that "We need to recapture the foresight and political courage of our 19th century forebears if we are to establish a modern transport and energy infrastructure in Britain for this century and beyond." Yet he has got the Victorians flat wrong. The Victorians did not come up with grand visions. The French did that – witness Haussmann's Paris – but the Victorians were the most ad hoc nation you could imagine. That is why we have so many competing rail lines for example, and why we have no "Grand Central Station" in London. The Victorians love of competition over planning and foresight gave us competing rail lines run by competing companies, who built a veritable spaghetti system of rail lines. Brunel, a man of vision and many achievements for sure, built his railway to a different gauge to the rest of the country, while neither his vacuum railway nor the Great Eastern succeeded. Vision can lead to mistakes as well as successes.

The reality is that the Foster proposal is an engineering and architecture led solution to a problem that is human. Airports are not about fancy buildings or high speed train lines to a handful of places. They are much more prosaic. They are about getting people from A to B quickly, while limiting disturbance to others. Nothing more and nothing less. The plans for an airport at Cliffe – like Maplin, Whitstable and other estuary plans – fail on this criterion.

14

Airports, Aviation and Global Warming

Airports

It is straight forward to make an airport environmentally friendly. Airports have large roof areas which are usually unobstructed. As such, and given the fall in the price of solar panels, we can cover every part of every roof with solar panels. It should be possible to use much of the ground area for solar panels as well. For example, all airports have a strip around the edge, typically around 100m in width, between the runway and the perimeter fence. We should explore using this area, as well as some areas between taxi ways and runways, for solar panels. East Midlands airport has even shown – somewhat surprisingly – that it is possible to include wind turbines at an airport.²³⁶

“The need to combat global warming is real. The European Union therefore needs to make the ETS work, or replace it with a system that does”

It should not be difficult to make sure that an airport is a net generator of electricity.

Airports are also perfect locations for ground source heat pumps. These can either be vertical – where heat is drawn from say 100m down, or horizontal, where a larger area is used, but the pipes descend only a metre or two below the service. Both are suitable for use in airport areas. These are extremely efficient ways to heat and cool buildings, particularly if the pumps are solar powered.

It is straightforward for airport to harvest rainwater from roofs and other vertical services for non-potable use such as industrial cleaning, and toilet flushing, and to provide a full range of recycling facilities.

We have also mentioned that airports are well-suited to electric vehicles, given that daily distances are low, top speeds limited, and rapid three phase recharging straightforward to incorporate. In addition, we suggested that towing aeroplanes, rather than having them use their jet engines to taxi around the airport would be a useful step forward.

Aviation

There is good news and bad news about aviation and the environment. The good news is that those who buy planes really care about reducing fuel usage, and as a result those who design planes design them to be as efficient as possible. This is in marked contrast to car buyers, who often buy less efficient cars because they like the look, or style, of the car. Fuel makes up about a third of all airline costs, although obviously this figure changes with the oil price. Operating a more fuel

236 <http://www.eastmidlandsairport.com/emaweb.nsf/Content/Greenappleawardpressrelease>

efficient plane offers a major competitive advantage, which is why airlines like to run fuel efficient planes.²³⁷ The result is that each generation of planes really are about as fuel efficient as engineers can make them, and that the next generation will be more efficient still.

The bad news is that despite all this, planes use a lot of fuel. For sure, delta-wing designs and other very radical high-lift concepts might be able to reduce fuel use further. Equally, biofuels may provide part of the answer.²³⁸ But the fundamental fact remains: it takes a lot of energy to travel thousands of miles, quickly. That is, ultimately, an immutable law of physics.²³⁹ Improvements to energy consumption per seat mile or per passenger mile will continue to be made. But those improvements will be incremental, rather than transformational. Furthermore, plane designs last a long time, so the lag between generation changes is long. The most optimistic projections of emissions suggest little gain in the next decade, with greater but more speculative gains from 2025–50.²⁴⁰

With the exception of spending money on fossil fuels directly, flying is likely to remain about the most environmentally destructive thing that you can do with your money. There are two ways of approaching this undeniable fact. The first is to throw your hands up in horror, and say that flying must, therefore, be curtailed, reduced, or even eliminated.

A better approach would be set an overall carbon budget for the economy, and then allocate it to the uses that offer the highest social value of carbon. This, in essence, is what the European Emissions Trading Scheme is designed to do. It is extremely welcome that aviation is now part of that scheme.²⁴¹ This means that if aviation wishes to increase the number of planes that fly then the industry will have to buy more carbon from other industries. There will be no net increase in carbon emissions. The problem is – apparently – solved. Yet the word “apparently” is appropriate. The ETS has not worked particularly well. The carbon price is very low, and the system seems awash with credits.

The need to combat global warming is real. The European Union therefore needs to make the ETS work, or replace it with a system that does. Frankly, if it fails to do so, then whether the UK allows another two runways to be built will be an irrelevance. Rather like local pollution at Heathrow, therefore, the best solution is to sort out the wider issue.

In that context aviation can expand. The government’s Committee on Climate Change has said that aviation can expand by 60% to 2050. The CAA report that 2011 saw around 2.2m passenger movements at UK airports.²⁴² A 60% rise means a further 1.3m movements are permissible – far above the additional 370,000 slots that we are providing here. Indeed, if this is the only expansion of runways in the South East, then the South East will take less than its “fair share” of the climate permissible rise in flights.²⁴³

Increasing aviation emissions in this way would make aviation a quarter of Britain’s 2050 CO₂ emissions, which would themselves be 80% lower than those that prevailed in 1990. There is nothing intrinsically wrong with aviation taking up 25% of total CO₂ emissions by that date. It is relatively straightforward to decarbonise electricity production, and even space heating. A combination of renewables, energy from waste and nuclear can all generate zero carbon, or very low carbon energy. Clearly this has to be done at an appropriate cost, but the cost of some forms of renewable energy have fallen significantly relative to fossil fuel

237 John Sutton’s book, *Technology and Market Structure* shows the importance of this in the context of the battle for market share between the Boeing 747, Lockheed Martin L-1011 TriStar and McDonnell Douglas DC-10.

238 Virgin, Continental and Air New Zealand have all successfully used conventional and biofuel mixes in tests. http://www.biofuelwatch.org.uk/docs/aviation_biofuels_article.pdf

239 When writing this paper a member of parliament told me that thorium nuclear powered aeroplanes were the answer to this issue.

240 <http://www.sustainableaviation.co.uk/wp-content/uploads/SA-CO2-Road-Map-full-report-280212.pdf>

241 http://www.decc.gov.uk/en/content/cms/emissions/eu_ets/aviation/aviation.aspx

242 http://www.caa.co.uk/default.aspx?catid=80&pagetype=88&sglid=3&fild=2011Annual_table_02/1.

243 370,000 represents a 37% rise in departures from all London airports.

costs recently. Broadly speaking it is easy to decarbonise any static energy use, and rather harder to decarbonise mobile energy use. This is because fossil fuels have a very high energy to weight ratio, making them well suited to applications that require energy on the move. For this reason it is not inconceivable to imagine a future in which fossil fuels are used only for travel. Even then, small scale hybrids cars and buses can offer short distance carbon free travel. In this context we may be able to see aviation take a larger share of the smaller carbon budget.

There are two points to grasp. We have a choice as to how we “spend” our carbon allocation. We can live in poorly insulated houses, have high fuel bills for heating, and not be able to fly. Or we can live in well insulated houses, have fuel bills for heating, and have the money and carbon allocation to see the world. Both scenarios have the same implication for global warming, but the latter seems a lot more appealing as a way to live. The world is an interesting place that is worth exploring. Using our carbon allowance to facilitate that seems more sensible than to use it wastefully, heating houses that could be insulated, or supplied with decarbonised energy.

Flying is bad for the environment, and although it will improve it will remain bad for the environment. Yet work is underway to allow us to continue to fly, without being environmentally irresponsible. Aviation is part of the ETS, and the government should push hard for that scheme to become more effective. Planes are becoming more efficient, and a rising oil price and inclusion in schemes like the ETS will create greater incentives to move further, faster in this direction. It is possible to decarbonise all static power uses, freeing up carbon that can be used for travel. Taking these together, the Committee on Climate Change has said that it is reasonable for aviation to increase by 60%. Total UK aviation growth may need to be controlled, but refusing to build additional runway capacity in the South East – as opposed to say auctioning carbon use economy wide – would be a socially sub-optimal approach to necessary environmental protection.

Conclusions

This report has shown that it is possible to devise new, innovative and effective solutions to the problem of aviation capacity in the South East. Britain can and should expand capacity. Doing so will support our economy, and is compatible with our domestic and international environmental commitments.

The best approach would be to build a new four runway Heathrow, immediately west of the current site. These new runways would replace the existing runways. This would be straightforward to construct, and relatively low cost by the standards of hub airports. A combination of tightening permitted noise classes, ending night flights and landing narrow bodied planes more steeply makes it almost certain that this airport would be significantly quieter than the existing airport, despite catering for almost twice as many flights. Leaving the airport where it is works for air traffic control. It also works for the wider economy: companies that have located near to the airport because they need to be near the airport do not have to move. The design of airport proposed here would be operationally efficient for both passengers and airlines, and would be the world's best hub.

If for any reason Heathrow cannot be expanded, the next best location is near to the current Luton airport. This airport is on the right side of London for the rest of the country, and can easily be linked with high quality connections to London, the M1, the West Coast mainline and the East Coast Mainline. There are disadvantages: the site is relatively hilly, and Stansted would have to close. In addition, business and individuals that have located near Heathrow for access to the airport would need to relocate. For those reasons Luton is second best, but deserves to be considered.

There is no rationale for trying to make either Stansted or Gatwick into Britain's major hub. Both should be treated as commercial airports, whose primary function is to service point to point leisure traffic. They may grow or decline, according to the commercial acumen of those who operate them.

There is no need for Britain to accept second best. We can build an effective and cost-efficient hub that works for passengers, airlines and people who live in and around it. This report has set out how to do just that.



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