

THAMES **HUB** AIRPORT

Outline proposal to the Airports Commission

July 2013

Contents	1
Introduction	3
Executive Summary	4
1. Strategic Fit	6
2. Surface Access	10
3. Environmental Impact	16
4. Economic Impacts	23
5. Global Connectivity	27
6. People	29
7. Costs and Funding	32
8. Operational Viability	36
9. Delivery	38
Contacts	40



Figure 1: Aerial view of Thames Hub Airport and London showing surface access by rail and road.

This document is a response to the Airports Commission's request for outline proposals to provide additional airport capacity in the longer term. It sets out the case for the Commission to shortlist the Thames Hub Airport for further study in its Interim Report in December 2013, and it has been structured around the Sift Criteria issued in May.

This document outlines a proposal to provide the hub airport capacity that Britain urgently needs. But it does not resort to short-term, 'sticking plaster' solutions. It is a realistic and flexible long-term plan, which can support future growth, without subjecting millions of people to aircraft noise and pollution. The Isle of Grain site is easily accessible from Central London, the rest of the UK and Europe – for example, it could be reached in approximately 26 minutes from St Pancras by utilising spare capacity on High Speed 1.

Expanding an existing airport is not the easy solution – it is fraught with constraints, compromises and hidden costs. The price of a new four-runway hub airport at Grain is £24 billion – less than two new runways at Heathrow. There is now a viable private funding model, which shows that the new hub airport can pay for itself within a decade of opening. Britain has the expertise – we have built the largest, most successful airports in the world in Asia, where the initiative to act on aviation capacity has been seized. Our experience in Beijing and Hong Kong demonstrates how the best of British innovation, design and engineering can be placed in the service of a national economic strategy. This is an opportunity to apply these skills to create a model of excellence, which can reassert Britain as an international trading centre and secure jobs and prosperity for future generations.

The Thames Hub Airport is a bold and realistic proposal to secure a global economic advantage for Britain. Recognising that investment in aviation capacity will have a transformative effect on trade and the economy, the new hub airport will reinforce Britain's position as one of the world's primary aviation centres, alongside China and the USA.

Aviation is a globally competitive industry, and Britain cannot dictate how airlines configure their routes or where they base their operations. Creating an aviation strategy to benefit the economy and UK passengers is about attracting airlines, and enabling competition – something only possible at a single hub.

The four runway Thames Hub Airport can open with capacity for 110 million passengers per year, and has the flexibility to grow to 150 million passengers per year and beyond. The site is the sparsely populated Isle of Grain on the Hoo Peninsula in Kent, where a new airport will not require a major standalone investment in surface access. This location capitalises on the eastward thrust of London's development and existing investments in high-speed rail.

Aircraft can approach the airport over water, relieving five million Londoners of the noise, pollution and dangers of flight paths over the capital. Unlike Heathrow, the airport can operate 24-hours a day. The Thames Hub Airport is also strategically located close to the South East's major ports to enable the successful economic integration of rail, sea and air freight.

The airport has a viable private funding model and the planning process would be identical to a third runway at Heathrow. Construction of a new airport would take the same time as the latest proposals from Heathrow, fewer homes would be relocated, and without the constraints of an urban site, it would be more cost-effective to build. Heathrow can be redeveloped to create new homes, establishing a prosperous new London borough and a sustainable commercial centre to rival Canary Wharf.

The project has been led by Foster + Partners, with support from a consortium of major organisations, and the team has the interim funding in place to carry out further studies, as required by the Airports Commission.

STRATEGIC FIT

The Thames Hub Airport responds to key policy challenges, including Britain's rising population, the need for sustainable economic growth and the global race for international business. The global economy is becoming increasingly fragmented, as emerging markets challenge the traditional dominance of the USA and Europe. In order to reach 75% of the world's economy, as Britain's air routes currently do, there must be direct access to 55 more cities by the end of this decade.

The noise from Heathrow's flight paths is unsustainable today, and its continued expansion is unthinkable. Operating at capacity has led to a poor experience for passengers and severe lack of resilience. Failure to bring British infrastructure up to the standards of other developed economies could cost the economy £90 billion a year by 2026¹. A new hub airport on the Isle of Grain is the most effective way to increase aviation capacity in the South East, and to unlock the markets that Heathrow is unable to serve.

The proposal includes cargo and airport support facilities, and the location maximises the advantages of its close proximity to major ports in the South East to create an unrivalled distribution network, which reasserts Britain's geographical advantage as the gateway to Europe. The airport is a standalone investment project, which can be integrated with wider strategic infrastructure initiatives for the UK. It can also form part of a coherent infrastructure plan for the Thames Estuary and London's future growth, embracing a new river crossing, future high-speed rail lines, a new Thames Barrier and sustainable energy infrastructure.

SURFACE ACCESS

The Thames Hub Airport can be accessed from Central London in less than 30 minutes via frequent, high-speed rail services. Passengers will be able to take a direct train from St Pancras to the new airport terminal in approximately 26 minutes. By utilising High Speed 1, passengers can reach an Isle of Grain airport from Birmingham or Manchester in less time than it currently takes to get to Heathrow. The proposals maximise the use of existing transport infrastructure – excluding a new 12-mile, high-speed rail connection to the airport site, direct trains from Waterloo, Liverpool Street, Bromley, Reading and the West Coast Main Line can run on the existing rail network. The airport can also be connected to Crossrail.

While the surface access strategy is public transport led, the proposal also includes a new road and improvements to existing roads, and integration with a Lower Thames Crossing in the future. Four park and ride rail stations around London will allow passengers travelling by car to complete their journey to the airport by rail.

ENVIRONMENTAL IMPACT

The greatest environmental benefit of the Thames Hub Airport will be in reducing the pollution, risk and noise caused by aircraft flying over London. A 2013 study found

¹ Civil Engineering Contractors Association (May 2013) Securing our economy: the case for infrastructure

that air pollution from Heathrow could be responsible for 100 premature deaths each year, and many more suffer sleep deprivation and difficulty learning due to aircraft noise. The pace of developing and rolling out quieter aircraft is very slow and steeper landings will be possible for less than 1% of current flights. By contrast, the Isle of Grain is one of the most sparsely populated areas of the South East and the majority of flights will approach over water.

Foreshore wildlife habitats in the Thames Estuary are under threat from rising sea levels, and the project can be a catalyst for the investment needed to create new habitats for migrating birds. The Thames Hub team proposes working closely with the Environment Agency and others to develop mitigating measures for the impact of development on wildlife.

ECONOMIC IMPACTS

The Thames Hub Airport can deliver transformative benefits at national, regional and local levels, as well as for the UK aviation industry, which is valued at £75 billion. National benefits include increased trade, inward investment, tax revenues and tourism. Benefits specific to the location include long-term cost savings and operational flexibility, maximum use of existing infrastructure for surface access, the regeneration of the Thames Gateway and the development of a freight nexus. Answering Amsterdam's claim to be the leading British hub, the airport is also ideally placed to attract passengers from northern Europe by rail.

The new airport will provide a major source of income for the local economy, with local government tax revenues, supply chain multipliers and agglomeration benefits for the surrounding area. The airport will create over 100,000 new jobs, and can improve economic links between the South East and North. In West London, high value jobs at the redeveloped Heathrow site will more than offset short-term job losses, and the timescale of the development will give sufficient time to plan for and manage this transition. The redevelopment of Heathrow can create new homes and a prosperous, sustainable business community to rival Canary Wharf. While the scale of the impact on existing communities must be carefully and sensitively addressed in every option, fewer homes would be demolished to build the airport platform on the Isle of Grain than to build a third and fourth runway at Heathrow.

The Thames Hub Airport can offer passengers choice, convenience and quality, and it can benefit the aviation industry by allowing airlines to grow and serve economically important routes. Paris, Amsterdam and Frankfurt have increased capacities to serve 100 extra routes each in the last twenty years – each now serves an average of 271 routes. In the same period, Heathrow has not just stagnated, but has been forced to reduce routes, from 183 twenty years ago to 170 today. The consequence has been

to limit the UK to a declining share of international aviation – only a new four-runway hub airport can reverse this trend.

The Thames Hub is designed to function as an integral part of a comprehensive strategy for UK aviation. While it plays a vital role in providing necessary hub capacity, its development is not intended to stifle the growth of regional airports, including Gatwick, Birmingham and Stansted, which can all expand over the next 15 years. The new airport will necessitate the closure of Heathrow, but as new capacity is developed, other UK airports, which have acted predominantly as local point-to-point suppliers or feeders into overseas hubs, can also be strengthened. Sustainable growth of regional airports will allow them to maintain their market share once the new transfer capacity comes on line.

COSTS, FUNDING AND DELIVERY

The initial phase of the airport, together with surface access can be built for approximately £24 billion. The key advantage of building a new airport, rather than extending an operational airport, and the advantage of working on an estuary site, with ease of access from both land and sea, is that there are no existing infrastructure constraints. The location is cost-effective and can be rapidly developed. A cost estimate has been developed in tandem with the delivery plan to produce a cashflow of project expenditure, which gives clear guidance as to when equity, debt and government guarantees might be needed.

The airport can be financed by private investment. The funding model ensures that the new airport will be financially sustainable, in terms of meeting private sector capacity and achieving a fair price for passengers using the facilities. The business model is predicated on incremental growth at steady state pricing, which is commensurate with charges today. Using conservative passenger numbers, it pays back within a decade of opening and within an assumed initial provision of 110mppa. It does not fall into the trap of relying on stellar growth, nor does it limit ultimate capacity, as it has the ability to grow in line with demand.

The Thames Hub Airport can open within 16 years. The initial phase of the hub airport can be ready to open by 2029 – the same as a third Heathrow runway, which would be full within a decade of opening. Phased development can take into account evolving passenger demand. The Thames Hub is a large project, but it is a more simple and effective option than the complex expansion of an operational airport. This proposal demonstrates that it is practical, affordable and necessary.

The Thames Hub Airport is a bold and deliverable vision, not just to maintain the UK's global aviation hub status, but to significantly enhance that status. The airport will be a sustainable economic resource, which will reinforce London's position as the world's global city, transform the Thames Gateway and help to secure prosperity for people and businesses across the UK by enabling them to connect and trade with a rapidly changing world. Open in the next decade and privately funded in a way that ensures it is globally competitive, the airport will provide jobs and improve people's quality of life, enhance the natural environment and help to reduce Britain's carbon footprint. This is a vision that must be embraced for the sake of future generations.

1.1 STRATEGIC CONTEXT

This vision for the Thames Hub Airport has been developed within the context of the long-term challenges that the UK needs to address. The population is growing rapidly and is expected to reach 70 million by 2026, with the number of households projected to rise 27% by 2033.^{2,3} Much of that growth will be in the South East, with London expected to accommodate over one million extra people, predominantly to the east of the capital – an area in desperate need of regeneration. To achieve the level of economic growth needed to provide enough jobs, the UK must rebalance its economy, both geographically, in redressing the North-South divide, and by sector, in augmenting its lead in services with growth in high value manufacturing.⁴ To support this rebalancing, there is a need to develop 21st century, high quality and sustainable transport and energy networks across the UK, as part of a wider strategy to decarbonise the economy. As other countries rapidly develop competing hub airports, served increasingly by long range aircraft, they pose a real threat to the UK's global aviation hub status and as a nation we have to properly address the country's long-term aviation requirements.

The Government's Aviation Policy Framework recognises the need for a significant increase in airport capacity, as long as the resultant level of carbon emissions remains within domestic and international climate change targets.⁵ Delivering such an increase in capacity would provide the international connectivity, particularly to fast-growing emerging economies, for passengers and goods that the UK needs over the long term to compete in the global race to facilitate trade, encourage inward investment and secure more jobs.

1.2 EXISTING SITUATION

Heathrow Airport is the UK's only hub airport and for over half a century it has led the development of global aviation outside North America. It has given the UK a competitive advantage that it needs to maintain. The case for more hub capacity has been looked at since the late 1960s, but its provision has been thwarted by the lack of a political consensus. Heathrow is now full and cannot be expanded on the scale required, due to its location, the predominant South Westerly winds and the scale of surrounding urban development, as any expansion would continue to inflict unacceptable levels of aircraft noise on Londoners.

The lack of spare capacity at the airport limits opportunities to connect with emerging economies, as well as having a significant negative impact on the passenger experience. Major delays are routinely built into aircraft arrival and departure schedules, with consequent increases in noise, carbon emissions and pollutants. When incidents occur at the airport, the lack of resilience has serious knock-on impacts for passengers and freight.⁶ The lack of capacity also means that Heathrow has the world's highest airline charges, has less air traffic movements (ATMs) and serves fewer destinations than Paris Charles de Gaulle and Frankfurt.⁷ All are severe restrictions on Britain's ability to compete. UK regional passengers, who already suffer from poor public transport access to Heathrow, have seen reductions in domestic air services to and from Heathrow. As a result, they are increasingly flying to competitor European and Middle Eastern hubs rather than using Heathrow, resulting in longer end-to-end journey times and higher carbon emissions.⁸

² BBC News (2011): UK population 'to increase to 70 million by 2027' <http://www.bbc.co.uk/news/uk-15461579>

³ Communities and Local Government (2010): Household Projections, 2008 to 2033, England https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6395/1780763.pdf

⁴ HM Treasury (2013): Reducing the deficit and rebalancing the economy <https://www.gov.uk/government/policies/reducing-the-deficit-and-rebalancing-the-economy>

⁵ Department for Transport (2013): Aviation Policy Framework https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/153776/aviation-policy-framework.pdf

⁶ Civil Aviation Authority: 2012 Q2 Airport Punctuality Statistics (September 2012)

⁷ The Air Transport Research Society: 'Key Findings of 2011 ATRS Global Airport Performance Benchmarking project' <http://www.atrsworld.org/docs/Key%20Findings%20of%20%202011%20ATRS%20Benchmarking%20Project%20-%202027July2011.pdf>

⁸ Civil Aviation Authority: Aviation Trends 2012 Q2 http://www.caa.co.uk/docs/80/RPG_AviationTrends_Q2_2012v2.pdf
The annual number of passengers flying from Manchester, Birmingham, Glasgow and Newcastle Airports to Middle Eastern hubs (Doha, Dubai and Abu Dhabi) grew from a few thousand in 1996 to two million in 2012.

All of these constraints mean that Heathrow is being overtaken by other European and global hubs in terms of quality of service and international connectivity, particularly to fast-growing emerging markets. It has also become 'London's airport', rather than an asset that benefits the whole country.

1.3 THE NEED FOR MORE UK HUB CAPACITY

Despite the current economic downturn, the Department for Transport predicts that traffic at UK airports will almost double by 2050.⁹ This is a continuation of the historic growth in passenger numbers and is broadly consistent with Boeing's prediction of 5% per annum growth in global air travel over the next 20 years.¹⁰ To accommodate this demand, appropriate capacity expansion is needed at a range of UK airports to offer passengers choice in a network of national airports.

However expansion at point-to-point airports, such as Gatwick and Stansted, will not on its own provide the type of connectivity that the UK needs to maintain its global aviation hub status, and a significant increase in capacity is needed at the UK's hub airport. The reasons for this are the same as those that have resulted in Heathrow losing its international competitiveness. Airline revenues are driven by first and business class passengers, who place a high value on time and frequency of services. An airport with spare capacity allows airlines to provide more frequent services, which raise yields. This in turn enables airlines to develop new services to a much wider range of destinations, including marginal destinations supported by transfer traffic, and at the frequencies required to make them financially sustainable. Hubs benefit both regional airlines and airports because the greater choice of long haul services at the hub airport helps to fill seats on feeder routes that would otherwise not be viable. This network effect, which delivers cost savings for airlines, has meant that hubs have developed an increasingly important role in global aviation networks, with their advantages becoming more pronounced as extra routes are added. As the process of aviation industry consolidation continues, airline alliances will increasingly focus their operations on a smaller number of global super-hubs. The UK economy will suffer if its hub airport has insufficient capacity to become one of those super-hubs.

The nature of airport hub operations, combined with the UK's relatively small size, means that, unlike the US where several hubs are served by three airline networks, the UK can only sustain one hub airport. Dividing the transfer traffic that hubbing depends on would reduce the choice of connections and dilute the transfer

passenger demand that supports routes and frequencies. As Heathrow has filled up with demand for long distance, highly profitable routes, smaller connections to the UK's regional airports have been squeezed out. A lot of this connectivity is now provided by Amsterdam, but as it in turn continues to grow, the same pressures will exert themselves. This will leave smaller cities stranded. A new hub can concentrate this connectivity through mandated access, thereby ensuring that routes are preserved.

A sustainable new hub airport is required that can provide the level of long-term hub capacity and passenger experience that the UK needs to remain competitive. A new hub would mean that Heathrow would have to change the nature of its operations and indeed potentially close as an airport. However this provides an unparalleled opportunity to redevelop the 1,400-hectare site into a major new business and residential centre for West London, potentially alleviating some of London's housing shortage and providing a next generation driver for high value employment growth in West London.



Figure 2: The Isle of Grain is recovered marsh land and one of the most uninhabited areas of the South East.

The UK's new hub airport needs to be located close to London, as over 50% of its current passenger demand comes from Central London. This is by far the country's largest air service market and the only area capable of supporting viable hub operations. At the outset, the Thames Hub team carried out extensive studies as to where new hub capacity could be provided in the crowded South East, using criteria similar to those identified by the Airports Commission. The conclusion is that, given the increasingly crowded nature of the region and scale of land required for a hub airport, the only environmentally and commercially feasible option is to build a new hub airport on the Isle of Grain in Kent, 35 miles from Central London. This is one of the most sparsely populated areas within the South East and the impacts on existing residents and the environment is much less damaging compared to similar levels of development at other locations. In addition the development of a new hub airport in this location would be the catalyst that would finally lead to the regeneration of the whole Thames Gateway corridor.

1.4 SCALE AND NATURE OF AIRPORT

The airport would open with a capacity of 110mppa and

⁹ Department for Transport (2013): UK Aviation Forecasts https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/183931/aviation-forecasts.pdf

¹⁰ Boeing: 'Current Market Outlook 2012-2031' <http://www.boeing.com/commercial/cmo/>

annual ATMs of 800,000 and would have the potential to expand to 150mppa plus. A sustainable hourly runway capacity of 140 movements is considered appropriate. The proposed capacity for the airport reflects the government's projection that Heathrow will grow to 81mppa by 2029, and the scale of the future shortfall in UK airport capacity over the next 40 years. Should additional demand require it, additional land can be safeguarded for future expansion.

The translation of this annual passenger capacity into airport facility requirements is largely based on extensive planning work undertaken during the Department for Transport's South East Regional Air Services (SERAS) study, which informed the 2003 Future of Air Transport White Paper.^{11,12} Achievable airport capacity is a function of many variables, including the nature of demand, airspace capacity, and the capabilities of navigational and other systems. Extensive further work would be required to assess these factors and to plan the necessary airport infrastructure in detail.

1.4.1 Location

The airport would be located on a near rectangular shaped platform, 5.2km long, 4.5km wide and 7m above sea level, on the Isle of Grain in North Kent. The height of the platform, which would be built on existing and partly reclaimed land in the Estuary, would provide sufficient protection against storm surges and rising sea levels.

1.4.2 Construction

The construction of the airport platform would use well-established civil engineering technologies, which have been used to build major airports on reclaimed land elsewhere in the world, such as Chek Lap Kok airport in Hong Kong. In Europe, similar reclaimed land techniques have been used extensively in Holland for many decades.

1.4.2 Airfield configuration

The most efficient operating layout for the airport is with four runways. These runways would be aligned in an east-west direction, and arranged in parallel pairs either side of central terminals and satellite concourses. The runway pairs would be separated by at least 2,000 metres and would operate in segregated mode, with one runway of each pair used for landings and the other for departures. To enable this operating mode, the runways in each pair would be approximately 400 metres apart and all four runways would be 4,000 metres long, allowing any runway to accept the largest aircraft at maximum weight. Additional land would be provided at each runway end for safety areas and access taxiways. The taxiway network would be designed to minimise average runway occupancy time and runway

crossings, allowing high runway utilisation rates and maximum flexibility to handle variations in the demand pattern. Taxiways around the ends of the inner runways allow aircraft to taxi to/from the outer runways without requiring interruption to the use of the inner runways. Areas of airport land are provided to accommodate the necessary airport logistics and support facilities that would be required to allow the airport to function. Public safety and development control zones would extend at least 3km off each runway. People would be unable to live or work inside the higher risk zone and there would be no new development and restrictions on new transport infrastructure within the lower risk zone.

1.4.3 Passenger terminal area

The central passenger terminal area occupies a zone at the centre of the airfield. Within this zone there is sufficient area available for different feasible configurations of terminals and aprons to be planned. Up to 300 aircraft parking stands would be needed to handle the anticipated demand, ranging in size up to the current Airbus A380 capability. Extensive analysis of demand, airlines and their alliance affiliations or partnering arrangements would be taken into consideration in the final design and future growth and flexibility would be incorporated for the outset. The evolving nature of the aviation business means that this flexibility is a real advantage.

For operational efficiency, and to allow capacity development to be phased, it is currently envisaged that the core passenger terminal facilities would comprise two adjacent, but separate, passenger processing terminals. Each terminal would be connected to the satellite concourses by high-speed and high-capacity transit systems. Aircraft will use stands at the core terminals and satellite concourses as well as remote parking stands. They would access the runways via cross-link taxiways connecting to dual parallel taxiways alongside each runway pair. A further parallel taxiway would also be provided between the runways in each pair.

1.4.4 Operations

Given the prevailing winds and the airport's location, aircraft would predominantly approach the airport over water. Unlike, for example, Heathrow, where night-time operating restrictions are imposed to reduce exposure of the large surrounding population to aircraft noise, it is envisaged that the location of the Hub Airport would allow 24 hour operations. This would significantly reduce the current noise, air quality and security problems of aircraft over-flying London. About 70% of the landings would be from the east with departures to the west routed to minimise over-flight of densely populated areas.

¹¹ DfT (2003): South East Regional Air Services study <http://tinyurl.com/pmud5hw>

¹² DfT (2003): The future of air transport <http://webarchive.nationalarchives.gov.uk/+/http://www.dft.gov.uk/about/strategy/whitepapers/air/futureofairtransportwhite5694.pdf>

24 hour operation would maximise utilisation of the airport infrastructure, for passenger services and air cargo traffic. Available runway slots during the normal operating day would be fully utilised to meet passenger demand. Although current demand for passenger services during the night is limited, the additional capacity afforded by 24 hour access could allow new night services to grow. It would also significantly strengthen the airport's resilience to incidents. In addition, departure tracks can be designed to minimise over-flight of densely populated areas. This operational capability would provide airlines with maximum scheduling flexibility and would mean the airport would have a significant advantage over rival European hubs which cannot offer night time take-off/landing slots.

1.4.5 Cargo facilities

Cargo operations would require both front-line and supporting infrastructure. On-airport facilities, with direct airside access to aircraft stands, would include general cargo warehousing and sorting buildings, forwarders' facilities and specialist integrators' buildings, plus extensive lorry parking areas. Initial estimates indicate that an airport of this scale would require some 270 hectares of land for cargo operations, although a proportion of this need not be on the landside-airside interface, as long as it is in reasonably close proximity to the airport. The cargo area would be located to the west of the airport. The 24 hour operating capability could increase opportunities for cargo, and wider integration into a logistics hub through rail could aid industries' wider trading capability via air and adjacent ports. Cargo areas of the airport would have direct rail access for cargo trans-shipment. This facility would potentially reduce the amount of goods vehicles generated by the airport.

1.4.6 Airport support areas

Various support facilities are essential to the operation of an airport, and operations on the scale envisaged would require substantial land areas. Primary operational facilities, such as the control tower, fire stations and operations centre would be located within the central terminal zone between the runways. Other functions, such as aircraft fuel storage, waste handling and power generation could be located outside but close to the operational airfield. A major user of land and one requiring direct access to the runways is aircraft maintenance. Assuming that a number of major carriers are likely to base substantial aircraft fleets at the airport, an estimated 300 hectares would be required for maintenance hangars, aprons and supporting facilities.

1.4.7 Airport associated development

The planned growth of London to the East will mean that large residential populations will be established with access to the airports employment market which we anticipate to be around 100,000 direct jobs on site,

with as many off-site jobs. The airport relocation will be planned with the advantage of at least a decade's notice and employers and employees will be able to make decisions about relocating with sufficient time to ensure minimal disruption and cost and maximum advantage from the introduction of new premises and operational infrastructure. To minimise the highway capacity and staff car parking land required, all of the support areas would be linked to the wider transport network by rapid transit systems. Cargo areas would have direct rail access for cargo trans-shipment thereby reducing the demand for high-capacity road access.

As illustrated by the degree of development around Heathrow, an airport of this size would generate a very high demand for employment land. Functions directly involved in airport and aircraft operations would, of necessity, be located on the airport. It has been estimated that about 470 hectares of land would be needed off airport to accommodate indirectly generated employment, and some 270 hectares for induced activity. It is envisaged that a substantial proportion of this land would be provided in an Airport City adjacent to the operational airport site. This zone would share the airport's direct access to the road and rail network, and would be linked to the airport passenger, cargo and maintenance areas by road and transit networks. Mechanisms such as an Enterprise Zone could give early advantages to companies wanting to establish themselves, either through relocation or opportunities for new entrants.

The wider potential for secondary activity would expand across the whole area potentially taking in East London, Essex, Kent and areas of Northern Europe. Air passengers are creating wider economic opportunity through their investment in landing charges and ensuring this secondary value is captured and also contributes to the cost of the airport needs to be planned.

1.4.8 Transfer of hub operations from Heathrow

The proposal assumes that when the Thames Hub Airport opens, the current pattern of air services transfers over from Heathrow. Further work will need to be done to assess the optimum pattern of additional air services that could maximise the use of the additional capacity.

The redeveloped Heathrow site will maintain the access it has to the M4 and M25 motorways. It currently serves as a major bus interchange for West London, and although this would be scaled back, the redeveloped site would still benefit from good access. The site also has tube and rail access to Central London, which will be further enhanced when Crossrail is extended to the current airport.

1.4.9 Timing of new airport

It is envisaged that the airport could be operational by 2029. Chapter 9 sets out the key delivery dates.

The new Thames Hub Airport will be supported by a comprehensive surface access strategy for passengers, workers and other visitors, which includes national and local rail connections, road improvements and local bus and taxi services. A key feature of the Thames Hub Airport is its ability to use existing and planned rail infrastructure to enable a high proportion of air passengers and airport workers to get to and from the airport using public transport.

The incorporation of surface access to and from the airport will be an important component during the planning of new transport capacity and connectivity in South East England. This is true of all existing airports which already rely on overstressed access routes. This will be best achieved through the co-ordinated efforts of a multitude of agencies.

It is important to demonstrate to project investors that the necessary surface access strategy for the new airport's opening can be delivered within the airport's funding and planning timescales. While future surface transport enhancements may go beyond the airport's initial 110mppa capacity to address wider regional growth, all the key transport links needed for the airport's initial opening is provided for in the first phase. In particular a suite of routes is available for Heathrow's existing customers to access the new airport

2.1 RAIL ACCESS

The Thames Hub Airport has been planned such that it can offer direct rail access from a wide range of locations so that access is distributed rather than concentrated onto just one or two routes. As well as benefiting from a high-speed rail service to Central London, the airport can also be reached directly from other locations within Greater London and South East England. Importantly the airport will have direct rail connectivity with towns to the north and west of London to allow established hub airport users easy access.

The rail access strategy has been developed using existing infrastructure where capacity currently exists or can be readily enhanced. Apart from brand new rail connections between the airport to HS1 and Gravesend, only relatively minor enhancements to the existing rail network infrastructure would be required to allow a wide range of passenger train services to and from the airport to operate.

The rail access strategy ensures the airport has a robust network of services available for its opening scenario. Passengers will be able to gain rapid access from and to central and greater London as well as from a wider hub catchment across the UK by high-speed rail. The connectivity of the airport to the Channel Tunnel via HS1 means that passengers from Northern Europe will also be within the airport's catchment.



Figure 3: Rail station below airport terminal.

All rail services to the Thames Hub Airport would arrive at a station located directly below the main passenger terminal building so passengers would not need to use an additional transfer between the railway station and the airport itself. A summary of the range of direct regular train services envisaged to and from this station is set out below:

2.1.1 Passenger services to/from Central London

Four different train services between Central London and the airport are proposed:

1. **High-speed from St Pancras:** A non-stop high-speed train service to the airport is proposed to run from St Pancras International station. These services would use existing spare capacity on the existing HS1 line from St Pancras to the Channel Tunnel. Trains would operate every 15 minutes with journey times of 26 minutes. St Pancras' extensive connectivity with other National Railway services and Underground lines means that it will be a convenient transit station for many passengers.

2. **Limited stop services from Liverpool Street Station:**
Departing every 15 minutes from the City of London terminus, this service would also stop at Stratford International and Ebbsfleet to pick up additional passengers. Also partly using the existing HS1 line, journey times to the airport would be about 35 minutes.
3. **Limited stop services from Waterloo Station:**
Departing every 15 minutes, services would run from Waterloo station to the airport and with a journey time of about 40 minutes. They would also stop at Bromley and Swanley Parkway to pick up additional passengers. Waterloo will be convenient for many travellers starting or finishing their journey in the West End of London or in the South West suburbs of London.
4. **Crossrail:** A high capacity stopping service to the airport can be provided by an extension of the Abbey Wood Branch of the planned Crossrail network to the airport. This would provide direct services to the airport from the West End, City and Canary Wharf. Up to 8 Crossrail services an hour could be envisaged to serve the airport. The proposed Crossrail route to Gravesend has already been safeguarded by the Department of Transport.

2.1.2 Passenger services from Greater London and South East England

A benefit of the Thames Hub Airport for passengers within South East England is that it allows them to reach the airport by frequent direct services from stations outside of central London using the connectivity of existing rail infrastructure within Greater London. The following stations would be expected to benefit from regular direct train services to the airport: Bromley, Watford, Wembley, Ealing, Stratford, and Ebbsfleet. This accessibility to the airport, avoiding the need to travel via Central London, will offer greater convenience to many who live outside London's inner suburbs.

Outside Greater London the following towns would also be expected to have regular direct services to the airport: Maidenhead, Reading, Hemel Hempstead and Milton Keynes. Journey times from Reading to the airport would be about 60 minutes and from Milton Keynes about 75 minutes.

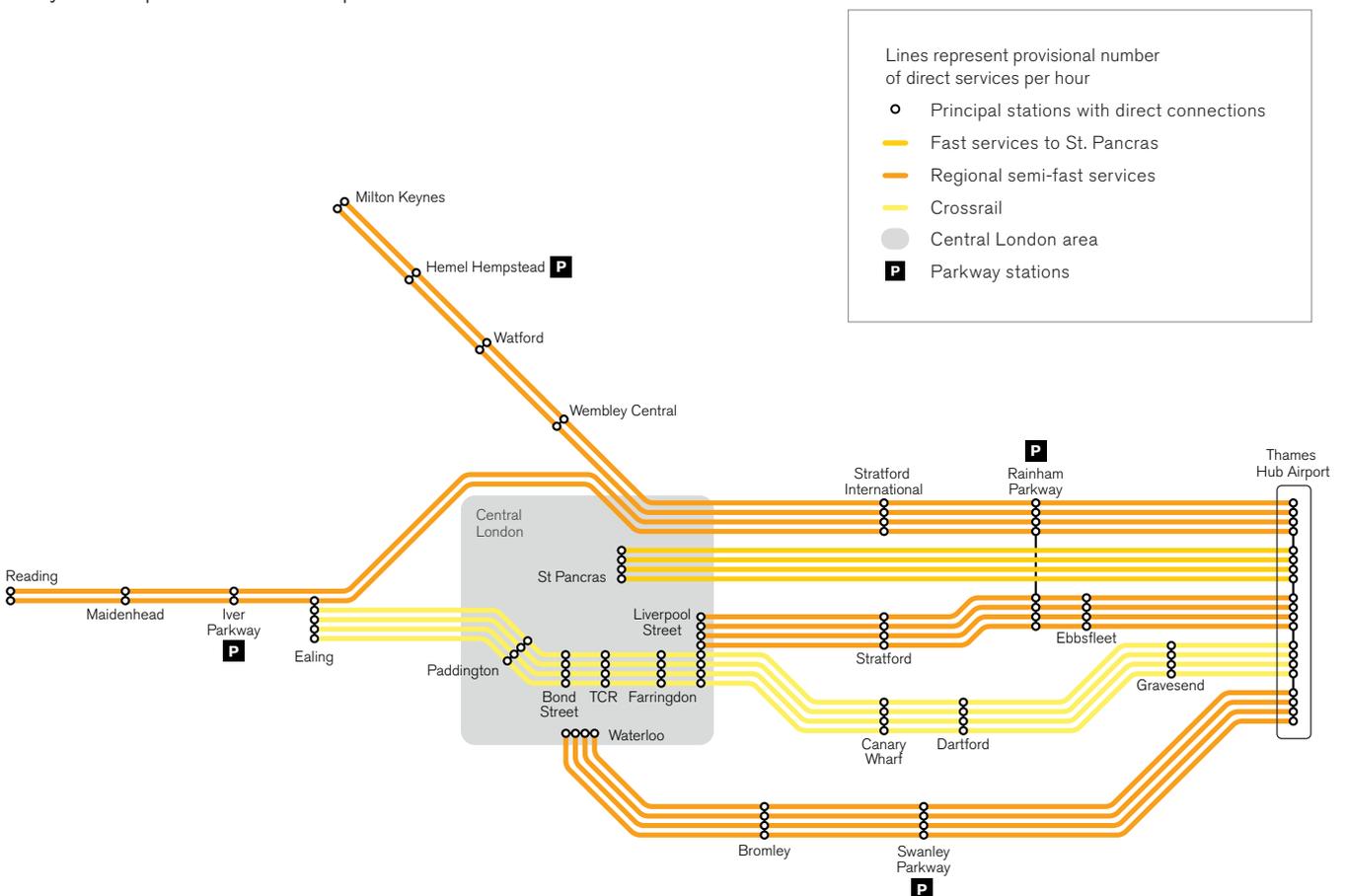


Figure 4: Typical direct rail services from London and the South East.

Direct train services to the airport from the M4 corridor, including Reading and Slough to the Thames Hub Airport will use existing rail infrastructure routes connecting the Great Western Main Line to HS1 north via Willesden Junction and Camden. Willesden Junction would require some remodelling to allow trains to cross services out of Euston.

2.1.3 Passenger services from the Midlands and the North

It is important that the airport is readily accessible by rail from the Midlands and the North of England. The surface access strategy allows for direct train services to the airport from cities such as Birmingham, Manchester and Leeds. Ultimately each of these cities would be expected to have hourly services to the airport using HS2. With HS2, direct journey times to the Thames Hub airport compared with typical existing end to end journey times to Heathrow Terminal 5 would be as follows:

	Existing to London Heathrow T5	To Thames Hub Airport via HSR
Birmingham	160 minutes (2 changes)	90 minutes (direct)
Manchester	200 minutes (2 changes)	110 minutes (direct)
Leeds	210 minutes (2 changes)	125 minutes (direct)

Figure 5: Rail connectivity: journey times

For passengers in the Midlands the proposed Birmingham Interchange station on HS2 would also provide an effective Parkway station for passengers to reach the airport who start their journey from home by car. Up to three direct trains an hour to the airport could serve this station with journey times of approx 80 minutes.

Whilst HS2 would clearly be beneficial for reducing journey times to the airport, direct rail services to the airport from the Midlands and North do not depend on the delivery of HS2, as train services to the airport can still access HS1 using existing rail network connections within London that avoid the need to change trains within Central London.



Figure 6: UK intercity and European rail connectivity

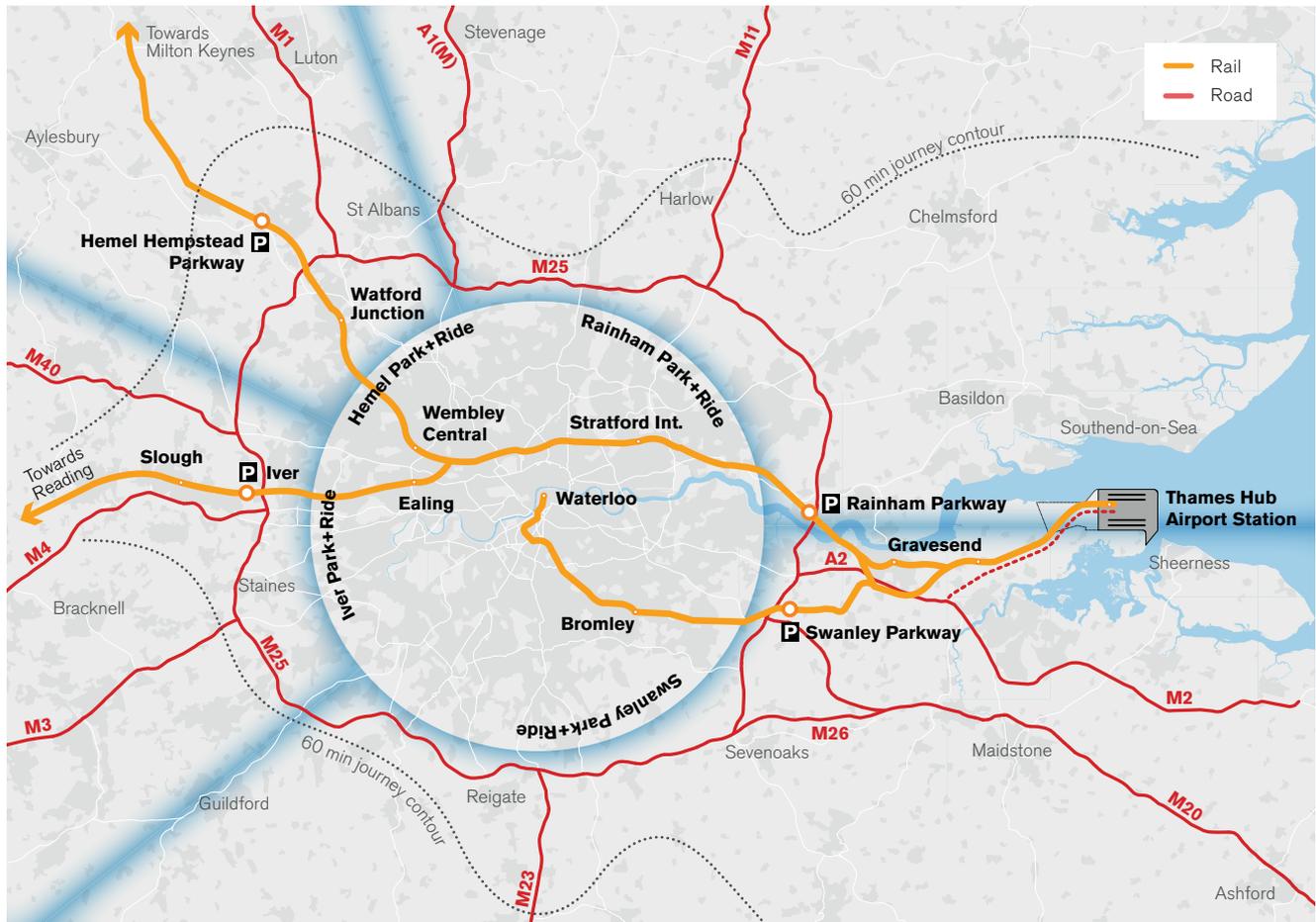


Figure 7: Parkway/journey time catchment and surface connectivity.

2.1.4 Rail access to/from Northern Europe

As well as having excellent rail connectivity to the main population centres within the UK, the Thames Hub Airport could also offer direct rail services to some of the major cities of Northern Europe via HS1 and the Channel Tunnel. Thus cities such as Lille, Brussels, Paris, Amsterdam and Cologne can be brought into the catchment area of the new airport.

2.1.5 Integration with a future high-speed rail network around London.

The Thames Hub Airport plans have been carefully considered within the context of other possible rail infrastructure that could be needed to meet future growth of rail demand with the South East of England. In particular, a future high-speed rail around the north of London would relieve the capital's existing rail network and improve rail capacity between the Channel Tunnel and the UK beyond London. The new airport would then be located on the primary rail line between the North, the Midlands, Kent and Northern Europe (via the Channel Tunnel). Access to the airport would also benefit from wider improvements made to London's suburban rail network.

Assumptions

In estimating the number of rail services required to serve the airport the following assumptions have been made:

- At least 38% of air passengers will be interlining (the same percentage as at Heathrow today) and will not leave the airport;
- 60% of departing and arriving air passengers will use rail for at least the last, or first, leg of their journey;
- 60% of the 100,000 employees at the airport will use rail to get to the airport;
- An employee annualisation factor of 230 and a 15% peak period factor;
- The number of 'meeters and greeters' using rail equates to 10% of the air passenger rail demand;
- Other rail passenger demand to and from the airport equates to 1% of the air passenger rail demand;
- Although the airport can operate 24 hours a day, high frequency rail services to the airport will be initially be provided for 18 hours a day. Between 11pm and 5am an hourly service to Central London would be envisaged.
- The average train load over this period is 300 passengers.

When the airport opens, these assumptions result in a total rail demand from people travelling to and from the airport of 60 million journeys per year, or 165,000 rail passengers per day. This equates to 15 direct services per hour in each direction. As passenger numbers at the airport expand, the number of direct rail services could be expanded to 20 direct trains per hour in each direction.

2.2 ROAD ACCESS

As with most airports, adequate road access to the Thames Hub Airport will be crucial to the airport's success. The airport proposal has been considered within the context of the existing road network serving its location and also proposed future enhancements in the area which are already being considered by the Department for Transport in particular the proposed new Lower Thames Crossing. A description of the anticipated additions and improvements to the local highway network is set out below.

2.2.1 New airport road access from M2/A2

A new highway link serving the Thames Hub Airport is proposed that connects with the A2/M2 junction 1 interchange. This new road would be a dual 3 lane all-purpose road (D3AP) that would act as a bypass to the existing A289 and A228 which would continue as local distributor roads servicing Strood, Wainscott and the Medway Tunnel to Gillingham. Junction 1 of the M2 would be remodelled to provide direct slip roads onto the new highway serving the airport.

2.2.2 New Lower Thames Crossing

The Department for Transport already has plans for a new Lower Thames Crossing to address highway network congestion issues in the area. Such a new crossing can become an important part of the road access strategy for the Thames Hub Airport.

Option C of the new crossing options being considered could connect part of the airport road access strategy. This option would connect the M2 with the A13 and the M25 between junctions 29 and 30. It is proposed that an additional branch of this new road would connect to the proposed new direct highway from the M2 to the Thames Hub Airport to facilitate road access from North of the River Thames.

2.2.3 Other improvements to local strategic highway

A range of enhancements would be needed to the existing A2/M2 and M20 corridors to deal with increased traffic levels due to the new airport. In many cases Active Traffic Management (ATM) measures could be used to improve capacity, however it is likely that some existing motorway junctions would need to be remodelled. The A229 link between the M20 and M2 would also need to be upgraded. It is likely that many of the improvements required to the A2/M2 and M20 corridors for the airport would be needed as part of the new Lower Thames Crossing proposal.

2.2.4 Passenger services from Parkway stations

Many travellers starting their journeys in outer London and the home counties will prefer to use private car from their homes. New Parkway stations at Iver, Hemel Hempstead, Swanley and Rainham are designed to attract these travellers to transfer onto rail for the final leg of their journey to the airport. These Parkway stations will have easy access from the motorway network, ample parking and could include check-in facilities. These Parkway stations will be readily accessible for drivers using the M4, M1, M40 and M25.

The combined journey time for all journeys to the airport, starting by car within the M25 and along the M4 corridor towards Reading and using the Iver Parkway station on the Great Western Line, will be no more than 60 minutes.

2.2.5 Car parking at the airport

Although the airport will have good road access, it is envisaged that the provision of on-airport car parking would be proportionately less than for most major airports as a large proportion of final journeys to the airport will be expected to be by train, including those from the proposed Parkway stations at Iver, Swanley and Rainham. Notwithstanding, large short and long-stay parking areas would be provided, together with staff and hire-car parking. It is estimated that approximately 20 hectares of short-term parking would be needed, plus about 200 hectares of long-stay, business, staff and hire car parking space. Space for such parking areas is allowed for in the Thames Hub Airport plan.

A proactive parking management strategy would be needed to encourage high levels of public transport usage to the airport. This will need to include a restrictive parking regime at the airport itself.

2.2.6 Coach and bus services to the airport

Whilst rail is expected to play a dominant part in providing public access to the new airport, buses and coaches will also contribute significantly, especially at a local level. Developing a robust new local public bus network strategy will be a crucial factor in supporting the operation of the airport. A new bus network would also significantly enhance overall public transport connectivity in North Kent. Whilst this strategy would be aimed mainly at encouraging airport workers to use public transport, it would also serve the needs of passengers who live relatively close to the airport.

For some areas less well served by rail it may be appropriate to introduce direct bus services to the airport. Such towns could include Maidstone and Sittingbourne.

In the wider area, new developments will emerge to serve the needs of the airport and these areas will also need good public transport access to the airport which is likely to be predominantly bus-based.

2.2.7 Airport surface access for freight distribution

Freight logistics plays an important role in aviation and the planning of airports. The good connectivity of the Thames Hub Airport to the existing rail and road networks means that opportunities will exist to exploit these as part of an evolving rail freight logistics strategy within the Thames Estuary. With the proposed rail connection to HS1 and road access to the M20, the new Thames Hub Airport can be used as a freight hub to serve Northern Europe for high value goods with a 'just-in-time' delivery strategy.

With the new London Gateway port already due to open soon on the Essex side of the Thames Estuary with established rail connections the opportunities exists to use the rail connectivity of the airport to enhance the Thames Estuary as a national Freight Logistics Hub.

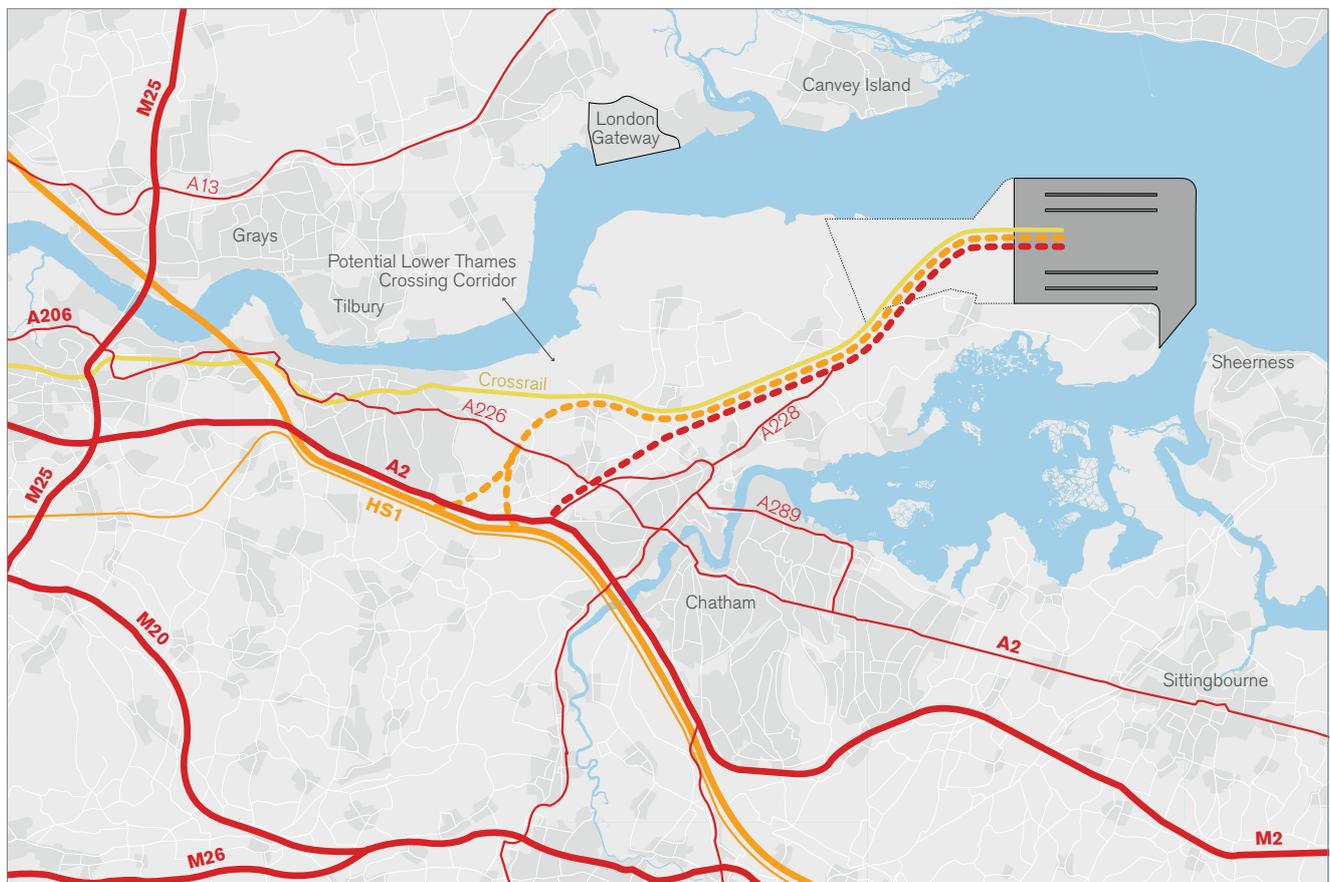


Figure 8: Surface access to the Thames Hub Airport.

- Existing high-speed rail
- - - Proposed high-speed rail
- Existing rail
- - - Crossrail
- Existing major road
- - - Proposed road
- Existing road

The Thames Hub Airport and redevelopment of Heathrow offer the potential to deliver significant environmental benefits. With most flights approaching the new airport over water, nearly three quarters of a million Londoners would experience significant noise relief and the lives of 100 people per year, who die prematurely from air pollution due to aircraft at Heathrow, would be saved. The scale of funding provided for the new airport would support a major environmental management programme, which would mitigate impacts and include compensatory measures for habitats that are lost.

The proposal for the Thames Hub Airport and the redevelopment of Heathrow offers enormous economic benefits for the country (as explained in Chapter 4). Securing these economic benefits will result in a range of environmental impacts on attributes such as noise, air quality, climate change, ecology, cultural heritage assets and water.

Some of these impacts, such as noise relief and reductions in air pollution due to the redevelopment of Heathrow, will significantly improve the quality of life and health of hundreds of thousands of people. Other impacts, such as impacts on wildlife and the loss of habitats on the Isle of Grain, will need to be properly addressed and a long-term programme of environmental management and mitigation measures put in place. This is all achievable and is a key component of the proposals for the Thames Hub Airport.

However in assessing these impacts it is important to recognise that, in the absence of the Thames Hub Airport, many of these environmental losses are already happening now and will continue to occur in future due to rising sea levels, storm surges and coastal erosion. Further, the level of government funding that is available to address these issues, now and in future, is likely to be limited, given the need to address other issues.

The scale of the Thames Hub Airport and the level of funding that it will bring will enable a comprehensive environmental management strategy to be developed for the Isle of Grain. This will provide a level of investment that will not only mitigate and provide compensatory habitats due to the impact of Thames Hub Airport, but it will also provide opportunities to improve the remaining natural environment and preserve the setting and features of the man-made heritage assets by record and within the design of the airport.

This chapter sets out, for each of the key environmental attributes, the policy context in which each attribute should be considered, the existing environmental situation for that attribute at Heathrow (because it is the UK's current hub airport) and at the Thames Hub Airport site and the likely impacts at these two sites.

3.1 NOISE

3.1.1 Policy context

DEFRA's Noise Policy Statement for England (NPSE) sets out the Government's vision to use effective management of noise, including that from aircraft, roads and rail, to promote good health and a good quality of life.¹³ Major new developments, such as a new airport, or the expansion of an existing airport, need to prove that they can be developed and work within this vision. This view is consistent with the principals contained within DfT's Aviation Policy Framework.

3.1.2 Existing situation

Heathrow's location to the west of London and the predominant south westerly winds mean that most aircraft approach the airport by flying over Central London. As a result aircraft noise is a major environmental problem that occurs day after day for people in West London, but which has significant economic and social costs, such as lost productivity, due to sleep disturbance and disruption to work and learning, anxiety and stress.

Transport for London (TfL) has recently updated the CAA's 2006 analysis, which was recently provided to the Airports Commission, about the number of people impacted by aircraft noise at Heathrow taking account of DfT's forecasts of the future aircraft fleet mix. This shows that there were 280,000 people living within the 57dB Lden noise contour and 756,000 living within the 55dB Lden noise contour around Heathrow.^{14,15} This could rise to a significant level under expanded flightpaths. In total aircraft noise at Heathrow negatively impacts approximately five million people who live under the airport's flight paths. According to the CAA, 28% of people in Europe who suffer from aviation noise live around Heathrow.¹⁶

The scale of this noise impact, combined with the amount of urban development around Heathrow, is the reason why the number of runways at the airport has not been increased in the past and why it cannot operate 24 hours a day or be expanded in future. Operational changes, such as mixed mode, have been considered. However this would provide only limited capacity expansion and

¹³ DEFRA (2010): Noise Policy Statement for England (NPSE) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf

¹⁴ CAA (2007): 'London Heathrow Airport Strategic Noise Maps 2006', ECRD Report 0706

¹⁵ Transport for London (2013): Unpublished advice provided to Foster + Partners

¹⁶ CAA (2011): CAA Insight Note 2, Aviation Policy for the Environment http://www.caa.co.uk/docs/589/CAA_InsightNote2_Aviation_Policy_For_The_Environment.pdf

would remove the current respite that local communities around the airport receive. As a result mixed mode is opposed by the airport's operator.

The Isle of Grain and wider Hoo Peninsula are quiet and sparsely populated, and currently experience little aircraft noise.

3.1.3 Impacts of proposal

The UK can only support one hub airport and the development of the Thames Hub Airport would require the closure of Heathrow. This would result in the complete eradication of aircraft noise and a significant improvement in the quality of life for local communities around Heathrow and for over three quarters of a million people who currently live within the 55dB noise contour across wide areas of London.

The new airport is bounded on two sides by water and urban development around the site can be managed in order to minimise human exposure to noise from aircraft and ground operations. However it would significantly increase the level of aircraft noise for some communities on the Hoo Peninsula. A small number of people currently living and working close to the Thames Hub Airport site, whose properties are not compulsorily purchased, will experience high levels of aircraft noise for the first time. In updating the CAA's 2006 analysis, TfL has estimated that just 31,000 people who live around the Thames Hub Airport site would fall within the 55dB noise contour. However, this impact needs to be considered against the scale of noise relief that would result due to the closure of Heathrow. It also takes account of the fact that the Thames Hub Airport would have the potential for night flights. The noise mitigation needs of these people will need careful consideration in the development of the Thames Hub Airport. Such mitigation measures would be from within the design of the Thames Hub Airport and from local measures.

In addition to TfL's noise analysis, we have reviewed detailed noise modelling assessments, carried out as part of the Government's South East Regional Air Services (SERAS) study, which informed the 2003 Future of Air Transport White Paper.^{17, 18} This considered how noise levels at various airport options, including Heathrow and the proposed Cliffe Marshes Airport in Kent, would change over the period to 2030. The noise contours used in that analysis, which measured daytime noise using the dBA Leq noise scale over a 16 hour period, showed significantly fewer people would be exposed to noise at Cliffe than at Heathrow. We have adapted this analysis and approximated noise levels at the Thames Hub Airport by superimposing the 2030

noise contours from the four-runway Cliffe Marshes option onto the Thames Hub site. The noise contours reflect the aircraft types, number of flights, operating conditions and flight paths for 2030 assumed in the SERAS study.

The contours largely cover areas of water and there is scope for the noise impacts of the Thames Hub Airport to be reduced even further by ensuring that flight paths are directed away from heavily populated areas. Given that the superimposed noise contours for the Thames Hub were based upon those from Cliffe Marshes, this has led to instances of aircraft appearing to take off directly over densely populated areas. When projected noise contours are produced for the Thames Hub Airport, it is anticipated that flight paths would be directed away from the most heavily populated areas and that the population affected will be further reduced. An airport further from heavily populated areas will also allow improvements in aircraft design to be fully utilised to further reduce noise levels. Modern aircraft can descend far more steeply than older aircraft, but it is not often possible to use this technology at Heathrow. The Thames Hub Airport and traffic control procedures can be designed to take advantage of these changes in technology.

The movement of aircraft at night would need to be very carefully monitored to minimise disturbance for local communities. A comparison of potential nighttime noise impacts, using the 90 dB(A) sound exposure level (SEL) as a measure of peak noise level that will cause sleep disturbance, from SERAS has shown that, compared with Heathrow, the numbers affected by night time noise at Cliffe Marshes in 2030 are considerably smaller. This demonstrates that a lack of noise constraints around the Thames Hub Airport would enable it to operate and generate economic and financial benefits for the UK economy 24 hours a day, something that land locked airports can never provide.

Further work is needed to assess the impact of changes in surface access noise from rail connections and upgraded road links at Heathrow and the Thames Hub Airport. At Heathrow, where 60% of passengers arrive at the airport by private transport, there will be reductions in vehicle movements by air passengers.¹⁹

There is also scope for further reductions in noise from airport workers and other visitors if the redeveloped commercial and residential centre on the Heathrow site prioritises and encourages the use of public transport.

¹⁷ DfT (2003): South East Regional Air Services study <http://tinyurl.com/pmud5hw>

¹⁸ DfT (2003): The future of air transport <http://webarchive.nationalarchives.gov.uk/+/http://www.dft.gov.uk/about/strategy/whitepapers/air/futureofairtransportwhite5694.pdf>

¹⁹ Greater London Authority Environment Committee – Air Quality and Noise Pollution Around Heathrow Airport Surface Access Issues – informal meeting, 6th December 2011

The area around the Thames Hub Airport is sparsely populated. However it will be important to assess the extent to which the noise climate within the immediate environment, and potentially beyond, will be changed by the introduction of new sources of surface access noise and how these can be managed and mitigated. During the design of additional road and rail infrastructure to serve the airport, careful consideration will need to be given to the inclusion of mitigation measures, such as barriers, bunds, cuttings or the use of tunnels. Where any changes would involve the widening of existing routes, there are opportunities to include mitigation measures to offset higher noise levels due to increases in traffic.

Overall the estuarial location of the Thames Hub Airport, as a replacement for Heathrow, has the potential to significantly reduce the overall number of people affected by aircraft noise in the South East.

3.2 AIR QUALITY

3.2.1 Policy context

Good air quality is important for the environment and human health and the proposal for the Thames Hub Airport would materially improve the health of huge numbers of Londoners and, over time, enable thousands of people to avoid premature death due to poor air quality associated with Heathrow Airport.

The air pollutants of most concern in the UK are Nitrogen Dioxide (NO₂) and Particulate Matter smaller than 10 micrometres in diameter (PM₁₀). Local authorities in England are required to achieve compliance with air quality objectives (AQO's) for these pollutants as part of the Air Quality Standard Regulations 2010. The UK is also required to achieve compliance with air quality limit values specified under EU Directives. Greater London currently fails to comply with the limit values for NO₂ and PM₁₀, and is not expected to achieve compliance for NO₂ until at least 2025.

3.2.2 Existing situation

Emissions from aircraft and road traffic associated with Heathrow Airport are partly responsible for London's poor air quality. Compliance with the EU's limit values is a constraint to development at Heathrow. NO₂ concentrations at the airport, which lies within an Air Quality Management Area (AQMA) for NO₂ declared by Hillingdon Council, exceeded the annual mean NO₂ objective by over 25% during the period 2008 to 2010. Research used pollution roses and data filtering techniques to quantify the contribution of aircraft emissions to NO_x concentrations monitored at seven sites close to Heathrow airport. It found that at the airport boundary 28% (or 34 µg/m³) of NO_x was associated with airport operations, falling to 15% (or 10 µg/m³) at 2 to 3 km downwind.²⁰

3.2.3 Impact of proposal

Providing more airport capacity (wherever that is provided) will increase emissions of air pollutants from aircraft and as a result of surface access movements. Conversely extra capacity will allow more efficient airport operation, with less aircraft queuing on the ground (taxiing) and in the air (stacking), thus minimising the impact of the extra emissions. However the Thames Hub Airport has a number of specific advantages in terms of air quality:

- emissions of all airport-related pollutants (from aircraft, ground operations, surface access) will take place in an area that is sparsely populated and has low background concentrations of air pollutants;
- the location of the airport platform in the Estuary will enable much of the pollutants emitted by aircraft and ground operations to disperse over water and away from people;
- as a new 'greenfield airport' there is scope at the Thames Hub Airport (as with noise) to manage new urban development associated with the airport in order to minimise exposure of people to emissions from aircraft and ground operations;
- as a new airport, the Thames Hub Airport can be designed to operate efficiently and minimise emissions of pollutants from ground airside and landside operations. For example, there is scope to introduce a fleet of electrically powered aircraft tugs with the supporting infrastructure; and
- the high projected public transport modal share at Thames Hub Airport will help to minimise air quality impacts.

The 2003 SERAS study included air quality forecasts for the existing Heathrow Airport in 2015, a new two-runway airport at Cliffe Marshes on the Hoo Peninsula in Kent in 2015 and a four runway Cliff Airport in 2030. The latter is comparable in terms of size and location to the Thames Hub Airport. The study included assumptions about the type and number of future flights and operating conditions. The study found that approximately 14,000 people living around Heathrow were predicted to be exposed to NO₂ concentrations above the annual mean NO₂ objective in 2015. However there was little impact on PM₁₀ with no population exposed to exceedances of the daily mean or annual mean objective. At Cliffe, no people were predicted to be exposed to NO₂ concentrations above the annual mean air quality objective for either option in 2015 or 2030. There was little impact on PM₁₀, with no population exposed to exceedances of the daily mean or annual mean objective.

²⁰ Carslaw et al. (2006): Detecting and quantifying aircraft and other on-airport contributions to ambient nitrogen oxides in the vicinity of a large international airport. *Atmospheric Environment*. 40/28 pp 5424-5434

An air quality modelling study undertaken in 2013 explored the potential air quality impacts of a third runway at Heathrow versus a new hub airport in the Thames Estuary.²¹ The study considered aircraft engine emissions, emissions associated with ground support equipment and aircraft auxiliary power units. The operation of Heathrow with a third runway was predicted to result in 150 deaths per annum due to air pollution, as opposed to 50 deaths per annum if Heathrow closed and an airport was built in the Thames Estuary. The Thames Estuary option reduced the health impacts of the UK hub by 60% to 70% as Heathrow is located upwind of Greater London, whereas much pollution from the Thames Hub would disperse over the North Sea, where there would be no population exposure.

Other research by Barrett and Fuller took a unique opportunity to look at evidence about the impact of Heathrow Airport and the surrounding road network on local air quality when the airport was closed for six days in April 2010 because of the Icelandic volcanic ash cloud. The results of this showed a two thirds reduction in airport-related NO₂ levels, from an average of 27µg/m³ to 8µg/m³.

Further work is needed to model the air quality impacts associated with changes in road traffic as a result of the Thames Hub Airport proposal, and to assess how the AQMAs at the Thames Hub and Heathrow sites will be affected. It may be the case that AQMAs no longer exist by 2030 due to improvements in vehicle emission technologies, cleaner vehicles and a reduction in pollution.

3.4 DESIGNATED SITES: ECOLOGY

3.4.1 Policy context

The ecological value of land and sea areas is recognized in the designation of sites under a range of international, European and national nature conservation legislation designed to protect and enhance the natural environment. A number of important ecological sites would be affected by the development of the Thames Hub Airport. However, it is important to note that sites are already under threat from rising sea levels and storm surges and that there is likely to be limited government funding available. The level of private sector funding associated with the Thames Hub Airport would enable a comprehensive environmental management strategy to be developed for the Isle of Grain that will not only mitigate the impacts of the airport, but it will also provide opportunities to improve the remaining natural environment.

3.4.2 Existing situation

The Thames and Medway estuaries are of international importance for wildlife, especially the large wintering populations of waterbirds. At low tide, foraging birds are distributed over the mudflats all along the Thames and Medway coasts of the Hoo Peninsula and on Mucking Flats, and there are also nesting populations of species on the salt-marshes, grazing marshes and lagoons associated with both estuaries. Several nature conservation sites fall within the Thames Hub's zone of influence and others lie within the 1km envelope for proposed road and rail routes serving the airport. They include Natura 2000 sites (Special Protection Areas and Special Areas of Conservation), Wetlands of International Importance (Ramsar sites), Sites of Special Scientific Interest and National and Local Nature Reserves. Some of these sites are already at risk of some habitat loss as a result of rising sea levels. Site management plans, based on current public funding, envisage programmes of replacement habitat creation through managed realignment on site, although this would result in a significant loss of agricultural land.

3.4.3 Impacts of proposal

The airport and related infrastructure will result in the loss of around 1,700 hectares of waterbird habitat, of which 10km² is intertidal and 7km² is grazing marshes. It could also potentially cause direct or indirect impacts through disturbance, habitat change, and the implementation of bird-strike risk reduction measures. Therefore a detailed ecological impact assessment is needed, as well as an appropriate assessment under the EU Habitats Directive and the UK Habitats Regulations. This is likely to result in an adverse impact in terms of EU sites. To address this, the plans will demonstrate why the Thames Hub Airport is a project of overriding importance and include compensatory measures.

Further work is needed to assess which options would most cost effectively provide compensatory habitat at the likely required ratio of between 2:1 and 3:1. There is an opportunity to work with the Environment Agency and other stakeholders, such as the RSPB, to protect land that is subject to rising sea levels and increasing frequency of storm surges. These options include beneficial recharge, managed realignment and habitat creation. There is scope to identify and purchase farm land at or above market rates which could then be converted into replacement habitat.

Estuary birds are highly mobile, particularly outside the breeding season, and existing schemes have demonstrated that they will readily use newly created habitats within an estuarine system, provided the conditions are suitable. Wallasea Island, which is

²¹ Yim et al. (2013): Air Quality and Public Health Impacts of UK Airports Part II: Impacts and Policy Assessment, Atmospheric Environment 67 pp. 184-192

receiving the spoil from Crossrail, and one of the largest realignment schemes in Europe on the Humber Estuary, with which the RSPB is involved, demonstrates both a precedence and experience in constructing coastal habitat in the UK at the required scale.

3.5 DESIGNATED SITES: CULTURAL HERITAGE

3.5.1 Policy context

Cultural heritage incorporates archaeology (both terrestrial and marine), the palaeoenvironment, built heritage and historic landscapes, in addition to intangible attributes that are inherited from past generations, including the historical record. Many cultural heritage assets are protected through designation, either through national legislation (scheduled monuments, listed buildings and conservation areas) or local planning policy (locally listed buildings). English Heritage has a statutory role to protect such heritage assets in England.

3.5.2 Existing situation

The Hoo Peninsula is over a hundred Km² and for its size includes a relatively small number of significant archaeological features, historic buildings, historic landscapes and the following designated areas, buildings and structures: Grade I and II listed churches; various scheduled monuments; Coastal Artillery Defences around the shorelines; Cooling Castle scheduled monument and its associated historic landscape; a scheduled priory; a Conservation Area and various listed buildings, including (but not exclusive of) houses, shops, barns, farmhouses, halls, a rectory and public houses. There are also two protected wrecks in the offshore zone.

3.5.3 Impacts

The Thames Hub Airport would directly impact on five of these cultural heritage assets. These would be a Grade I listed church, a listed public house, listed WWII shoreline defences, scheduled Coastal Artillery Defences and the listed Grain Tower which lies within them. However, for a proposal of this scale, direct impacts on just 5 designated buildings and structures is far fewer for comparative purposes than the list of assets that would be impacted by a third runway at Heathrow.

The effect of the development on the designated assets would be permanent and irreversible. However through sensitive design and professional mitigation, adverse effects on nationally significant heritage assets can be reduced. A special and holistic approach can be adopted within a framework for the treatment of these assets. This can be formulated by fully incorporating the views of local and national stakeholders and using the present legislation and National Planning Policy Framework to specify the treatment to each designated asset.

This will inform the mitigation solutions that would most fairly reflect the significance of the assets in question.

We recognise the legal protection given to statutorily-designated assets and the potential to cause complications to the planning process for Thames Hub Airport if inadequate mitigation measures are implemented. A range of measures exist for dealing with heritage consents and further work is needed to determine which is the most appropriate to use, through discussions with relevant stakeholders. We would aim to create the best possible archive of these structures or areas through preservation by record. In some cases, this would include the reinstatement of the buildings elsewhere, should their significance warrant translocation. There may also be opportunities to incorporate these assets, and/or representations of them, within the design of the airport.

The historic and visual settings of these features are also significant, and those near the airport or within the transport corridors, or their Zones of Theoretical Visibility, would also require varying degrees of mitigation. Sensitive landscaping and noise and vibration reduction measures would go some way to mitigating such adverse effects.

The cultural heritage resource chiefly comprises non-designated assets. Most of these comprise buried or extant archaeology, historic structures notable for having a local architectural or historical value, palaeoenvironmental deposits and marine archaeology. These assets form an integral part of the country's historic environment, and their treatment is managed within the planning process through the National Planning Policy Framework and local planning policies. Those assets potentially affected by the development will be assessed and subject to a fully comprehensive suite of investigation to inform a robust mitigation strategy. The mitigation ultimately applied will be tailored to the significance of the assets and will be equally as comprehensive in its approach. Both investigation and mitigation will be fully informed by stakeholder consultation.

3.6 CLIMATE CHANGE

3.6.1 Existing situation

The Climate Change Act 2008 introduced a target to reduce the UK's greenhouse gas emissions (GHG) by 80% by 2050 compared to a 1990 baseline. While international aviation emissions fall outside of international agreements, the UK government has introduced a target to limit UK aviation emissions to below 2005 levels by 2050. Based on passenger demand projections, the DfT has forecast that UK aviation emissions will rise to 48 million tonnes of CO₂ equivalent (MtCO₂e) in 2030, levelling out by 2040 and beginning to fall by 2050, due to market maturity, capacity constraints, improvements in aircraft fuel efficiency and use of biofuels.

²² Sustainable Aviation (2008): Sustainable Aviation CO2 Roadmap <http://www.sustainableaviation.co.uk/wp-content/uploads/sa-road-map-final-dec-08.pdf>

The aviation industry's vision for a lower-carbon aviation industry is set out in the Sustainable Aviation CO₂ Roadmap.²² This anticipates that, with improved technology (new aircraft engines and airframes), more efficient air traffic management, the use of biofuels and other measures, GHG emissions can be reduced to 2000 levels by 2050 while passenger numbers grow by a factor of three.

Greenhouse gas emissions need to be considered as a global issue, as reflected in the inclusion of international aviation in the EU Emission Trading Scheme (ETS). Irrespective of whether or not the Thames Hub Airport is built, growing aviation demand means that emissions will inevitably increase globally. Inclusion of international aviation in the EU ETS from 2012 requires all commercial aviation operators emitting more than 10,000 tonnes CO₂e per year from flights to or from EU member states to monitor, report and have independent verification of their GHG emissions. This will effectively cap international aviation emissions for flights originating from or destined to EU member states by requiring operators to pay for emissions reductions made in other sectors where they are not able to achieve the level of reduction required.

3.6.2 Impact of proposal

The Thames Hub offers a number of advantages in terms of carbon emissions over other proposals for long-term airport capacity, as set out below.

Airport operations

The provision of extra capacity will allow the operation of efficient aircraft arrivals and departures from the airport, resulting in reductions in carbon emissions and cost savings for airlines and passengers. There will be no need for incoming aircraft to be held in stacks, as is routine at present, and aircraft will be able to taxi to the runways without being held up in long queues and inefficiently burning excess fuel. It is estimated that the additional costs to airlines operating at a four runway hub airport due to the ETS Cap will be between €120 million and €360 million with an expected value of €300 million. Failing to provide extra hub capacity and forcing UK air passengers to fly to global destinations via Middle Eastern hubs would increase carbon emissions, as well as incurring additional costs and time

Surface transport emissions

Enhanced rail passenger and freight services are a key benefit from the Thames Hub proposals. While further work on the carbon impacts is needed, the mode shift impact is expected to have knock-on effects to UK transport emissions, which should be affected positively as a result with emissions per passenger or freight tonne movement being reduced.

Energy use

The Thames Hub site is estimated to require approximately 400 to 600 GWh of power per annum. This demand could be met from zero-carbon energy by constructing an array of 1,000 tidal energy turbines in the Thames Estuary, adjacent to the airport platform. It is anticipated that through efficiency measures, building design for passive temperature control and lighting, and exploiting further opportunities for on-site renewable generation, for example solar photovoltaic arrays, wind turbines or ground source heat pumps, the total power demand of the Thames Hub Airport site can be further reduced. Airport service vehicles have the potential to be a significant source of GHG emissions over the operational life of the site if powered by fossil fuel combustion engines. With advances in technology, opportunities for electric and alternative fuel vehicles can be maximised and the airport's planning can minimise the need for powered transport of passengers across the airport site, reducing vehicle GHG emissions.

Construction

The construction of the Thames Hub Airport and associated rail and supporting infrastructure has the potential to ensure that embodied emissions of GHG are minimised through the efficient and innovative use of materials, energy and water. A range of measures are available including:

- reducing materials consumption;
- preventing wastage and following the waste hierarchy;
- increasing reuse and recycled content;
- matching the durability and lifespan of assets to service life;
- using resources with no scarcity and source security issues;
- using products with lower embodied carbon;
- using products with lower embodied water;
- reducing energy use during construction; reducing water use during construction;
- enabling water efficiency in use;
- enabling energy efficiency in use; and
- enabling reuse and recyclability at end of life.

Where large quantities of materials are required, transport can also be a significant source of carbon emissions. However these can be minimised by specifying the use of local recycled materials, managing waste as near to the place of production as possible and, given the airport's location in the Estuary and close proximity to HS1, exploiting opportunities to maximise marine and rail transport.



Figure 9: Chek Lap Kok island reclaimed for Hong Kong Airport.



Figure 10: Hong Kong International Airport at Chek Lap Kok.

3.7 WATER

The estuarine location of the Thames Hub Airport offers a number of significant advantages in terms of its impacts on three water environment sustainable development indicators – water availability, river quality and flooding.

3.7.1 Water availability

Much of South East England has constrained, and therefore unreliable, water resources, with additional demand potentially being met for 30% or less of the time. In contrast to the alternative land-locked proposals for hub airport capacity, the location of the Thames Hub Airport offers potential to make no demand on water availability, with the potential for all water needs to be met through coastal abstraction and desalination. Thames Water's 2010 Beckton desalination plant proves the technology for abstraction and reverse osmosis desalination, using 100% renewable energy resources.

3.7.2 River water quality

In much the same way that the Thames Hub Airport's water demand could have zero impact on water availability, local treatment of wastewater, reuse where appropriate and discharge in the coastal zone could ensure zero impact on river water quality. Further, the Thames Hub Airport would not impinge directly on any rivers designated as water bodies under the Water Framework Directive, affecting only local drainage channels on the Hoo Peninsula. Any risks associated with these small watercourses could be readily mitigated through appropriate design, such as constructed wetland treatment systems to treat car park/airport runoff.

3.7.3 Flooding

The main flooding threat to the Thames floodplain, including areas of the Isle of Grain, is from the tidal Thames. Whilst the probability of flooding is very low (< 0.1% per annum), it could increase as a result of sea level rise. At an estuary-wide scale, the proposed land reclamation for the airport platform is unlikely to have a significant effect on the propagation of tidal and surge levels up the Estuary. However the Thames Hub Airport has an advantage in that the reclamation would reduce tidal flood risks to those low lying areas located immediately behind it.

3.8 LANDSCAPE

Existing situation

The Thames Gateway landscape is characterised by its flat and low-lying landform with a strip of marsh coastline and the Thames Estuary to the north. It is a major shipping route with large industrial buildings on the horizon. The condition of the landscape in the Hoo Peninsula and the Medway marshes is considered to be poor, due to the lack of a coherent landscape pattern. By contrast, the East Thames marshes are a coherent landscape, in moderate condition. The sensitivity of the landscape to change is considered moderate in the Hoo Peninsula and the Medway marshes and the sensitivity of East Thames Marshes is considered to be very high, due to the characteristic historic ditches and grasslands, military and industrial installations and ancient trackways.

Impacts of proposal

We recognise that the large scale and nature of the Thames Hub will have significant impacts on the existing landscape character of the area. Large terminals and operational buildings, offices, roads and car parks will interrupt the broad open scale of the marsh landscape, in the manner of existing industrial structures. The network of ditches and creeks running through the marshes will be severely affected or destroyed. The settings of historic buildings and structures adjacent to the airport will be dramatically changed, assuming that they are not removed. The low hills of the Hoo Peninsula rising out of the surrounding marshland will be lost entirely. Existing open views out over the Estuary will be lost and replaced by terminal buildings, aircraft hangers and extensive areas of paving. However, hangars and terminal buildings are generally low density and widely spaced, and their design can be considered in a wider landscaped context.

The likely visual receptors of the proposed development would be residents of properties within the Hoo Peninsula and Isle of Grain and beyond, tourists, workers and bird-watchers. The impacts would extend beyond the Hub itself with the extensive road and rail infrastructure, as well as the creation of the new island for compensatory habitat. As a result a holistic and comprehensive landscape mitigation strategy will need to be developed which extends beyond the immediate boundaries of the Thames Hub Airport site.

The Thames Hub Airport has the potential to deliver transformative economic benefits at national, regional and local levels. For the UK aviation industry it will bolster its growth potential as it reinforces the UK's position as one of the world's primary aviation centres, alongside North America and China. The initial estimate of these benefits is £75 billion, which would far exceed the costs of the project.

The provision of additional hub airport capacity will have major economic impacts. The balance of those benefits and costs will be shared between air passengers, non-users, airlines, airports and the government. This chapter identifies the specific economic benefits that would arise from the location of the Thames Hub Airport to the east of London. These location-specific benefits would build on other national, local and regional economic benefits, as well as those that would accrue to the UK aviation sector. All of these benefits are considered in this chapter along with previous estimates of the likely economic impacts. Chapter 7 explains how the costs of the airport have been determined.

4.1 LOCATION-SPECIFIC ECONOMIC BENEFITS

The Thames Hub Airport has a number of major economic advantages compared to alternative proposals to provide additional hub capacity.

- a. **Long-term cost savings** - As a purpose built facility, the Thames Hub Airport can provide the level of long-term hub capacity that the UK needs in one development phase, rather than piecemeal expansion elsewhere and the construction costs of doing this will be much lower than options elsewhere. Expanding existing airports, which will impose significant operating constraints on their construction programmes, will be much more expensive. Its greenfield development will enable some of the value generated by businesses that locate around the airport to be captured, and can contribute towards the investment costs of the project.
- b. **Maximum use of existing infrastructure** - Further cost savings can be secured by making use of existing and planned rail infrastructure as explained in Chapter 2. For example, the close proximity of HS1 to the airport means that, with the construction of a connection near Gravesend, the spare capacity on this world class line can be used to carry passengers between Central London and the Thames Hub Airport in just 26 minutes. Crossrail could also be easily extended to the airport. Land has already been protected for the project between Abbey Wood and Gravesend and this could be extended to serve the airport. Further use can be made of the international platforms at Waterloo and the South London rail network. The existing rail network can also be used to provide direct rail services to and from the airport from Greater London, the South East and the rest of the UK. This would also avoid the cost and time of people having to travel into and out of Central London to get to and from the airport.
- c. **Ability to attract extra air passengers from Northern Europe by rail** - As identified by Greengauge in its recent report, the proximity of the Thames Hub Airport to HS1 means that it has the potential to attract additional air passengers from North West Europe who will arrive and depart using high-speed rail services through the Channel Tunnel.²³ Other airport proposals would be unable to do this.
- d. **24 hour operation** - In a global economy, the ability to offer flexible connection opportunities for passengers and freight users in other countries and different time zones is key. The airport's estuary location, with flights predominantly approaching over water, means that it could offer 24-hour operation. This would maximise utilisation of the airport's infrastructure and offer benefits for passengers and air freight users. This is the only proposal for long-term hub capacity that can offer this benefit.
- e. **Noise and air quality benefits** - The economic value of the environmental benefits that a Thames Hub Airport would deliver – as described in Chapter 3 - would be significant. The livelihoods and education of hundreds of thousands of people living and working around Heathrow are constantly interrupted by aircraft noise. This results in sleep disturbance, stress and has negative impacts on their productivity, all of which represent a huge cost to the economy. Similarly there are enormous economic costs from the premature deaths and morbidity impacts of air pollutants from Heathrow which, due to the prevailing winds, drift across Central London.
- f. **Regeneration** - The new airport will bring urgently needed regeneration to North Kent, providing essential jobs in one of the most deprived areas in England.²⁴ The scale of the project will allow currently stalled housing developments to proceed and will kick-start the wider regeneration of the Thames Gateway, which has failed due to the absence of a major generator of jobs.

²³ Greengauge (2013): Travel market demand and the HS1 – HS2 link <http://www.greengauge21.net/publications/travel-market-demand-and-the-hs1-hs2-link/>

²⁴ Kent County Council (2011): The Indices of Deprivation 2010: Detailed findings for Kent [https://shareweb.kent.gov.uk/.../Deprivation/deprivation-in-kentreport-2010\(1\).pdf](https://shareweb.kent.gov.uk/.../Deprivation/deprivation-in-kentreport-2010(1).pdf)

The proposal estimates the airport will employ 100,000 onsite workers and generate as many direct and indirect off-site jobs, and estimates the annual economic value of these direct jobs and indirect jobs as £1.3 billion and £2.6 billion respectively.

g. Development of a freight nexus in the Estuary -

The Thames Estuary has long been the major economic portal for UK trade and the opening of London Gateway will mean that ports within 30 miles of the Estuary will soon account for 75% of all containerised traffic to and from the UK. The UK's hub airport also has an important role as a node in the growing transport of high value 'just-in-time' belly freight around the globe.

The location of the Thames Hub Airport to the east of London, with fast HS1 connectivity to the capital, European markets and the UK's manufacturing heartlands (via a short link to HS2) would provide a perfect complement to recent port investments in the Estuary, such as London Gateway which offer first drop and last pick-up advantage for European shippers. Globally, air freight users are increasingly choosing to base themselves in locations with high quality port and airport infrastructure. Development of the Thames Hub Airport would provide an opportunity to develop a freight nexus in the Estuary and to become the leading European freight distribution centre, overtaking the Netherlands.

4.2 NON LOCATION-SPECIFIC IMPACTS

The location specific benefits set out above will enhance other national, regional and local impacts from increasing hub airport capacity.

4.2.1 National impacts

The national impacts are likely to include:

- a. macro-economic impacts for the UK arising from an increase in hub airport capacity, leading to an increase in trade, inward investment, the value of extra inbound and outbound tourism and productivity impacts. The provision of extra hub capacity will increase the UK's ability to connect and trade with the world's fast growing emerging economies. The lack of slots at Heathrow means that airlines from emerging economies are often deterred from providing air services to the UK – they are much less interested in serving UK point-to-point airports and often look to other markets instead. New air services will increase trade, inward investment and tourism. As well as boosting the global competitiveness of London and the South East economy, the extra capacity provided will bring benefits to firms and households across the country;

- b. changes in surface access travel times for air passengers, airport workers and other visitors getting to and from the new hub airport and those travelling close to the Heathrow site;
- c. the carbon impacts arising from additional flights, airport ground handling vehicles and passengers and workers getting to and from the airport; and
- d. additional tax revenues for the Exchequer (e.g. corporation tax, VAT, Air Passenger Duty).

4.2.2 Local and regional impacts

The local and regional economic impacts are likely to include:

- a. economic impacts arising from the construction and operation of the new airport. These will include:
 - i. direct income injections into the local economy from additional direct, indirect and induced jobs and business expenditure and profits;
 - ii. revenues for local government (business rates) generated by the airport; and
 - iii. the operation of supply chain and induced income multiplier effects. However this impact also operates at the national level.
- b. Short-term job losses at the Heathrow site, a reduction in the size of the West London economy and the loss of local tax revenues. However Heathrow only accounts for a small proportion of the West London economy and these local economic impacts would be more than offset by higher value jobs and higher income injections into the local economy if the Heathrow site is redeveloped as a commercial and residential hub for West London to rival Canary Wharf. Given that the necessary infrastructure already exists at the Heathrow site, the low unit costs of providing these jobs makes this a low cost way of securing high value growth for London; and
- c. Wider economic impacts, such as agglomeration benefits, in areas around the new hub airport as surrounding urban development grows. There will also be land value changes around both the new hub airport and Heathrow.

4.2.3 Aviation industry impacts

Aviation industry impacts are likely to include:

- a. benefits to air passengers who, because of the increase in hub airport capacity, are able to make more journeys at lower costs (due to more competition between carriers and reduced delays), at higher frequencies and via more preferred airports. Existing passengers will also benefit from increased reliability in departure and arrival times and a reduced risk of delays due to incidents at the airport. There are similar benefits for exporters shipping high value, just-in-time goods as belly freight;
- b. the opportunity for existing UK-based airlines to grow their businesses by providing more flights to and from the UK and to reduce their costs. In particular, the impact of extra capacity in bringing down airport charges and increasing passenger demand will benefit airlines; and
- c. the competitive impacts of a new hub airport for other non-hub (point-to-point) airports in the UK and consequent economic impacts in those regions. Some of these airports, possibly those in the South East, may lose passengers to the new hub airport, while other airports further afield may benefit from greater access to the hub airport.

4.2.4 Measuring impacts

These economic impacts can be estimated using techniques that range from the use of global, national and local economic models, the development of transport models, the use of shadow costs based on willingness to pay surveys, the application of elasticities and simple multipliers, through to qualitative assessments. The complexity of the Thames Hub project and range of impacts will require the use of all of these methods in order to develop the business case.

While initial estimates can be made of the impacts of Thames Hub, the robustness of these numbers will increase as more airport design work is carried out. It is also important to recognise that short-term impacts may differ from long-term impacts as people and firms change their behaviour over time in response to the Thames Hub.

In 2009 the DfT estimated that the national economic benefits of two additional runways in the South East would be £35 billion.²⁵ While these runways were not in the same location, it provides an indication of the scale of economic benefits that could be expected to arise from extra hub capacity. A number of recent studies have tried to quantify these national benefits. For example, the CBI estimated that one additional daily flight to each of the world's eight largest high-growth markets would increase UK trade by as much as £1 billion a year.²⁶ Other reports, such as the Frontier Economics study for the former BAA, focused on the economic costs of not expanding Heathrow, which were estimated at £14 billion over 10 years.²⁷

The £75 billion estimate takes account of these previous estimates as well as the wider economic benefits of developments identified in major project appraisals, such as HS2.

4.3 BASE CASE

In order to correctly estimate these economic impacts, a base case scenario of what happens in the absence of additional hub capacity would need to be developed as a first step. Defining such a scenario is always a challenge, because it has to cover the period over which impacts would arise and requires that assumptions are made about a number of issues, such as those listed below.

4.3.1 Macro-economic factors

It will be important to assess:

- a. how the UK and world economies are likely to develop and whether a lack of additional UK hub capacity might dampen UK economic growth;
- b. how populations might evolve around the Thames Hub and Heathrow sites and at the regional and national levels; and
- c. future levels of UK and global demand for air travel to and from the UK using a hub airport (wherever the hub airport is located – in the UK or elsewhere).

²⁵ DfT (2009): UK Air Passenger Demand and CO2 Forecasts <http://webarchive.nationalarchives.gov.uk/>

²⁶ CBI (2013): Trading Places <http://www.cbi.org.uk/media-centre/press-releases/2013/03/squeezed-airports-risk-uk-missing-out-on-billions-of-pounds-in-trade/>

²⁷ Frontier Economics (2011): Connecting for growth: The role of Britain's hub airport in economic recovery: A report prepared for Heathrow <http://hub.heathrowairport.com/>

4.3.2 Aviation factors

A key issue is how Heathrow's competitive position as a hub airport would change in the absence of additional hub capacity. DfT estimates that the airport could grow to 81mppa, as average aircraft size and load factors increase and if mixed mode is allowed (although the airport opposes this, as its resilience would suffer and the passenger experience would deteriorate). Without mixed mode, an assessment is needed of Heathrow's capacity limit, when that will be reached and how passenger numbers would evolve over the long term. This needs to take account of issues such as:

- a. developments at competitor European and Middle Eastern hubs and their future competitive response;
- b. the extent to which airline network economics and aviation industry consolidation will encourage long haul traffic to transfer from Heathrow to other hubs;
- c. how other London and UK regional airports respond. For example, how will Gatwick and Stansted develop if new hub capacity is not provided? UK regional airports may accelerate the current trend for services to use other hub airports; and
- d. how changes to European airspace structures and technologies will enable more air traffic capacity to be handled.

4.3.3 Surface access factors

Current strategic transport models show that road traffic will rise by 44% by 2035 (compared to 2010) and rail demand will increase by 20% in Central London and 32% by 2019 driven by population and income growth. The base case needs to specify what new transport projects (e.g. additional infrastructure) and other interventions (e.g. road pricing) will be needed to cope with background demand. There is also the question of the extent to which the absence of additional hub capacity would dampen down background demand.

4.3.4 Environmental factors

Existing environmental conditions will change over time in the absence of extra hub capacity. For example, sea level rise and more storm surges in the Thames Estuary are predicted to lead to a loss of marine and coastal habitat on the Isle of Grain, irrespective of whether an airport is built.

Summary

The range and scale of economic benefits resulting from the Thames Hub Airport would provide the biggest single boost to the long term productive capacity of the UK economy in the first half of the 21st century. To ensure these impacts are captured and robustly assessed, a comprehensive programme of analysis is needed to develop the business case for the airport.

The world economy is fragmenting, driven primarily by the increase in emerging economies. As the number of important cities rises, the effectiveness of point-to-point travel is reduced, as daily routes cannot be satisfied by these smaller cities alone. A hub to concentrate and redistribute this new demand becomes all the more necessary to provide the volumes required for daily services. Northern Europe is optimally positioned for this role, with London able to access 27% and 94% of the worlds GDP by short-haul and long-haul flights respectively*. However London's ability to access these new markets and offer new routes, which can reduce overall flight distances, cannot be realised because Heathrow is now at capacity.

5.1 GLOBAL ECONOMIC FRAGMENTATION

In 1990, a little over twenty years ago, the population of Europe and the United States represented just 14% of the world's population – and yet these countries accounted for half the global economy. In 2010, their share of GDP (PPP) had shrunk to 40%.²⁸ Traditional emerging markets, particularly the BRICS, are joined by new rising economies, such as Mexico, Malaysia, Columbia, Kazakhstan, Thailand and Turkey. The growth of each of these economies translates into tens of millions of new consumers, growing businesses and untapped trade and tourism potential, distributed across hundreds of new and modernising cities.

There are 50 cities in China larger than Birmingham, with more than 3 million inhabitants – Heathrow serves just three of these. Indonesia's population is 240 million and the country's economy is growing at 6% each year. There are currently no direct flights to Indonesia from the UK. Both examples illustrate the challenge that Britain faces, as new urban centres emerge and the world's economic centres become more fragmented.

In order to reach 75% of the world's economy, as Britain is currently able to do, there must be direct access to 55 more cities by the end of this decade, than the 366 cities that were accessible at the start. Looking further ahead, this fragmentation of the global economy is expected to continue apace.

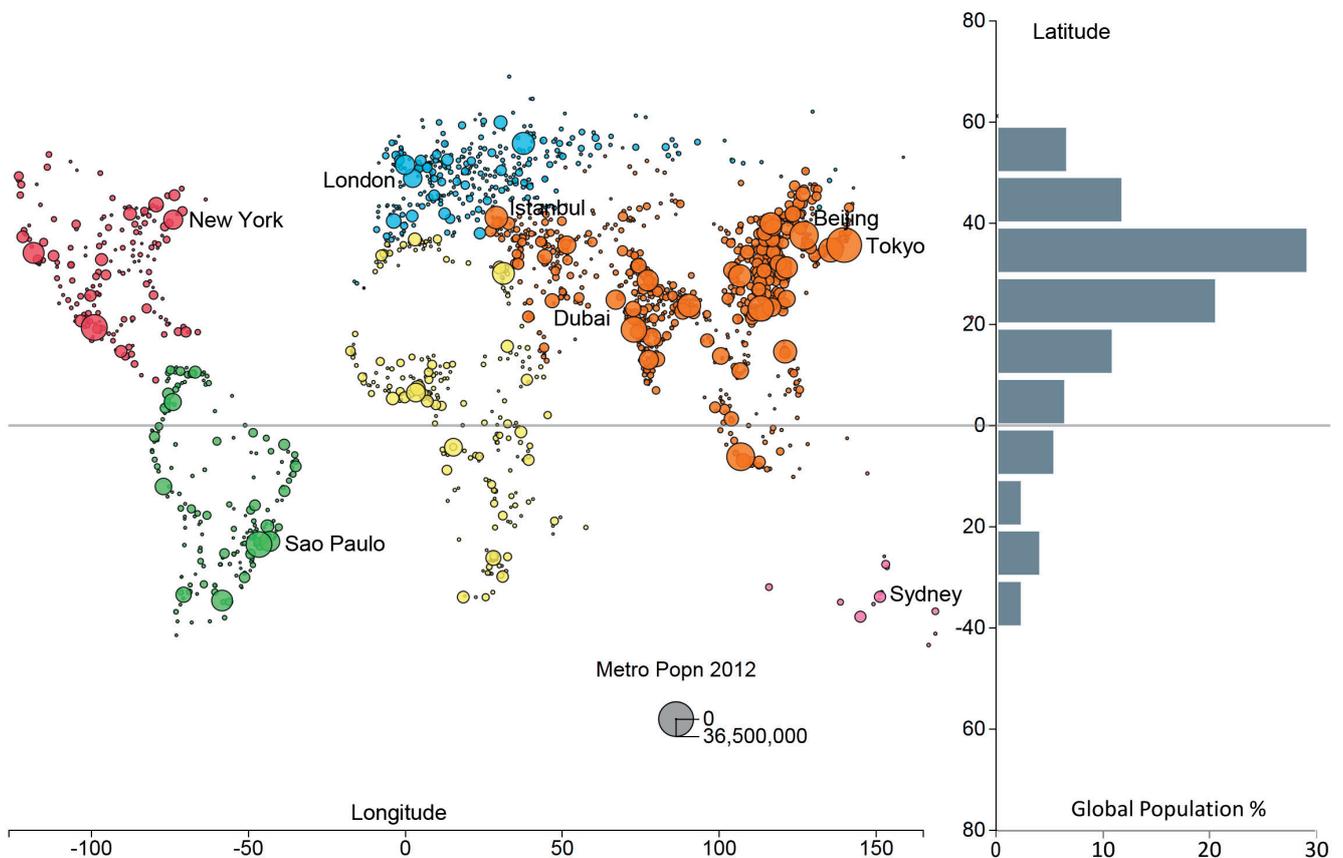


Figure 11: Graph showing geographical distribution of population for the largest 2000 metro areas on the left, and summated by latitude on the right. (Data from the Hambalt 6000 model).

* Short Haul: 3hrs 2,000km Long Haul: 10,00km

²⁸. (Source: World Bank, Hambalt 6000 City Model)

²⁹. International passengers growing from 1.1bn in 2011 to 1.45bn in 2016 (Source: IATA)

³⁰. Average = 170, 1991, average = 271, 2011 (Source: OAG,TfL)

By concentrating demand, a hub airport can make these new routes viable, frequent and affordable. But while in the next five years, an extra 340 million people²⁹ will catch an international flight, none of them will fly to Heathrow, because it is full.

5.2 LONDON IDEALLY PLACED

London is uniquely well placed to act as a global hub. 87% of the world's population and 90% of the global economy resides in the northern hemisphere (see Figure 11).²⁹ This becomes significant when looking to connect these places together via a hub; the vast majority of ideal shortest routes (great circle arcs) avoid the equator and instead often passing close to the North Pole (see Figure 12) – this fact is often surprising to those accustomed to standard maps, which greatly exaggerate distances to the Poles. As the vast Pacific Ocean is on the other side of the northern hemisphere, there is a concentration of key routes passing near to or over the UK. As a direct result of this global position, 27% of the world's GDP can be reached in less than a three hour flight from London, and 94% of the world's economy can be reached in less than 13 hours by air. This combination of short and long-haul economic connectivity is unique to North-West Europe (see Figure 13). It is worth noting that the potential to provide the shortest flight distances has wide implications on reduction in flight times, carbon emissions and costs, both for the operator and consumer.

Paris, Frankfurt and Amsterdam have increased capacities to serve 100 extra routes each in the last twenty years – each now serves an average of 271 routes³⁰. And of these, 27 of Amsterdam's flights are to UK destinations, compared to 7 regional flights from Heathrow. In the same period, Heathrow has not just stagnated, but has been forced to reduce routes, from 183 twenty years ago to 170 today. Heathrow is the UK's sole hub airport as only it has the volume of passengers and transfer times necessary to generate the frequency of flights and global connectivity required to act as one. The consequence has been to limit the UK to a declining share of international aviation.

With a critical lack of supply, the economic decisions have been short-term and commercial. Heathrow now supports a relatively limited number of legacy, high-profit routes, at the expense of providing full, cost-effective access to the key growth markets that are critical to the sustainable economic growth of Britain's services, trade, industry and tourism. London is an international city, uniquely positioned to capture and benefit from the rapid growth of global aviation. The only thing holding this back is lack of hub capacity, which Heathrow and piecemeal expansion at Gatwick, Stansted and regional airports cannot provide.

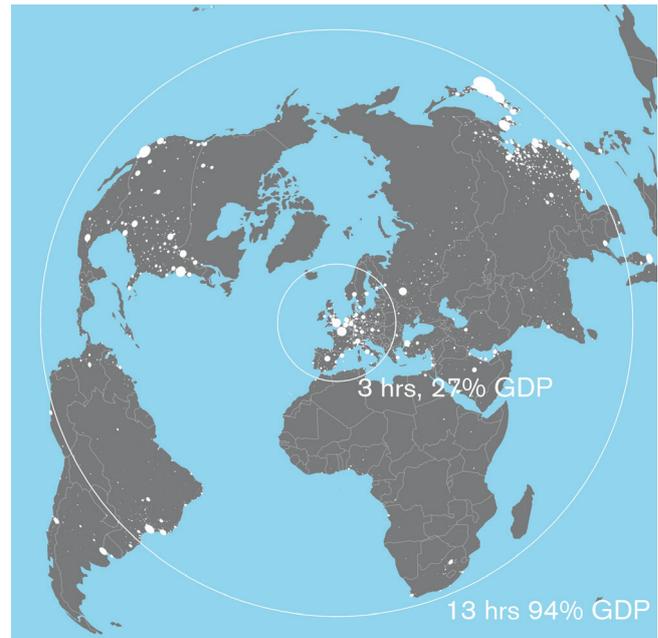


Figure 12: Map centred on London showing metro areas sized by GDP, rings showing locations accessible within the time frame of a short-haul (3hrs) and a long-haul (13hrs) flight.

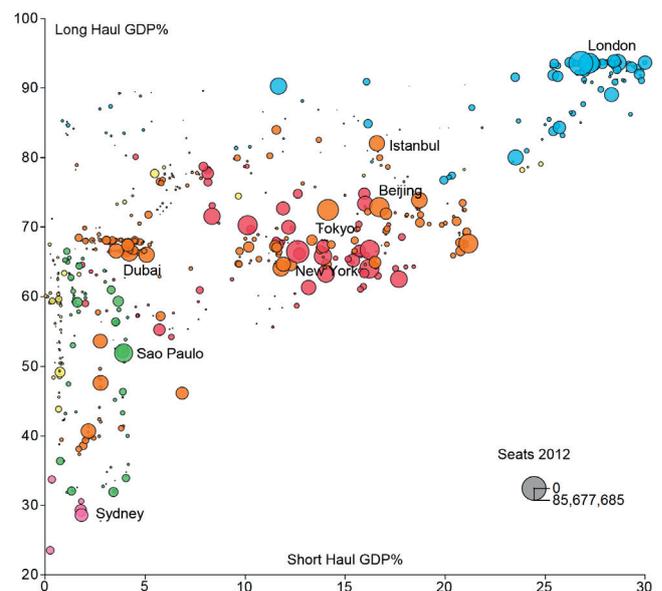


Figure 13: Graph showing for each of the top metro areas the percentage of GDP accessible by short-haul and long-haul flight distances. City circle size proportional to current available flight capacity (measured in seats).

The Thames Hub Airport will bring a range of benefits for air travellers. The scope for airlines to grow their businesses (something not possible at present) will benefit airport workers and employees in supply chain businesses who transfer to the Thames Hub Airport, and will bring employment opportunities for local communities in Kent. The redevelopment of Heathrow, as a major commercial and residential growth area, will improve the quality of life for residents in West London and will bring high value jobs.

6.1 PASSENGER EXPERIENCE

The Thames Hub will provide four main benefits that will further the interests of air passengers.

1. the increased hub airport capacity, relative to that at Heathrow, will enable more frequent air services to be operated by existing and new airlines and allow a wider range of destinations to be served, particularly to fast growing emerging markets, poorly served by Heathrow at present. This will benefit both local air passengers, flying directly from Thames Hub, as well as those passengers flying in and out of the airport from UK regional airports.
2. the ability to operate the airport 24 hours a day will provide airlines with greater flexibility over flight times and will provide a more competitive service offering for both departing and arriving passengers.
3. the airport infrastructure – runways, aprons, terminals, surface access links and stations – can be designed at the outset to provide minimum 45 minute connection times, to rival those at Schiphol.
4. the additional capacity will improve the airport's resilience when incidents occur and significantly reduce the likelihood that passengers will be adversely impacted by flight delays and cancellations. Given the level of suppressed demand, it is estimated that an additional runway at Heathrow would be fully utilised within five years. Therefore this would do nothing to enhance the airport's long-term resilience in dealing with incidents and would not improve the passenger experience.

Chapter 2 describes how air passengers will benefit from fast and sustainable public transport access to and from Thames Hub Airport.



Figure 14: Passenger misery at Heathrow.

6.2 EMPLOYMENT AND HOUSING

The capacity provided by the Thames Hub Airport will allow airlines to grow their businesses (something they cannot do at present). This will benefit airport workers and employees in supply chain businesses who transfer to the new airport. The new airport will be a major source of additional employment. Aside from the construction jobs, the airport is estimated to require up to 100,000 on site workers and be supported by a further 100,000 off-site employees. The on-site estimate is based on an analysis of aircraft movements and passengers per employee at Heathrow and other global hub airports, takes account of the improving trend in airport productivity driven by new technology and automation and has been scaled to reflect the size of Thames Hub in terms of passengers and air freight opportunities. The off-site estimate reflects a scaling up of current employment around Heathrow.

The scale of employment associated with Thames Hub will bring transformative economic benefits to North Kent and South East London and will enable the long planned regeneration of the Thames Gateway to actually occur. Many of the on-site employees, particularly those in high wage and high skill jobs (e.g. air crew, management, maintenance roles), are expected to transfer from Heathrow to Thames Hub. The combination of long-term levels of unemployment and a growing population will mean that the local labour market in North Kent and South East London will be more than capable of supplying workers for those roles at the new airport where existing employees do not transfer over from Heathrow.

Some existing Heathrow employees in low wage roles are unlikely to transfer to the Thames Hub and there are concerns about job losses. However if a decision is made to develop a new hub airport (whether in the Thames Estuary or elsewhere) and close Heathrow, the new airport would not open for 15 years. This is one third of a person's working life and provides plenty of time to develop a comprehensive strategy to manage the transition of roles and skilled training programmes. Further, the increasing trend for employees today, particularly in low wage jobs is to have a much larger number of jobs during their working lifetime. Most of those employees working at Heathrow today will not be the same as those working in 10 years time. Despite the economic downturn, London's economy grew by 12% between 2007 and 2011 (twice the UK rate) and the capital's continued expansion to 9 million people by 2020 will mean that those employees who decide not to transfer to the Thames Hub in 2029 are likely to find alternative employment.^{31, 32} The long planning horizon for the new airport would also apply for businesses that currently provide services for Heathrow Airport.

The number of additional employees and their families, directly or indirectly related to the new airport, who move to the area around the Thames Hub will need to be housed. This demand will enable current planned housing developments in North Kent, which were put on hold following the economic downturn such as the Eastern Quarry, to be delivered. However it is anticipated that these will need to be supplemented by new housing developments and social infrastructure such as schools, shops and other amenities. All of these housing developments will further boost local employment opportunities.

The Heathrow site could be redeveloped into a major commercial and residential hub. The site, which would be the largest development site within the M25, is in a prime location for redevelopment, given its excellent transport links to both central London and the rest of the country. In addition to the construction jobs that will be generated, the redevelopment will provide a unique opportunity to create thousands of permanent high wage and high skill jobs in West London to rival Canary Wharf. The economic activity and local taxes raised will benefit the local communities and it would play an important role in helping to address and accommodate some of London's population pressures.

6.3 LOCAL COMMUNITIES

Chapter 3 explains the noise relief and air quality benefits that the Thames Hub Airport will provide for millions of Londoners. A large number of residents around Heathrow will experience health benefits such as a reduction in mental stress, due to reduced noise nuisance, and an improvement in air quality. Conversely a much smaller number of existing residents around Thames Hub will suffer from aircraft noise for the first time and experience higher levels of air pollution. The proposal is to establish a development control area around the Thames Hub airport to ensure that these impacts are not increased due to further urban development encroaching towards the airport boundary.

The team has carried out an initial assessment of the specific communities on the Hoo Peninsula that would be impacted by the Thames Hub Airport. Owners of these properties will need to be compensated and the residents rehoused. Other residents, close to the airport site, will be entitled to receive compensation from the airport operator for the costs of installing noise mitigation measures such as double glazing.

Further afield, the urbanisation impact of the new airport on the surrounding North Kent area will be significant. This is an area which has suffered economically from a lack of employment opportunities and poor transport links. Aside from providing employment opportunities, the wider development that will result due to the airport will bolster land values and property prices. Similarly, property values around Heathrow will be positively impacted by its closure and redevelopment.

Detailed plans will be required to address the needs of vulnerable groups and these will need to be developed in liaison with those impacted and local agencies.

These groups are likely to include:

- a. those local people who will be impacted by Thames Hub and the closure of Heathrow but with whom it is difficult to engage. This may include households with people who are elderly, disabled and single parents;
- b. residents on the Isle of Grain that are part of close knit communities – this will need to be taken into account in any resettlement plans for these residents;
- c. those low wage workers at Heathrow that are unlikely to transfer to Thames Hub will need support in finding alternative employment; and
- d. air passengers with disabilities whose needs will need to be incorporated into the design of the surface access improvements and new airport infrastructure.

³¹ Office for National Statistics (2013): London's economy has outperformed other regions since 2007 <http://www.ons.gov.uk/ons/rel/regional-trends/regional-economic-indicators/march-2013/sum-london.html>

³² Mayor of London (2013): 2020 Vision: The greatest city on Earth http://www.london.gov.uk/sites/default/files/2020_vision_web.pdf

6.4 WIDER SOCIAL IMPACT

A wider social impact arises from the transformative benefits that the Thames Hub would bring to the UK economy. Not only will the additional capacity provided enable more flights to a wider set of destinations, benefitting business and leisure passengers and air freight users, but the airport's location will significantly enhance those benefits for air freight users and help rebalance the economy and close the North South divide. Historically the Estuary has always been the UK's major trade portal and this is set to continue as new port developments, such as London Gateway, take place. The airport's location, close to these ports and with world class rail access provided by HS1, will strengthen the development of a freight nexus in the Estuary. The capacity and flexibility this offers will facilitate trade and access to European and global markets for air freight users in the manufacturing heartlands. This will encourage manufacturing exports, help deliver manufacturing jobs that the UK needs and help reduce the income disparities between the UK's regions. The long-term social impacts of this for the country would be significant and would include greater domestic and international social mobility, wider regeneration impacts and increased aspiration.

6.5 ENGAGEMENT WITH STAKEHOLDERS

Robust stakeholder engagement and community consultation will need to form an important part of the feasibility work to develop the Thames Hub proposal during 2014 and 2015 (in liaison with the Airports Commission) and beyond if the Thames Hub is selected as the UK's new hub airport. It is vital that all relevant stakeholders have the opportunity to understand the proposal and have their views taken into account. There may be a case for the Airports Commission to co-ordinate consultation with key stakeholders and community groups across all of the short listed proposals being developed in 2014 and 2015.

If, in 2015, the Airports Commission recommends the Thames Hub for development, it would be defined as a Nationally Significant Infrastructure Project (NSIP) and would be taken through the major projects statutory planning process, as set out in the 2008 Planning Act. This places a statutory duty to ensure that a project's promoters consult with local authorities, local communities and other key persons and bodies, such as Natural England, the Environment Agency and English Heritage. In terms of local authorities the development of the Thames Hub airport would involve liaison with the South East Local Enterprise Partnership, Medway Council and Kent County Council and adjacent authorities. Similarly the closure of Heathrow will involve work with Hillingdon and Hounslow Councils.

However there would need to be interfaces with a large number of other stakeholders. These would include Heathrow Airport Limited, the airlines, NATS, CAA, DfT, HS1, Network Rail, Highways Agency, utility companies and Parish and Town Councils. The team's experience in working with these bodies to deliver major infrastructure projects demonstrates its capability to progress a project through planning and regulatory approval processes and the team has strong existing relationships with many of these key stakeholders, that can be built upon in progressing the Thames Hub. One-to-one meetings are likely to be most effective with these stakeholders to facilitate a spirit of teamwork and build trust and consensus around solutions to programme and project issues.

In terms of working with local communities, the team has already met with groups opposed to, and supportive, of the Thames Hub, such as the Friends of North Kent Marsh and Demand Regeneration in North Kent. Further engagement with local communities will require the use of exhibitions, door-to-door publicity, development of the Thames Hub website and use of social media to proactively engage and communicate, encourage feedback and build local consensus. The approach will need to build on successful consultations on previous projects to ensure that people are engaged and this process must start early to allow more opportunities for concerns raised to be resolved through the design process. A Statement of Community Consultation (SOCC) will need to be produced summarising the consultation methods employed, the outputs from the consultation process and explaining how it has influenced the final design of the Thames Hub. This will be informed by discussions with local planning authorities who will have developed Statements of Community Involvement (SCI).

The £24 billion cost of the Thames Hub Airport has been based on detailed costings for similar sized platform-based airports that have been built or proposed and updated to current prices. The airport's initial 110mppa capacity is underpinned by a private sector funding model that will ensure that airline charges at airport remain globally competitive.

7.1 DEVELOPMENT OF COST ESTIMATE

The cost estimate has been reviewed and further developed by a team of aviation cost consultants with considerable industry expertise. The early stage work to develop the cost estimate focused on defining the scope of the project, identifying the elements of the overall project and ascertaining the principal cost allocation headings. This developed the airport and non-airport scope and defined the parameters of the budget. It also looked at issues such as reclamation, transport infrastructure, logistics area, off-site infrastructure capacity enhancement and compensation provision.

The work to develop the cost estimate also took account of the cost advantage that the Thames Hub will have, in that it is being developed in a wholly landside and non-aviation operational environment, with ample space provided in adjacent zones for logistics and construction management. This will aid the construction process greatly over developing in a live airport, such as adding a third runway at Heathrow, and airside environment, because productivity increases significantly, costs reduce proportionately and the material handling process is greatly simplified. This doesn't ultimately reduce the complexity of the finished facility, but it de-risks the programme and logistics management for the delivery phase of the project. Wherever possible, measured quantities, functional unit assessments and competitive market pricing data have been used to compile the developed cost estimate. Where not possible, estimated allowances have been assessed for the quantum of the works, to be refined and further analysed at a later date when the more detailed information is being developed.

The developed cost estimate has been prepared by considering all aspects of the project to define the specific scope and assumptions to ensure that the cost estimate allowances and totals represent a credible proposition. The embryonic stage of the design also means that the maximum impact of value management is yet to be realised, enabling the cost parameters to be set at the commencement of design stage and the project designed to the budget, rather than the budget being a function of the design.

The developed cost estimate for the Thames Hub Airport includes allowance for:

Item	£bn
Land Purchase / Legal Fees	3.44
Land reclamation	1.77
Formation of compensatory habitats for birds	0.07
Runways, taxiways and aircraft aprons	1.21
Terminal and satellite buildings and airport roads	1.93
Air traffic control equipment and navigational aids	0.06
Consolidation centres	0.02
Maintenance facilities	0.09
Ground support equipment facilities	0.05
Central plant to serve the campus	0.14
Fire stations and other rescue services	0.10
On-site access roads and landscaping	0.25
Long and short stay car parking	0.42
Airport offices	1.24
Compensation / Transition Costs	1.50
Total	20.00

Figure 15: Initial estimates of construction costs excluding surface access and other costs.

As stated above, design development and contingency provision is included, as are design and delivery fees to take the project from inception right through to completion. It also allows for £1.5 billion for businesses and property/land purchase costs of £2.5 billion. The developed cost estimate excludes any element of work that sits outside of the footprint of the airport campus (i.e. roads, rail, statutory authorities' infrastructure etc) and police station facilities, catering facilities, fuel farm, aircraft hangers, cargo and hotels within the main campus.

7.2 CASH FLOW

The developed cost estimate has been dovetailed in with the overall planning, design, development and operational handover programmes to produce a cashflow that maps the expenditure profile of the project scope across the delivery timeline. This assists greatly in understanding the investment commitments and the peak spend profiles during the project lifecycle and how these will need to be carefully managed during the life of the project. This is then used to feed into the funding model to demonstrate the overall deficit and funding assumptions, as well as the point at which private sector equity and debt is required.

7.3 RISKS

Any large project has risks around its cost control and funding. The UK's design and contracting industries are however well versed in aviation projects, and have a proven track record in managing them effectively. Whilst the Thames Hub is a large project, it is relatively simple in its construction sequencing and has major advantages by virtue of its unencumbered site.

The cost estimate for the project assesses the construction risks and include a contingency based on a fixed percentage. It will benefit from the ongoing study and management of these risks, especially with the long planning lead in times.

The funding strategy uses the well proven strategy of forward funding from the existing RAB to fund the initial stages of the project, followed by debt and equity funding serviced eventually from the operating regime at the new airport. The assumptions on the funding required, its timing and cost are all risks that need to be considered further. They are however the same for any airport solution, and the availability of funding, including government investment in any transport infrastructure that other solutions might require cannot be guaranteed at costs identified this early in the process.

For any solution, careful consideration will be needed about the start date and pace of construction expenditure. Theoretically, it would be possible to start on site the day after Development Consent Order (DCO) approval is secured, but this introduces cost risk. Conversely, doing the minimum amount of work to get DCO approval and delaying everything else post decision is the least cost risk option, but could add a couple of years to the start date. The key is to understand the financial and programme implications of a delayed start on site date and balance these against the up-front cost risk. Inherent in this is the risk that the government could delay the project at any time, which would significantly increase the cost. These issues are common to any solution.

Similarly, there is a need to carefully assess the optimum financing strategy for the project. Judgement will be needed to assess how much capital is included in reaching the first financial close for the project. One financing approach is to use several financing rounds over the course of the project's construction period, but in doing so having regard to investors' exposure to refinancing and market risks.

In any long term project there are cost risks that cannot fully be mitigated and must be accepted. Inflation, although low at present for some cost elements, may be a significant factor over the timescale of this project and materials, resources and fuel prices are more than likely going to increase differentially. It is difficult to forecast

general market conditions, which could be favourable, but the cost of environmental and sustainability legislation and regulation is likely to be more expensive in future. Clarity is also needed on who takes the risk of historical environmental contamination.

Whilst the team is confident that the demand for air traffic will grow, there remains a risk around the performance of the airport in relation to traffic volumes and mix, commercial revenues and operating expenditure. These risks can be reduced by developing a supportive regulatory regime.

Whilst these risks will be the same whichever solution is adopted, there are no particular reasons why the Thames Hub Airport is affected by these funding risks more than any other proposal for long term hub capacity. In many regards the freedom for construction that the large site offers is a considerable advantage.

7.4 AIRPORT FUNDING

The team has developed a private sector Regulated Asset Base (RAB) funding approach for the airport that recognises the scale of investment required, the need to minimise public funding and the risks faced by taxpayers and takes account of the delivery timescales needed to build a new airport. A funding model has been developed, and feedback from discussions with government and industry stakeholders has shown that this represents a credible funding solution, although further work is needed to develop the approach. The approach is based on the six principles explained below, in a logical sequence. The numerical estimates in the funding model will be shared with the Airports Commission as the team liaise and clarify the details of the proposal with the Commission over the next few months. It is worth noting that the approach applies to any of the long-term options for additional airport capacity, except expansion at Heathrow.

7.4.1 There can only be one hub.

The inherent nature of airline hub and spoke networks, combined with the UK's small geographic size, means that the country can only support one hub airport. If a new hub airport is built (whether in the Thames Estuary or elsewhere) Heathrow will have to close. Given the value of slots at Heathrow, no one airline would willingly move to a new hub airport if the existing hub, with its high levels of interconnecting traffic, remained open. In addition airlines are increasingly consolidating around alliances. Oneworld (the largest alliance at Heathrow) and Star account for more than 75% of the airport's traffic and neither alliance would move from Heathrow unless they were forced to do so. As a result, the funding model assumes that Heathrow will close when the Thames Hub Airport opens.

7.4.2 Heathrow and the Thames Hub should be regulated as one entity.

Heathrow and the Thames Hub are serving the same airlines and same markets. The construction of Thames Hub can be considered as an extension of London's hub airport capacity and should not be seen as a competitor to Heathrow. The two airports can therefore be treated as a single entity with a combined RAB for the purposes of setting airport charges – this approach was used to fund the construction of Heathrow's Terminal 5. In this way capital contributions from Heathrow towards the construction of Thames Hub can be included within the combined RAB.

7.4.3 Some of the Thames Hub's construction costs can be offset by the sale and redevelopment of Heathrow.

If Heathrow is to close, then the land can be redeveloped and sold, and the money raised used to offset the construction costs of the new airport. In addition some of the value generated around the new airport can be captured and the proceeds used in the same way. At present the owners of Heathrow are unable to capture the value around the airport.

7.4.4 The expenditure peaks and impact on airline charges can be smoothed out over a 20-year transition period.

The construction of a new airport would create a very large spike in capital expenditure and, without any modification to the airport charges regulatory framework, this would lead to an unacceptable increase in landing charges. Charges at such an unsustainable level would be counter-productive in terms of generating more hub traffic by expanding capacity. This spike can be smoothed over a 20 year regulatory transition period, during which there would be significant growth in passenger numbers and, as noted above, proceeds can be used from the sale of the Heathrow site and income generated from property around the Estuary airport. The property income will only be available after the opening of the new airport and subsequent redevelopment of Heathrow, which is why the transition period needs to be extended beyond the opening of the new airport. In order to promote the interests of passengers, the Civil Aviation Act 2012 gives CAA more flexibility in how it regulates airport charges. However the funding approach assumes that the current quinquennial regulatory control period process for setting airport charges continues. The 20-year transition period evenly straddles the 2029 opening date for the Thames Hub and covers four control periods - Q7 (2018 to 2023) through to Q10 (2033-2038).

7.4.5 The investment risks will be borne by a Development Company and not the operating airports.

The construction of a new airport is a much riskier activity than the day-to-day operation of an airport and it would be better managed by creating a third party Development Company (Dev Co). To make a financial return, Dev Co's expenditure needs to be recovered from the capital allowance generated from the regulatory process of setting charges and from the proceeds of property sales. There is a relationship between the level of risk borne by Dev Co and the rate of return that investors in Dev Co would expect to make. Given that the funding will need to be raised on the open market, we have assumed that the return on that money, and therefore on the development risk borne by Dev Co, will need to be unwritten to some degree by Government, to ensure the cost of funding is not too high. When complete the Thames Hub Airport will be operated by an airport operating company (Air Co).

7.4.6 The funding approach must meet the needs of key stakeholders.

Five groups of key stakeholders will be impacted by the closure of Heathrow and the development of the Thames Hub. The funding approach has been developed in a way that meets the needs of all of those stakeholders.

- a. **Heathrow Airport** - Heathrow's shareholders hold a significant level of investment in the airport, which is reflected in the current value of Heathrow's RAB. When Heathrow is closed this investment needs to be recognised and compensated. The shareholders should be offered an equity stake in the Thames Hub, equivalent to Heathrow's closing RAB, or be fully recompensed to the value of the closing RAB. The debt structure behind Heathrow's shareholders is in some cases long-term and the terms of this debt will have to be taken into account in deciding how best to manage the transition period and to compensate shareholders.
- b. **Airlines** - The extra capacity provided by the Thames Hub would allow airlines to significantly grow their UK businesses in a way that would not be possible if Heathrow was not expanded. However in recent years, the airlines have made significant investments in Heathrow's facilities, such as Terminal 5. As a result they are now paying significantly increased landing charges at Heathrow relative to historic levels and comparator airports. The 20-year transition period can be used to minimise the impact on landing charges at the Thames Hub in order to maintain its competitiveness over the transition period and beyond. The airlines will require assurance that there is sufficient surface access, at competitive prices, to serve passengers and the airport's workforce.

During the last years of Heathrow's operation, the quality of the passenger experience must be maintained and not allowed to degrade. This will require a degree of continued investment in the airport. The airlines will also need to very carefully plan the transition of services to the new airport.

- c. **Passengers** - The interests of passengers are aligned with those of the airlines, both in terms of landing charges, which flow through to ticket prices, and surface access. Passengers need to have additional hub capacity to give them the range of destinations and frequencies they require at a reasonable cost. However it must not be at the cost of their convenience and experience during the transition and beyond. The extra capacity at Thames Hub will reduce the demand for runway slots and would be expected to result in lower airport charges, which in turn would feed through into lower air fares. However the airport funding approach assumes that the additional air passengers that can use Thames Hub will help contribute towards the infrastructure costs of the airport. However to remain globally competitive, airport charges at Thames Hub (from its opening in 2029 until 2039) will be held constant, in real terms, based on the level of charges at Heathrow at the end of Q6 (2019). After 2039 standard economic regulation of airport charges would resume, which, due to the additional capacity provided, would be expected to reduce in real terms.
- d. **Local communities and wildlife** - The funding model includes costs that arise from impacts on local communities and wildlife:
- i. Local communities on the Hoo Peninsula impacted by the airport must be treated fairly and property owners whose buildings have to be demolished need to receive appropriate compensation. Plans are also needed to address a number of listed buildings.
 - ii. The number of people impacted by aircraft noise and exposed to poor air quality due to the airport will be significantly less than the population affected by Heathrow. However new populations will be impacted for the first time and they need to be properly compensated through appropriate mitigation.
 - iii. The impact on local wildlife, particularly birds, will require investment for mitigation, to replicate habitats that are lost and to minimise risks from birdstrike in operating the airport. The proposals to provide compensatory habitats would be a major environmental initiative.
 - iv. The planning and design phases of the new airport will need to incorporate a full Environmental Impact Assessment (EIA) to ensure all major issues have been properly identified.
- e. **Government / CAA** - In view of the current economic and fiscal climate, the funding approach minimises the need for public funding and the state's risk exposure. The funding approach is also consistent with the more flexible regulatory approach permitted by the Civil Aviation Act 2012 in order to promote the interests of passengers.

Any proposed project on this scale and at this early stage in its development will include potential operational risks. We have identified five key risks for the Thames Hub Airport and carefully considered the extent to which these risks are real. In each case we have sought expert views and, based on this advice, we have concluded that all of these risks can be managed and suitable mitigation measures put in place.

8.1 SAFETY COMPLIANCE

The Thames Hub Airport would operate in accordance with international aviation safety standards. However a number of specific risks have been identified and we have developed proposals to address and manage these risks.

8.2 RISKS

8.2.1 Bird Strike

The issue of how bird strike risk should be managed has to be comprehensively considered. Bird strikes occur at the majority of airports across the world and between 1998 and 2002, Heathrow had 268 bird strikes, Gatwick 201 and Stansted 109.³³ We have already met, and propose to work closely with, the Environment Agency and other stakeholders, such as the RSPB, to consider a range of options for providing compensatory habitats for birds to address the bird strike risk. We would seek to provide a significant area of attractive new habitat that will encourage large numbers of birds to roost and feed away from the airport. When the airport opens, bird strike management will be an integral and ongoing part of the airport's safety management system. This will involve:

- a. **Habitat management** - This will minimise the attractiveness of the airport and its vicinity to birds. It consists of two processes to deter bird life:
 - i. removing attractive features such as food; security; and breeding grounds; and
 - ii. effectively denying access for the birds. Different habitats attract different species, at different times of the year, and habitat management measures need to be targeted at those bird species that are found close to Thames Hub site. When the airport is operational there will also be a need to avoid creating new habitats in the immediate vicinity of the airport that are attractive to birds.
- b. **Bird control management plan** - These measures will be undertaken by the airport operator and may require the cooperation of local authorities and landowners. It will be important for the operator to detect quickly birds within the vicinity of the airport and employ effective dispersal tactics. These may include visual, acoustic or lethal methods and may involve the use of mobile patrols.

8.2.2 Fog

We have carried out a preliminary assessment, using different meteorological datasets and reports, about the incidence of fog and restricted visibility conditions at London's airports and in the Thames Estuary. However some of the datasets are old and may not reflect current meteorological conditions. Therefore we believe a substantive study, based on more recent Met Office data, is needed to assess the relative incidence of fog in the Thames Estuary compared to other airport locations.

Occurrences of fog at airports are addressed by using navigational aids. Aircraft at the Thames Hub Airport would, as at most modern airports, operate under Instrument Flight Rules. To facilitate full airport operability under low visibility conditions, Thames Hub Airport would be equipped with state-of-the-art navigational systems. This would ensure unimpeded aircraft movements and safety, with the airport operating to ICAO CAT II/III standards.

8.2.3 LNG plant

The Thames Hub Airport will impinge on National Grid's Liquefied Natural Gas (LNG) facility at Grain. An airport located near an LNG plant would not be exposed to any greater hazard from that plant than would any other commercial or industrial land use, and there have not been any incidents at an LNG plant that have affected UK airports. However the LNG plant would, in principle, be exposed to the risk of an aircraft impacting on the facility. An assessment of this risk needs to be carried out for the Thames Hub based on HSE relevant guidance.³⁵ However based on past experience of Public Safety Zone assessments, which follow similar principles, the risk of such an incident occurring appears likely to be very small. While the consequences of an aircraft impact on an LNG facility would be severe, there have been no such incidents in the UK. From the team's discussions with National Grid, it is understood that the LNG plant will be life expired by the time the airport opens in 2029. Therefore an option exists for the LNG facility to be relocated to an alternative location.

³³ The Thames Estuary Research and Development Company (2009): Thames Estuary Airport Feasibility Review <http://testrad.co.uk/wp-content/uploads/2012/08/TEAFRreport.pdf>

8.2.4 SS Richard Montgomery

The SS Richard Montgomery is a US World War II Liberty ship that sank in 1944 off the coast of Sheerness, about three miles to the east of the Thames Hub site. The hull lies about 15 metres under water and contains around 1,400 tons of high explosives. This poses a significant threat to the local community, to shipping in both the Medway and Thames Estuaries and to London. The wreck lies in a prohibited area, close to one of Europe's busiest shipping lanes, and is constantly monitored by the Maritime and Coastguard Agency (MCA). The latest MCA report in September 2011 states that³⁶:

- a. regular surveys have shown that the hull is reasonably stable, although the hull and the explosives themselves are degrading; and
- b. although there are many unknowns, expert opinion has suggested that the munitions cargo is likely to be stable if left undisturbed.

However, it has always been recognised that there may come a point when the risks associated with non-intervention will become greater than the risks associated with a carefully planned intervention operation. Munitions experts have advised us that the wreck will have to be dealt with at some point, irrespective of whether or not the Thames Hub Airport is built. While we do not believe construction of the Thames Hub Airport will have any impact on the wreck, we recognise its perceived threat to the proposed airport and local communities. Therefore we recommend that further studies are undertaken, led by the Government, to determine what interventions should be considered and when they should be carried out.

8.2.5 Airspace

Airspace is often the forgotten factor when considering airport developments, yet it is a crucial element, with airspace in South East England already among the most complex in the world. As part of Eurocontrol's SESAR programme, a great deal of work is ongoing to restructure airspace across Europe and to introduce new technologies that will significantly increase the capacity of air traffic management systems.

We have met and discussed with NATS, who confirmed that in terms of air traffic management anything is possible and that a Thames Hub Airport could be accommodated. However there would be significant impacts for other airports in the region and the eastern boundary of UK airspace. Belgian and Dutch airspace – and the proximity of Schiphol and Brussels airports – means that climb and descent profiles would be affected, which would require international cooperation to resolve.

A feasibility study would be required to assess the full air traffic management implications by addressing the following issues:

- a. Establish design assumptions for the airport (such as four parallel runways, projected Air Transport Movements (ATMs), 24hour operations);
- b. Assess planned airspace in the Thames Estuary vicinity (by modelling of Thames Hub traffic patterns, implications for capacity at remaining London airports);
- c. Determine the size of the Radar Manoeuvring Area (RMA) required;
- d. Analyse potential implications for ascent/descent trajectories and their interaction with other airports, coupled with an environmental assessment of these new routes;
- e. Overlay existing / future plans alongside the Thames Hub Airport proposal, based on SESAR principles and the EU's Single European Skies requirements;
- f. Assess the knock-on impacts for the wider UK / European air traffic network;
- g. Determine transition arrangements and assess 'in tandem' operations with other airports;
- h. Assess ground environment issues (this would include proximity to built up / populated areas and would require Third Party Risk modelling, noise and air quality assessments); and
- i. Assess proximity to conservation and wildlife areas, coupled with localised risk assessments (e.g. bird strikes, ground obstacles etc.).

³⁵ HSE (2012): Failure Rate and Event Data for use within Risk Assessments (28/06/2012) <http://www.hse.gov.uk/landuseplanning/failure-rates.pdf>

³⁶ Maritime and Coastguard Agency (2011): SS Richard Montgomery Surveys 2008 & 2009: Summary Report <http://assets.dft.gov.uk/foi/dft-f0007971/f0007971-summary-report.pdf>

The four runway Thames Hub Airport can be opened by 2029, the same year as Heathrow's recent proposals for a third runway.³⁷ The delivery timetable, involving the planning, construction and operational readiness and transition phases, has been developed as an integral part of the private sector funding model for the Thames Hub Airport. The delivery timetable is set out below.

Date	Milestone
2015 Summer	The Airports Commission recommends a preferred long-term option for the UK to maintain its global hub status
2015 Autumn	The Government confirms the Commission's recommendation
2017 Summer	An Aviation National Policy Statement is designated following consultation and Parliamentary approval
2018 Summer	DCO application for new airport submitted (with pre-application work, including environmental impact assessment and consultation, taking place from Summer 2015 onwards)
2020 Spring	DCO decision, if statutory deadlines are adhered to
2022 Summer	Construction commences
2029 Spring	ORAT phase
2029 Autumn	The Thames Hub Airport opens with a capacity of 110mppa. Services are transferred from Heathrow and its redevelopment begins
2030	Heathrow site remediation complete
2032	First phase of redeveloped Heathrow site opened

Figure 16: Thames Hub Airport delivery programme.

It is worth noting that the planning phase up to 2022 will be the same for any of the long-term proposals to expand hub airport capacity. In terms of the construction phase, we estimate that the Thames Hub Airport (with four runways) would take the same time as the development of a third runway at Heathrow. This is because the Thames Hub Airport would be built on a greenfield site, without any of the constraints on the construction programme for expanding an operational airport.

9.1 TRANSITION

We have allowed for a minimum period of six months for ORAT (operational readiness and transition) although single system trials will be programmed to overlap with the final elements of construction. All the final commissioning of the construction will be complete by this stage to allow the operational staff full access to the facility. The main surface access links will be open by this stage so that the staff who will need access to familiarisation, training and trails can reach the airport. Without an adequate ORAT period it will be impossible to open the airport successfully.

While many jobs will be able to relocate to the new hub airport, there will be job losses in West London due to Heathrow's closure. New employment opportunities will be generated by the redevelopment of the Heathrow site as a commercial and residential centre, but it will take time for these to appear.

9.2 MITIGATIONS FOR DELIVERY RISKS

Any airport solution will have significant risks associated with its planning and implementation. Many of these are inherent in the political decision making process, and the Airports Commission is a vital component in ensuring cross-party support for the delivery of additional hub airport capacity, irrespective of location.

Any solution will have a large number of stakeholders with competing views, fears and aspirations. It will be inevitable that there will those who oppose, either in full or in part, the proposition and will seek to delay and disrupt it. The scale of the undertaking may benefit from having a unique authorisation process developed to accommodate it. However recent planning legislation and regulation has been specifically set up to enable major projects to be approved and this has proved workable with other projects.

Delivering an airport on the scale of the Thames Hub Airport is a major undertaking and the risks associated with its delivery are significant, but well understood from other projects. Airport construction on this scale has taken place across the world in the last few years, with the world's largest airport currently under planning for construction in Istanbul. While such projects represent major challenges of scale, resources and logistics, few have experienced significant delay or cost escalation in their construction. A lot of the consultants working on these projects are based in the UK.

³⁷ In January 2009 the Department for Transport confirmed that a third runway at Heathrow could open 11 years later in 2020. DfT (2009): Britain's Transport Infrastructure - Adding Capacity at Heathrow: Decisions Following Consultation http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/15_01_09decision_doc.pdf

The risks in constructing a new airport lie mostly with the ground works, where basements are required, and in mechanical and electrical services required.

The proposal will require considerable work in the construction of the platform, not least due to the scale of the land reclamation and earthworks required. However, this type of works is not uncommon and is successfully carried out around the world on a far larger scale. Early advice has been sought from the world's largest dredge fleet operators to ensure our assumptions are realistic.

The costs and timescales for above ground civil engineering work are easier to forecast and can be delivered using an Engineering, Procurement and Construction (EPC) contract, which would significantly reduce cost and project delay risks. Airport terminals and their transportation systems include a large proportion of mechanical and electrical equipment and its design, integration and commissioning is a recognised challenge. However, improvements to this type of equipment tend to be small and incremental and there are no fundamental systems involved in airports that could be viewed to present a significant technological risk similar, for example, to that of introducing a new signalling system for a high speed railway.

There are of course many logistical challenges in building a new airport anywhere in the UK, including access for construction materials, availability of resource and their accommodation and the potential for disruption to the local area. None of these, however, are insurmountable and the development of the Olympic Park for the London 2012 games has shown that UK construction is more than capable of dealing with these. Further, the estuary location of the Thames Hub Airport will enable maximum use to be made in transporting materials and equipment by water to the site.

Constructing an airport presents one set of challenges and experience tells us that making it operable is at least as challenging. The Thames Hub Airport will also have risks related to its transfer from Heathrow and in the logistical requirements for that to occur seamlessly. However, there are numerous recent examples of new airports being constructed and made ready extremely efficiently. The efficient transition to the new Hong Kong Airport is an excellent example and was project managed by British firms. A clear advantage of the Thames Hub Airport is the ability to construct and start operations in an environment that is not constrained by an operational airport and can be brought on line gradually.

The team recognises that there are significant risks to the construction and operation of the new airport, but there is nothing that suggests that this cannot be achieved within the projected cost and time parameters. The construction methodologies, technologies and resources are all tried and tested and should be confidently achievable.

9.3 TIMING

A project of this scale would clearly take a considerable time to plan and construct particularly given the timescales required for reclamation works and subsequent settlement of airport platform material. The development would need to be phased in a manner reflecting both construction constraints and the primary aim of providing airport capacity to meet evolving demand. Passenger terminal capacity and aircraft stands can be provided in relatively small increments to match demand growth, but runways represent large increments of capacity. There are also constraints on the proximity of ongoing construction to operational runways and other areas, which phasing must take into account.

Further details about the proposal can be obtained from the Thames Hub website:

www.thameshub.com

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Figure 17: Aerial view of Thames Hub Airport and London by night.