# London Airspace Consultation
# Part F

## Proposed changes to London City, London Biggin Hill and London Southend routes above 7,000ft over parts of Kent, Essex and Suffolk

**Contents**

## 1 Introduction

1.1 This part of the consultation document relates to proposed changes to London City Airport arrival and departure routes through the network airspace (above 7,000ft[1]) extending across parts of eastern and southeastern England. It also addresses some changes to routes for Gatwick, London Biggin Hill and London Southend airports that use the same network airspace.

1.2 These changes have potential effect across the geographic area outlined in red in Figure F1. Figure F1 also shows the neighbouring areas being considered in this consultation. If an area of interest is on, or near, a boundary between two parts, then consideration should be given to the consultation material covering both areas. You may also wish to use our postcode search facility at www.londonairspaceconsultation.co.uk which will automatically highlight the parts of the consultation document most relevant to that postcode.

1.3 The design and performance of the airspace in this region is primarily of importance to the efficiency of the overall air traffic network, rather than the local operation of London City Airport. This part of the consultation is therefore sponsored solely by NATS.

1.4 Any changes to routes below 4,000ft are the responsibility of the relevant airport. London City Airport is in the process of determining how to best modernise its existing routes below 4,000ft in line with FAS and the forthcoming European requirement for PBN routes (see Part A for details); their intention is to match the position of today's flight paths as closely as possible so as to minimise change. Once this is complete, London City Airport will engage with local stakeholders to explain the benefits of PBN in the vicinity of the airport, but as their investigations are on-going they are not co-sponsoring this London Airspace Consultation.

1.5 The changes to routes above 4,000ft proposed here will be more effective if they feed into/from a PBN route structure below 4,000ft, however, they would still be beneficial, and could be implemented, without any low level changes.

1.6 NATS and London City are working together to ensure that the changes above 4,000ft and below 4,000ft are coordinated, and whilst the preceding paragraph describes the contingency arrangements, it is our current intention to draw the two strands of work together in a joint submission to the CAA in the latter part of 2014.

1.7 Low altitude changes at London Biggin Hill Airport would also complement the airspace being proposed here, and whilst optimising the PBN system will require PBN routes at low altitudes for London Biggin Hill, their relatively small traffic numbers means that their impact on overall efficiency is significantly less than London City. London Biggin Hill does not, at this stage, intend to modernise their low altitude routes.

[1] All altitudes stated in the consultation document are above mean sea level

1.8 NB London Southend airport is independently developing a separate airspace change proposal focused on low altitude airspace in the vicinity of the airport; consultation on their plans is on-going. Their consultation affects some of the same geographic areas covered in our London Airspace Consultation. We would encourage you to go to www.southendairport.com for details of proposals being generated by London Southend Airport, in addition to considering/responding to our consultation.

1.9 Other air traffic flows, such as Heathrow departures, may also use some of the airspace at higher altitudes over the red outlined area in Figure F1. This proposal is not considering changes to any flows in this area other than those listed in paragraph 1.1. Should any changes be sought for the other flows they would be subject to separate design and consultation at a later date.

1.10 Part A of the consultation document should be read first, as it sets the context for the proposed changes and for the consultation, including a description of the design objectives for airspace change at various heights and what will happen after this consultation.

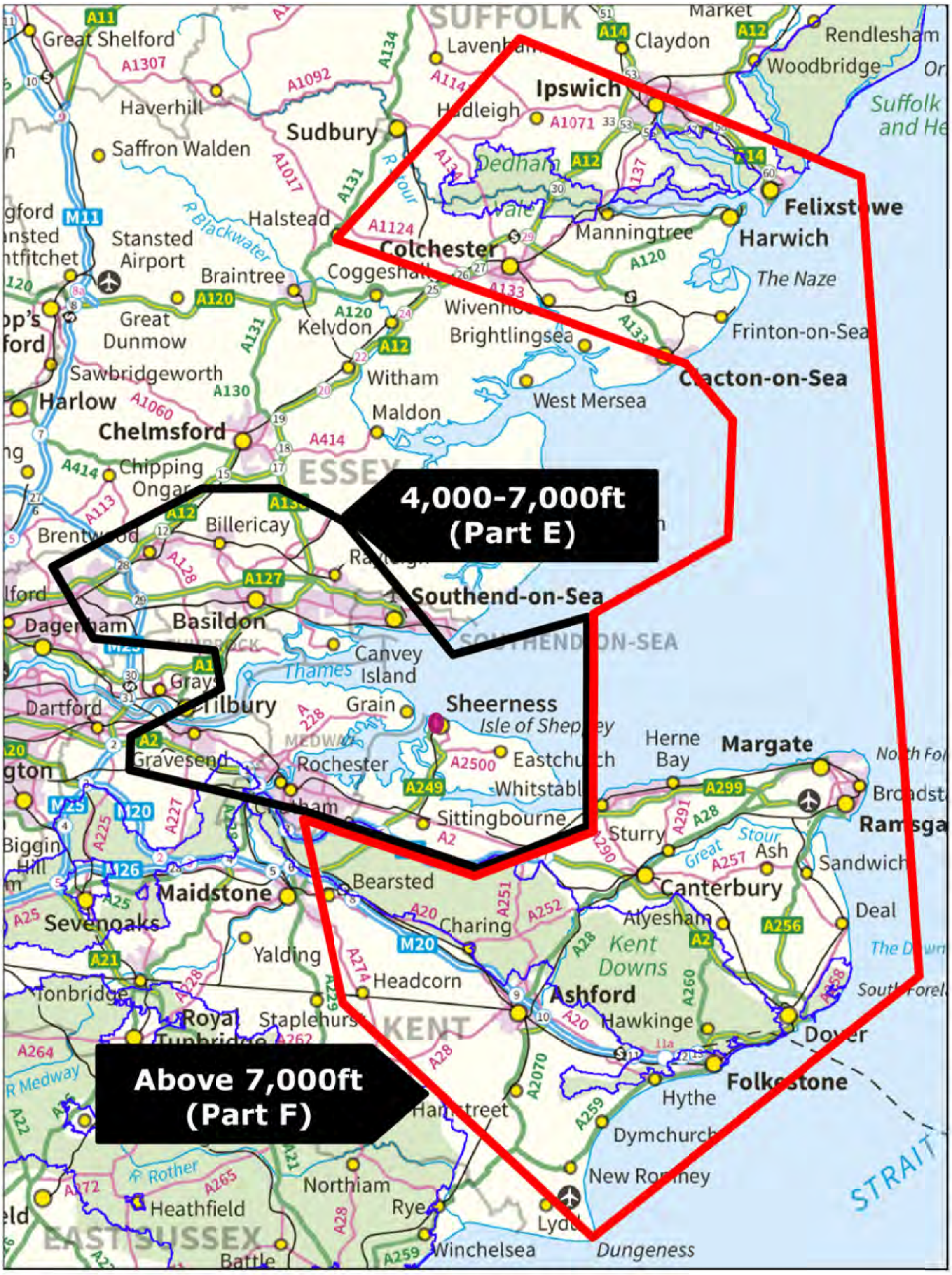




**Figure F1: Consultation areas for Part F**

1.11 Considerable care has been taken to make this consultation accessible to anyone who may wish to respond. The design and operation of airspace is, by its nature, a complex and technical issue. In order to help readers fully understand the rationale behind the changes being proposed we have, where we feel it appropriate and necessary, gone into some technical details and used relevant terminology. Any technical terms used are summarised in a glossary at Appendix B.

1.12 We aim to provide an understanding of the potential effect of the proposed changes; and to provide an opportunity to feed relevant information into the on-going design process.

1.13 In Part F, in relation to proposed changes in the red-outlined area in Figure F1 (above), we address:

- *Today's airspace usage*; this section provides a description of today's flight paths including maps of where they are generally seen
- *The objectives and justification for the proposed changes*; this section describes the kind of route system we are seeking to implement and the potential benefits and impacts. At this stage, we cannot say exactly where the local benefits and impacts will be, so with respect to our objectives we ask you to consider and feedback on the generic effects of the proposed changes rather than impacts on specific places
- *Local considerations for route positioning*; this section describes potential local effects. It asks for your feedback on any location that requires special consideration in the on-going design process, and why we should consider it special. This will help us assess the effects of various design options and identify an optimal solution

1.14 Part G of the consultation document provides additional detail on some of the subjects covered in Part F which may be of interest, but is not required to answer the questions. References to Part G are provided (generally via footnotes) where it provides additional information.

1.15 Questions are highlighted within this document in yellow. You can answer these using the online questionnaire at www.londonairspaceconsultation.co.uk or via the postal address provided in Part A.

## 2 Today's Airspace Usage

2.1 Today's flight paths for London City arrivals and departures are illustrated in Figure F2. This shows the average number of flight paths that overfly the area of interest. Figure F3 shows the same information with Areas of Outstanding Natural Beauty (AONBs) and National Parks highlighted.

2.2 The arrows on Figures F2 and F3 illustrate the general direction of the predominant air traffic flows; black arrows show London City Departures to the south and white arrows show London City and Biggin Hill Arrivals from all directions. For details of intermediate altitude traffic flows see Part E.

2.3 These plots show all flights, not just those above 7,000ft. We have not limited the altitude of the plots because aircraft below 7,000ft may be noticed in and around the area of interest, and because we want to give you a sense of the overall traffic pattern – where flights are going to and coming from.

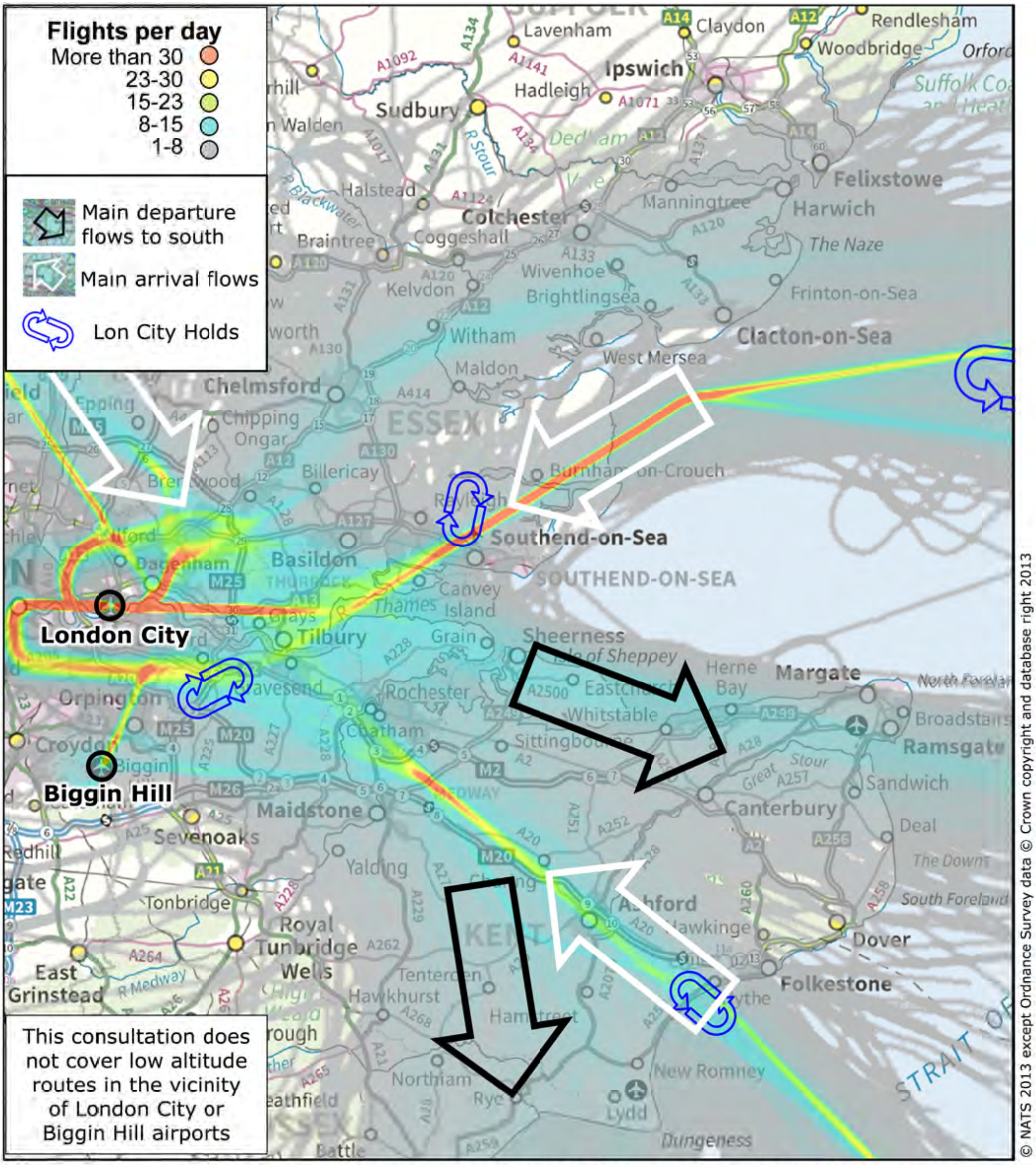


**Figure F2: London City and Biggin Hill flight paths (the traffic sample shown covers both Runway 09 and Runway 27 operations at London City Airport)**

The shading on these maps has been optimised for viewing on screen. All maps are available to view on the website at www.londonairspaceconsultation.co.uk where you can also zoom in on maps and switch easily between the current day traffic picture and the consultation swathes for the new routes.

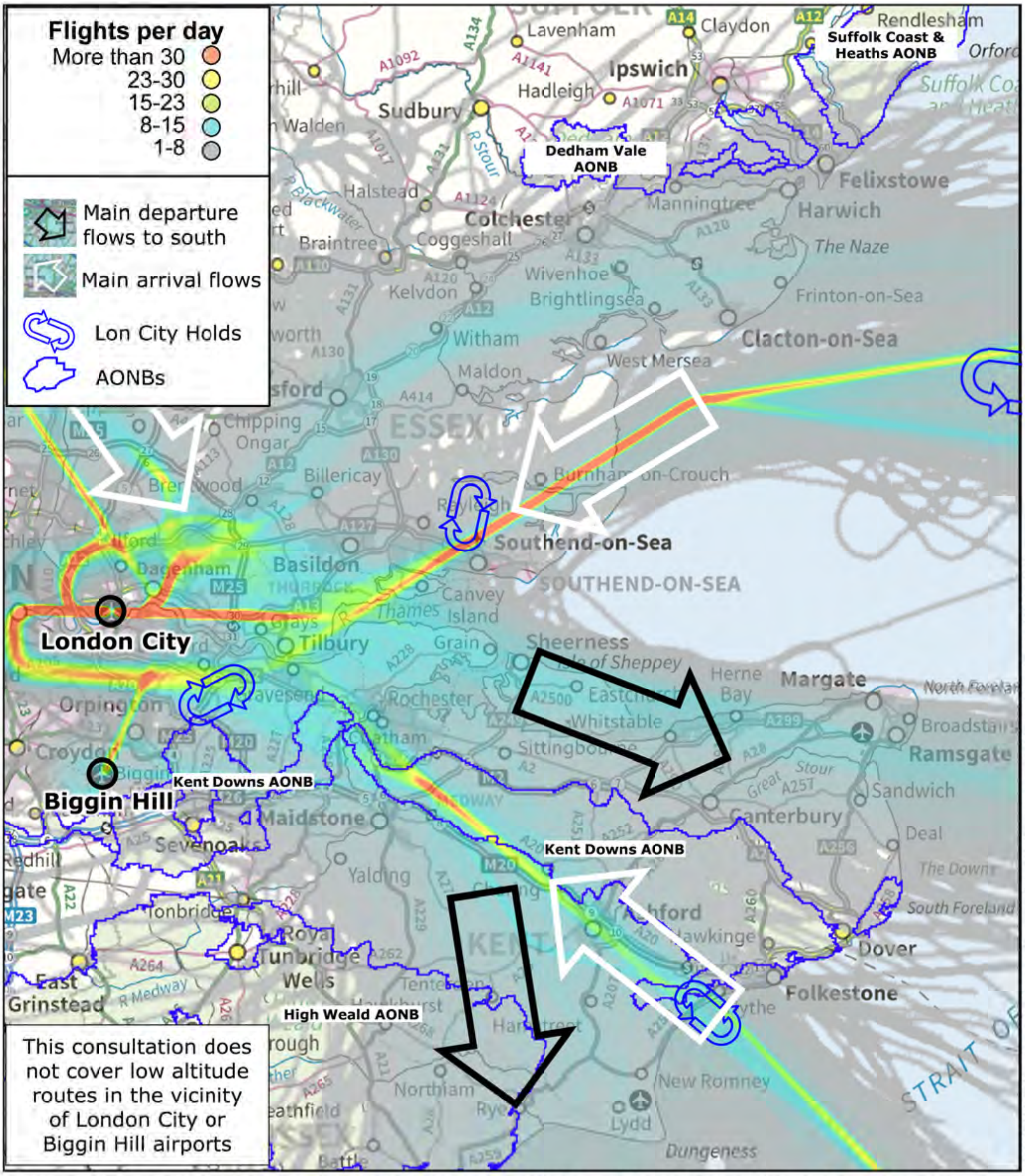




**Figure F3: London City and Biggin Hill flight paths with AONBs shown (traffic sample shown covers both Runway 09 and Runway 27 operations at London City Airport)**

The shading on these maps has been optimised for viewing on screen. All maps are available to view on the website at www.londonairspaceconsultation.co.uk where you can also zoom in on maps and switch easily between the current day traffic picture and the consultation swathes for the new routes.

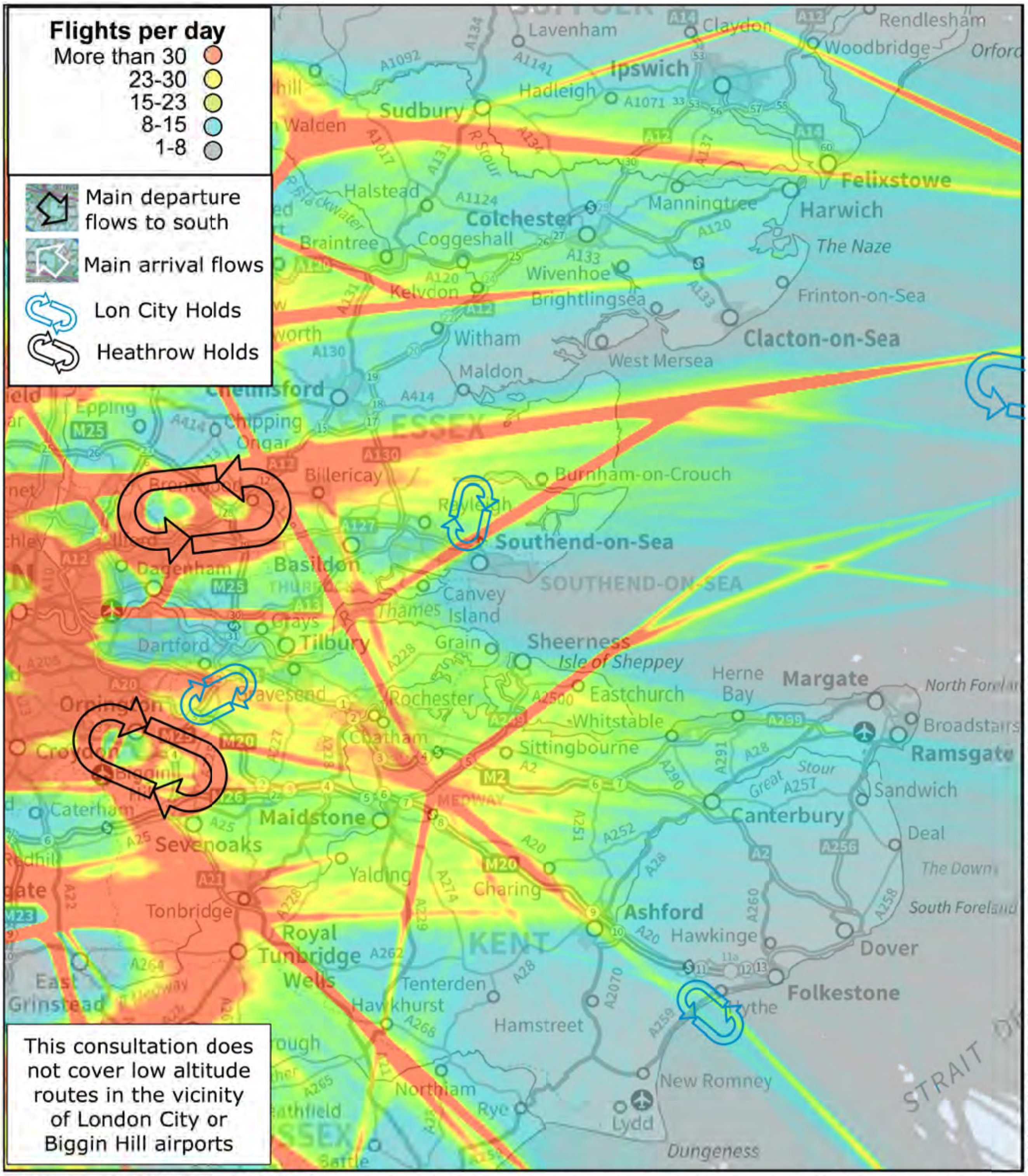




**Figure F4: All aircraft flight paths (the traffic sample shown covers both Runway 09 and Runway 27 operations at London City Airport)**

The shading on these maps has been optimised for viewing on screen. All maps are available to view on the website at [www.londonairspaceconsultation.co.uk](http://www.londonairspaceconsultation.co.uk) where you can also zoom in on maps and switch easily between the current day traffic picture and the consultation swathes for the new routes.

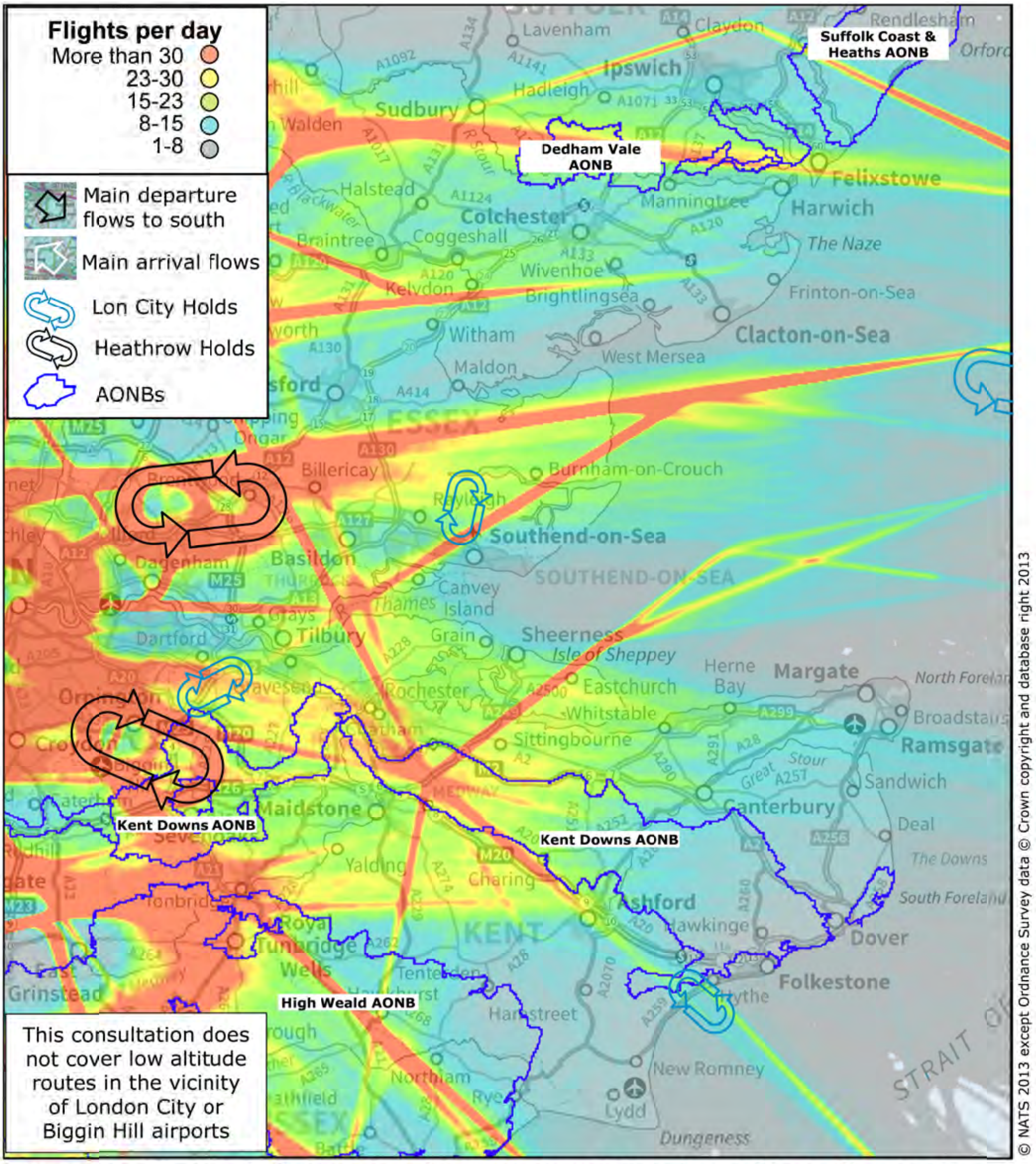


**Figure F5: All aircraft flight paths with AONB boundaries shown (the traffic sample shown covers both Runway 09 and Runway 27 operations at London City Airport)**

The shading on these maps has been optimised for viewing on screen. All maps are available to view on the website at www.londonairspaceconsultation.co.uk where you can also zoom in on maps and switch easily between the current day traffic picture and the consultation swathes for the new routes.

Figures F4 and F5 show flight paths for all the flights in the region, including those to/from Heathrow, Gatwick, Stansted and Luton airports, all of which are significantly busier than London City; again we have provided this information because this other traffic may be noticed, and so that you can understand the overall traffic pattern. You will see that no overland areas in the region are completely free of aircraft flying overhead.

2.4 We have provided additional detail in Appendices to the consultation document:

- Appendix C provides a pictorial overview of the route network and air traffic flows over London and the South East
- Appendix F provides a series of maps showing the location of flight paths at various altitudes
- Appendix H provides detailed tables of current and forecast route usage
- Appendix I provides details of the traffic samples used to create the maps in this section

2.5 The way in which the airspace route system works means that changes in one area can have a knock on effect across a much wider area. Understanding the benefits of the changes we are proposing in the network above 7,000ft therefore requires an understanding of how the network affects routes at all altitudes. This section describes key characteristics of the London City and London Biggin Hill route system as it is today.

**Today's London City Arrivals**

2.6 Air traffic control sort arriving aircraft into an efficient stream or 'sequence' of aircraft for landing during busy periods. An efficient sequence is where aircraft are safely spaced, ensuring the runway is fully utilised and that flights are not unnecessarily delayed in the air.

2.7 Ensuring that the spacing between aircraft is optimal reduces the time aircraft spend queuing to land; in turn this reduces passenger delay, $CO_2$ emissions and the local noise/visual impact of aircraft spending more time in the air than necessary.

2.8 This process is usually facilitated through the use of holding stacks where aircraft can circle above one another while waiting to land[2]; these are generally referred to as 'holds'. The published holds for London City arrivals from the north, west and east are currently over Swanley at 3,000ft and over Southend at 4,000ft and 5,000ft[3]. They were established in the 1980s when traffic levels were much lower than today so they were developed primarily as a contingency. Regular use of the holds was not expected and therefore they are limited in terms of the numbers of aircraft they can accommodate; in addition regular use can affect the efficiency of the system as a whole.

[2] A short video including an explanation of holding is available on the consultation website at www.londonairspaceconsultation.co.uk.
[3] There is also a contingency hold over the North Sea; however this is too far away from the airport to be used regularly.

2.9 The existing arrangements mean that, when aircraft are queuing to land at London City, air traffic controllers can rarely rely on using the holds alone. Instead they have to issue variable, often complex, navigation instructions (known as ‘tactical vectoring’ or ‘vectoring’) to aircraft, in order to queue them at relatively low altitudes (3,000ft or 4,000ft) over parts of London.

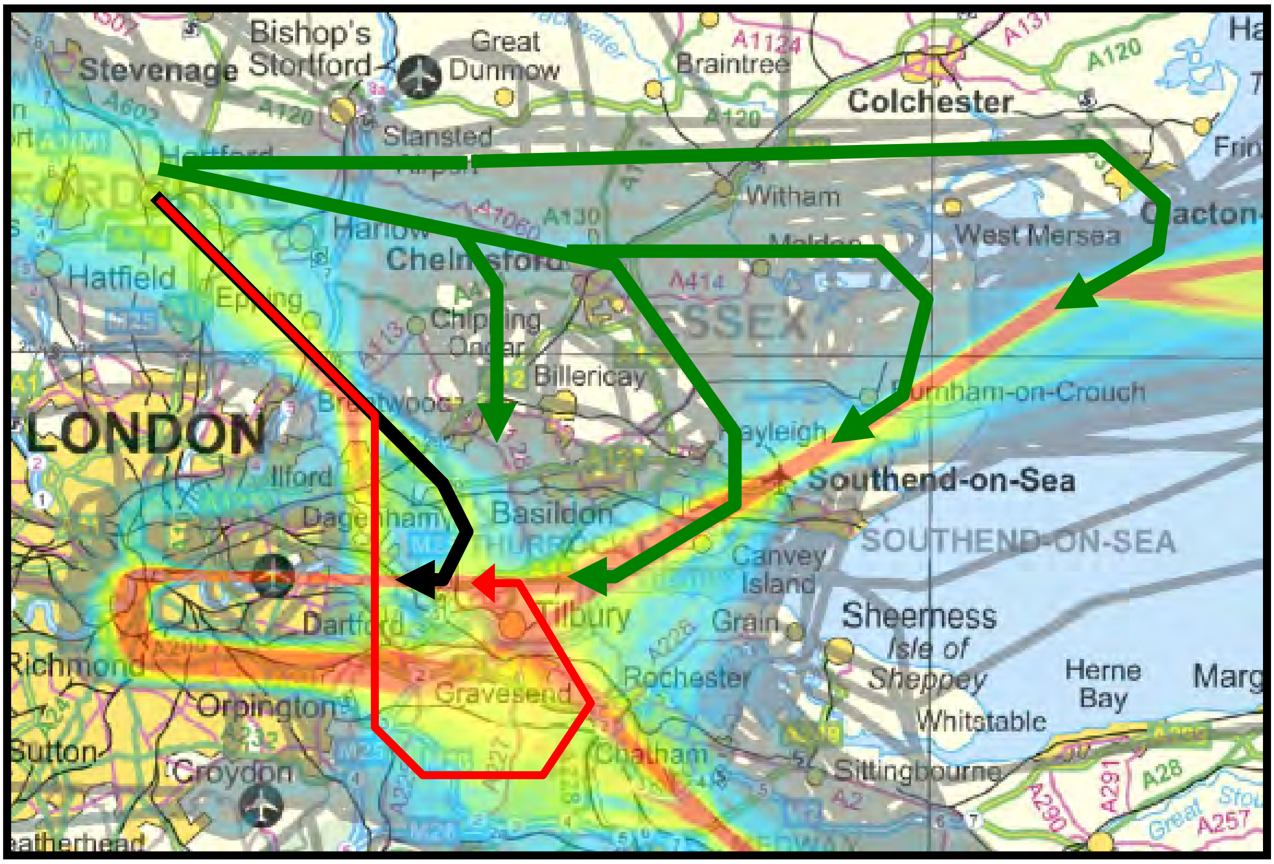




**Figure F6: Examples of flight path variation for arrivals from the north and west**

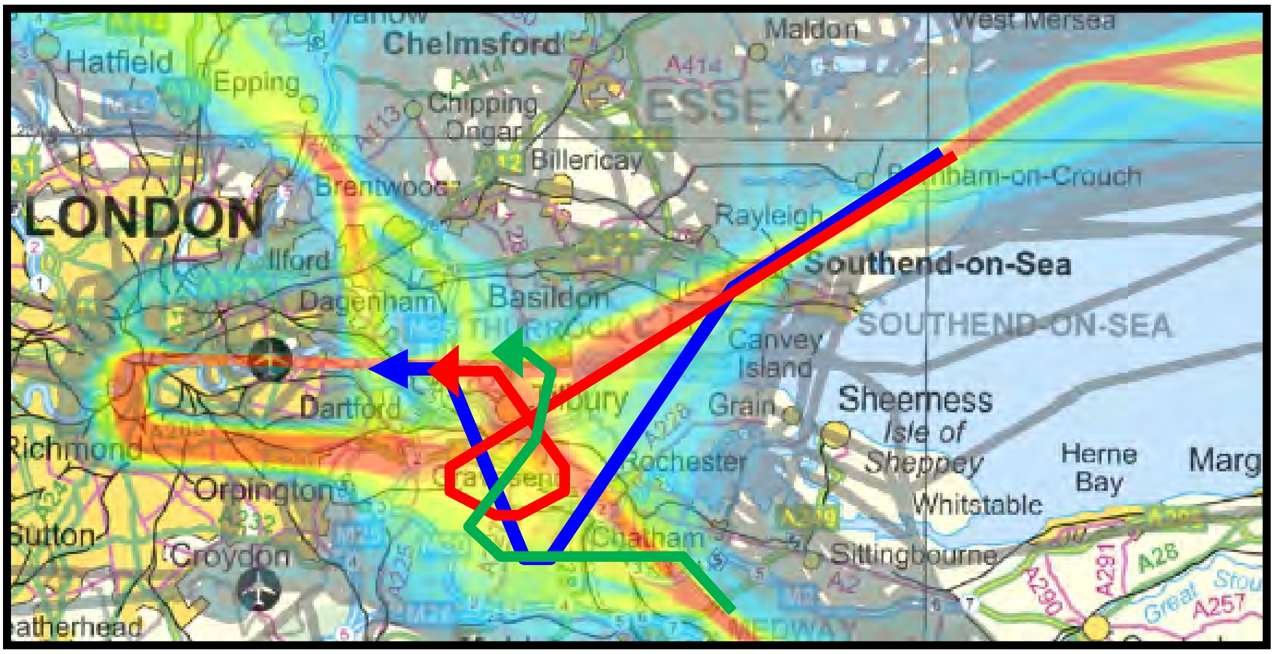




**Figure F7: Examples of flight path variation for arrivals from the east and south**

The coloured arrows on both these figures illustrate the variation in flight paths for London City arrivals. The dotted lines in Figure F6 represent flight paths that are occasionally used.

2.10 This means that today's arrivals for London City do not follow a single flight path and can be spread over a wide area – shown by the coloured tracks in Figures F6 and F7 which are illustrations of actual tracks that have been flown by aircraft queuing to land at London City Airport.

2.11 These figures show that much of the vectoring for London City arrivals takes place over southeast London where the aircraft are flying level at 3,000ft or 4,000ft (rather than descending, which is generally a quieter operation). The background plots to Figures F6 and F7 show 2008 traffic patterns before the economic downturn. While current traffic levels do not require as much low altitude vectoring as then, it still occurs today on a regular basis. 2008 plots have been shown to illustrate how, without change, the density of low altitude traffic over east London will increase as traffic levels recover and pass previous peaks.

**Today's London City departures**

2.12 Currently, London City southbound departures initially have to turn north after take-off. They then turn east and eventually south to cross the Thames Estuary in the vicinity of Canvey Island.

2.13 The departure routes take them through congested airspace which often leads to them being kept at low altitudes. This is because they initially have to keep below the heavy flow of Heathrow arrivals (seen on Figure F4 as the red areas over central and north London). They can then get caught beneath London City arrivals coming from the direction of Southend, seen in Figure F2 but best illustrated in Figures F6 and F7. This means that the southbound departures are regularly kept as low as 4,000ft until they have crossed the Thames Estuary.

**Traffic to/from other airports**

2.14 London Southend Airport uses the same arrival routes as London City through network airspace, but they are generally vectored off the route system towards the Southend runways once below approximately 5,000ft. Southend departures do not utilise the same departure routes as London City departures, but do operate at lower altitudes above some of the areas shown in Figure F1.

2.15 London Biggin Hill arrivals use the same route system as London City arrivals down to approximately 4,000ft, from where they are vectored towards the relevant runways. Descriptions of the London City arrival route system and flight paths above 4,000ft should therefore be assumed to refer to London Biggin Hill arrivals also. London City airport is, however, much busier; approximately 90% of the traffic on this route will be for London City and only 10% for London Biggin Hill. Changes to London Biggin Hill departure routes are not within the scope of this consultation.

2.16 Figures F4 and F5 show that traffic to/from other airports may be seen overflying these areas, in particular Stansted and Heathrow departures, although these aircraft are mostly at higher altitudes. We are not proposing changes to any of these other traffic flows at this time.

2.17 Changes to London Southend arrival and departure routes below 7,000ft are not within the scope of this consultation. Where London Southend traffic is likely to utilise the network airspace above 7,000ft, we are considering it alongside the London City traffic that would share the same route structures.

## 3 Objectives and Justification for Proposed Changes above 7,000ft

3.1 This section describes our objectives for changing the routes used by London City and London Biggin Hill air traffic. It describes what we are trying to achieve and the generic benefits/impacts that would result; we then seek your view on these objectives. Specific local considerations are discussed in Section 4, while fuel burn implications for specific routes and effects on specific aviation users are discussed in Part G.

3.2 We have been working for some time on developing the best approach for using PBN[4] to improve the way in which we manage air traffic. The conclusion of this work is that a system based on 'Point Merge' for London City and London Biggin Hill arrivals can best realise the benefits available from PBN.

### Point Merge for London City and London Biggin Hill Airports

3.3 Point Merge is a system by which the aircraft in a queue to land fly an extended flight path around an arc, instead of holding in circles or being vectored to extend their flight path at low altitudes. They fly along the arc until the next slot in the landing sequence is free, at which time air traffic control (ATC) will turn the aircraft off the arc into the landing sequence. Extending the flight path in this way means that aircraft queue one behind another at higher altitudes, rather than one above another in a hold or in unpredictable patterns at low altitudes (as shown in Figures F6 and F7 and described in paragraph 2.10). Arcs from opposite directions are separated vertically by 1,000ft.

3.4 The Point Merge structure shown in Figure F8, with arcs ranging from around 15 to 40 nautical miles[5] long, will need to be positioned into the consultation swathes discussed later in Section 4.

3.5 The appropriate size and precise location for the Point Merge arcs will be determined through the detailed design process to be undertaken following consultation.

3.6 Figure F8 is provided as background information. Should you wish to understand more about Point Merge, further technical information may be found at:
www.eurocontrol.int/eec/public/standard_page/proj_Point_Merge.html

[4] See Part A for an overview of modern navigational technology (referred to as PBN) and its relevance to this proposal.
[5] Aviation measures distances in nautical miles. One nautical mile (nm) is 1,852 metres. One road mile ('statute mile') is 1,609 metres, making a nautical mile about 15% longer than a statute mile.

3.7 Holds are still required as an overflow for the Point Merge system; however, they would be used less often and could be at higher altitudes than the holds in place today.

3.8 The generic benefits of the proposed system based around the introduction of Point Merge for London City and London Biggin Hill arrivals are:

- Enhanced safety
- Reduced delays
- Reduction in the area regularly overflown at lower altitudes
- Reduction in stepped descent
- Reduction in stepped climb
- Reduced average fuel and $CO_2$ per flight

3.9 Point Merge will change the local noise and visual impacts of aviation as it will change the spread of flight paths across the sky from what is seen today; some areas may be overflown more, others less and some will not notice any significant change. Other than this potential change in local effects, which may be positive or negative, we are aware of no other detrimental environmental consequences.

3.10 The potential benefits and impacts of Point Merge are not limited to the airspace above 7,000ft; it has knock-on implications to the operational and environmental performance of the surrounding airspace, in particular the routes at lower altitudes that feed air traffic from the Point Merge system to the runway. This section describes the generic benefits and impacts of Point Merge, focussing on the area above 7,000ft but also highlighting where there are benefits to the wider system. Further details of operational benefits and issues are also provided in Part G.

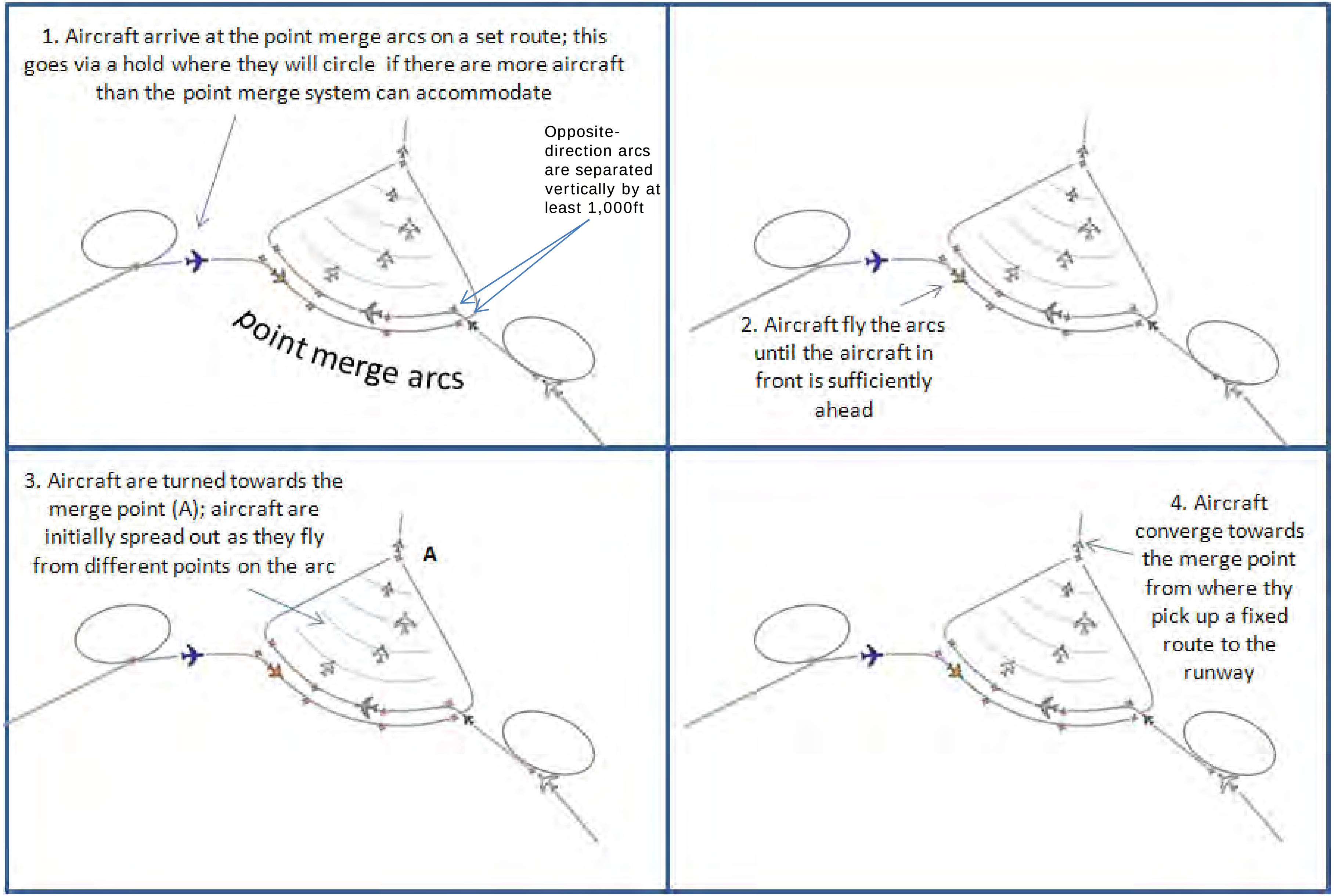


**Figure F8: An illustration of Point Merge**

**Point Merge enhances safety**

3.11 Holds and the associated vectoring required to develop the landing sequence (see Section 2) are a particularly complex operation. Although it is complex, this system has been in use worldwide for many decades. It is, however, generally accepted that a reduction in complexity will enhance safety. Point Merge is a more predictable system where the aircraft flight paths are less complex; its introduction therefore offers the opportunity to further enhance the safety of the air traffic network.

**Point Merge reduces delays**

3.12 The number of aircraft that air traffic controllers can manage in any given hour is limited for safety reasons – complexity is a key factor that determines what the limit is for a given sector of airspace. Once it is predicted that the limit will be reached, additional flights due to pass through the sector are delayed until such time that they can be safely accommodated.

3.13 Point Merge helps sort the air traffic into an efficient sequence at higher altitudes, reducing the complexity of the operation and therefore increasing the number of aircraft the controller can safely handle. This is referred to as an increase in the airspace capacity which also means a reduced likelihood of delay for arriving aircraft and their passengers.

3.14 Delay was becoming a significant issue until the economic downturn in 2008 depressed traffic levels. Air traffic levels are now recovering, albeit slowly, and without a change to the way in which air traffic is managed we will see an increase in delays as traffic levels grow.

3.15 Testing has shown that the improved system efficiency that Point Merge enables will be able to accommodate forecast air traffic growth[6] to 2025 without significant delay. NATS operates under the terms of our Air Traffic Services Licence, which requires us to be capable of meeting, on a continuing basis, any reasonable level of overall demand for air traffic control services. Airspace change is required to accommodate growing demand; growth in the overall number of flights is therefore assumed with or without this proposed airspace change.

[6] The forecast growth used to underpin the analysis presented in this document can be found at Appendix H.

### Point Merge reduces the area regularly overflown at lower altitudes

3.16 Today's holding and vectoring results in variable flight paths at intermediate and low altitudes. This means that aircraft flight paths at these altitudes are spread over a wide area as described in Section 2.

3.17 Point Merge not only provides a queuing area, it also helps ATC sort the aircraft into an efficient sequence at higher altitudes than today (above 6,000ft compared to the vectoring which occurs today at 3,000ft to 4,000ft). In turn this means that the flight paths to the runway can be flown more consistently, with distinct environmental benefits:

- The spread of traffic is much less, so the extent of the area where aircraft are regularly flying directly overhead is smaller - this is in line with Government guidance (see Appendix A)
- The routes can be positioned to reduce overflight of populations and/or environmentally sensitive areas below 7,000ft, for example over the sea

3.18 The application of Point Merge therefore offers the opportunity to reposition the vast majority of low altitude air traffic that currently approaches London City from the directions shown in Figure F6 and F7 into a single flow, approaching from the east over the Thames Estuary.

3.19 This is discussed further in Part E which considers the airspace used by aircraft leaving the London City Point Merge arcs, where they will descend below 7,000ft.

### Point Merge reduces stepped descent

3.20 Point Merge provides more predictability for flight crew compared to today's approach environment in which pilots follow specific instructions from ATC rather than follow a fixed route.

3.21 More predictability means the flight crew can plan a more gradual descent rather than a 'stepped descent' where aircraft descend in stages, often with long periods of level flight at low altitudes. Minimising stepped descent can reduce noise impact and improve fuel efficiency; saving fuel means less $CO_2$. It can offer such an efficiency improvement that it can often present an overall benefit even if aircraft flight paths are extended in order to achieve it[7,8].

3.22 In today's airspace, air traffic control organises the spacing in the London City landing sequence at low altitudes (see paragraphs 2.10-2.11). This means that aircraft are often required to descend early, then fly level at low (inefficient) altitudes for a relatively long period.

3.23 Setting the landing sequence order in the Point Merge system helps pilots plan their descent to stay high for as long as possible before commencing a more

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[7] A short video explaining the benefits of airspace change – including those from continuous climbs and descents - can be found at www.londonairspaceconsultation.co.uk.

[8] Overall $CO_2$ efficiency is discussed in paragraphs 3.30-3.35. Further details and a route by route analysis are provided in Part G.

gradual descent. This means that, compared with today, aircraft should generally be higher and quieter[9].

3.24 London City Airport airspace changes alone would not enable a full continuous descent down to the runway as London City traffic flows interact with air traffic to/from neighbouring airports which are not being consulted on here. The introduction of Point Merge would, however, decrease the occurrence of stepped descents, and reduce the amount of level flight required at low altitudes.

**Point Merge reduces stepped climb**

3.25 Aircraft operate more efficiently at higher altitudes meaning less fuel is burned, therefore emitting less $CO_2$ into the atmosphere. Aircraft at higher altitudes are also less likely to cause local impact from noise or visual intrusion. It is therefore in everyone's interest that departing aircraft can climb efficiently to higher altitudes, minimising 'steps' where they have to stop climbing and fly level for a period, often at lower altitudes[10].

3.26 London City departures have an initial step in their climb at 3,000ft to keep them below Heathrow arrivals descending in the airspace above. The current routes that take London City southbound departures out over the south coast of Kent then have to cross the London City arrivals from the northeast (see Figure F2). The proximity of the arrival stream often leads to the departures being held down at 4,000ft, beneath the arrivals, until they have crossed the Thames Estuary.

3.27 The introduction of Point Merge would realign arrival routes from the east from their current location over Southend to one somewhere along the Thames Estuary. Furthermore PBN offers the opportunity to realign the southbound departure routes (see previous paragraph) to take them further east before heading south. The combination of realignment of both arrivals and departures offers the opportunity to provide a system that ensures London City departures would climb above the arrivals in normal circumstances; these departures would climb to at least 7,000ft by the time they cross the Thames Estuary.

3.28 By facilitating climb in this way, Point Merge would enable aircraft to more quickly achieve 7,000ft where noise is considered less of a nuisance (see Government guidance at Appendix A), while climbing more quickly to efficient cruising altitudes also provides a contribution to the fuel and $CO_2$ savings discussed below. Continuous climb offers such an efficiency improvement that it can often present an overall benefit even if aircraft flight paths are extended in order to achieve it[11].

3.29 The positioning of London City departure routes between 4,000ft and 7,000ft and the associated noise impact is discussed in Part E of the consultation document.

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[9] A large proportion of the Point Merge route system for London City will be out over Thames Estuary, but its southern boundary and the routes from 7,000ft that will descend traffic from the Point Merge structure are likely to be overland or close to the shore and so continuous descents would provide some noise benefit.
[10] See footnote 7 on page F17
[11] See footnote 8 on page F17

### Point Merge enables a reduction in average fuel and $CO_2$ per flight

3.30 We have undertaken computer based simulation modelling to assess the potential fuel benefits that the implementation of Point Merge would enable across the network, including changes to the arrival routes feeding into the Point Merge system and changes to neighbouring departure routes. This has estimated that the fleet operating today at London City Airport would plan to carry between 2,500 and 5,000 tonnes (t) per year less fuel in 2016[12]. Given forecast traffic increases this estimated saving is expected to rise to between 3,000t and 5,900t in 2025. The range is wide because we have not yet established the final position of the routes which will be established with the benefit of the feedback from this consultation. See Appendix H for details of forecast traffic.

3.31 Fuel efficiency for London Biggin Hill arrivals is also expected to be improved commensurately with London City arrivals; however given the limited number of London Biggin Hill arrivals there were insufficient flights in our analysis data sample to produce reliable results.

3.32 However, we can make broad assumptions to estimate the order of magnitude for this benefit: London Biggin Hill has approximately 10% of the number of flights that London City has, but these are generally smaller, more fuel efficient aircraft types. On the basis of these assumptions we broadly estimate that the commensurate benefit for London Biggin Hill arrivals would be in the region of 5% of those quoted above for London City arrivals.

3.33 London Southend arrivals from the south and east in network airspace are also covered by this consultation; however the impact of this change on fuel/$CO_2$ can only be assessed when it is better known how these flights would connect through intermediate and low altitude airspace to London Southend airport. This is not yet known and hence no analysis is presented here. Any such changes would be subject to separate design and consultation processes at a later date (see Part G for further details on changes at London Southend airport).

3.34 The savings in planned fuel give an indication of the potential $CO_2$ savings as the amount of $CO_2$ emitted is directly proportional to the amount of fuel burned; 1 tonne less fuel burned means 3.18 tonnes less $CO_2$ released into the atmosphere[13] and so the above fuel figures indicate *potential* $CO_2$ savings in the approximate range of 8,000t to 19,000t per annum[14]. However, it may be that some of this $CO_2$ saving is already being realised, as air traffic control often navigate aircraft off their planned route – for instance, to provide

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[12] This is the total reduction in planned fuel across the fleet for all journeys – arrivals and departures in 2016. For more detail on fuel planning including how the proposal affects individual route efficiency see Part G.

[13] The mass of $CO_2$ emitted is greater than the mass of fuel burnt because the oxygen component of $CO_2$ is drawn from the atmosphere rather than the fossil fuel itself (which provides the carbon component).

[14] These figures represent the saving as a result of the proposed change compared with the do nothing scenario, assuming the same number of flights for both scenarios. They do not represent a reduction in the overall amount of $CO_2$ – the main factor in overall $CO_2$ is the growth in the number of flights; this is beyond the scope of this consultation (see Part A Section 3).

shortcuts[15,16]. Therefore the future savings in planned fuel (described in paragraph 3.30) may not translate fully into savings of $CO_2$.

3.35 Once we have undertaken detailed design work considering all the consultation feedback, we will undertake further analysis to determine the expected effect of Point Merge on average $CO_2$ per flight[17]. While we are not able to quantify the benefit at this stage, we will ensure that the reduction in planned fuel means that average $CO_2$ emitted per flight would reduce.

3.36 We will be faced with choices in terms of positioning the routes; these choices depend on operational factors, in particular safety and efficiency, and on environmental factors such as minimising overflight of certain areas whilst also minimising fuel burned and associated $CO_2$ emissions.

3.37 We have to consider whether flying a longer route to avoid a particular area outweighs the cost in terms of fuel and $CO_2$. On average, adding one nautical mile to a typical London City Airport flight such as a two engine small jet (eg Embraer E170) at 8,000ft will result in an extra 6.9kg fuel burn per flight. If this was applied to all London City Airport flights, it would relate to approximately 600t more fuel (2,000t of $CO_2$) per year in 2016 rising to over 700t fuel (2,400t $CO_2$) in 2025. In addition to the environmental costs, financially this would cost the airlines (and ultimately their passengers) approximately £410,000 per annum in 2016 rising to £480,000 per annum by 2025[18].

[15] Aircraft plan their route along a defined route structure. This route structure is generally designed such that neighbouring routes do not cross one another at the same level. This can mean that, in places, published routes are lengthened to avoid one another. If there is no traffic on nearby routes then there may be no reason to follow the lengthened route. In these circumstances ATC can consider giving the aircraft an instruction to go direct to a point further along their route, thereby providing a shortcut.

[16] As airspace gets busier ATC tend to rely more on the route structure as there is less space and time to provide alternative instructions. Therefore we expect this ATC intervention to gradually become less common in the future as traffic grows. However, some intervention will always occur; for example shortcuts are always an option during periods of light traffic such as at night. This would be the case for both the current airspace structure and with a new Point Merge structure.

[17] Estimating the likelihood and effect of air traffic control intervention requires assessment of the detailed design; therefore this estimation cannot occur until after consultation and subsequent design work has been undertaken.

[18] Using a typical aviation fuel cost of £650 per tonne. The figures shown are rounded.

**Altering routes to fly around environmentally sensitive areas rather than overhead is likely to mean more fuel burn and more $CO_2$ emissions because the altered route would usually be longer. In general, which should take precedence - minimising overflight of sensitive areas by flying a longer route around them, or flying the direct route overhead the area to keep the route shorter and minimise fuel burn and $CO_2$?**

- **Flying longer routes around environmentally sensitive areas should always have greater precedence than flying overhead on shorter routes which minimise fuel burn / $CO_2$**
- **Flying longer routes around environmentally sensitive areas should generally have greater precedence than flying overhead on shorter routes which minimise fuel burn / $CO_2$**
- **Flying longer routes around environmentally sensitive areas should be given equal weighting to flying overhead on shorter routes which minimise fuel burn / $CO_2$**
- **Flying shorter routes which minimise fuel burn / $CO_2$ should generally have precedence over flying longer routes around environmentally sensitive areas**
- **Flying shorter routes which minimise fuel burn / $CO_2$ should always have precedence over flying longer routes around environmentally sensitive areas**
- **Don't know**

**What, if any, factors should be taken into account when determining the appropriate balance of flying around environmentally sensitive areas versus overhead (for instance the altitude of the aircraft may be a factor, or the frequency / timing of flight)?**

**Please go to the online questionnaire at www.londonairspaceconsultation.co.uk to give your answers to these questions**

### Point Merge would change the location of flight paths

3.38 Part A of the consultation document describes how the introduction of PBN will inevitably result in some changes to where aircraft flight paths are seen in the future, regardless of whether the system is based on Point Merge or otherwise. The application of Point Merge would, however, influence the general characteristics of the new traffic patterns for both arrivals and departures.

3.39 Figure F4 shows how flight paths today can be seen over the whole area of interest; this will continue to be the case, although the areas in which they are concentrated is likely to change. Overall we expect Point Merge to mean a reduction in local impact because of the generic benefits from reduced flight path dispersal, and more continuous climb/descent as described above. However, whilst many areas would experience less impact (fewer flights overhead, or flights overhead at higher altitudes), some others would experience more as traffic patterns shift (ie the brightly coloured areas in Figure F2 would shift to reflect the Point Merge traffic patterns illustrated in Figure F8[19]).

3.40 Questions on what should influence the positioning of the Point Merge routes are the subject of Section 4. However, in addition to feedback on local matters, this consultation is seeking feedback on whether the *objective* of changing today's route system to one based on Point Merge is justified, given the generic benefits and impacts described in this document. Answering this question does not prevent you from providing information on local sensitivities in answer to the questions presented later in Section 4; for example you may support the objective of Point Merge but have strong views on areas that should be avoided. Equally you may have information that we have not considered that leads you to oppose Point Merge in principle, regardless of local issues. Please use the question below to express your view on the general principle and the question in Section 4 to provide specific local information.

3.41 This part of the consultation document is specific to environmental stakeholders beneath the network airspace (above 7,000ft). There are additional benefits and impacts relating to Point Merge that specifically affect airspace between 4,000ft and 7,000ft, and which specifically affect the aviation community; more detail on these can be found in Parts E and G of the consultation document respectively.

**This proposal is seeking to change the way aircraft use airspace by developing a system for managing arrivals based on Point Merge, rather than the holding stacks/vectoring currently in use.**

**Please indicate the extent to which you support or oppose our objective of providing a future arrival system based around Point Merge.**

**Please provide any additional information you think is relevant to our objective to redesign arrival routes around a Point Merge system.**

**NB separate questions are provided in Section 4 to identify specific local considerations relating to the positioning of the routes associated with Point Merge.**

**Please go to the online questionnaire at www.londonairspaceconsultation.co.uk to give your answers to these questions**

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[19] If this proposal is accepted, we expect that change to observed flight paths would be spread over a period of time. This will be partly due to the phasing outlined in Part A, but also because the airspace structure is part of a wider system including the aircraft, engineering systems and the air traffic controllers themselves. Although changes to the route structure happen instantaneously, the operation of airspace would evolve over time as the different systems and working practices possible in a PBN environment are adopted. The likelihood of gradual change is discussed in more detail in Part G. This means that new routes would have an immediate effect in places and a more gradual one in others.

### Changes to London Gatwick Airport Arrivals

3.42 This consultation presents proposals for Point Merge for both London City and London Gatwick Airports. These two parts of the proposal are independent of one another, although the proposed arrival routes for London Gatwick traffic from the east would use some of the same airspace as the London City arrivals and departures over east Kent and the Kent Downs.

3.43 Parts B to F of the consultation document are divided geographically; while Part D primarily addresses the London Gatwick Point Merge, it is necessary to include the arrival route from the east here in Part F, as it requires changes over east Kent and the Kent Downs.

3.44 Gatwick arrivals over Kent will be descending towards the Gatwick Point Merge system south of the airport; the arrival route will come from the region of Margate heading towards Hastings. The potential effect on the High Weald AONB and on Hastings is addressed in Part B. The potential effect over Kent and the Kent Downs AONB is considered below.

### Limitations on Route Flexibility

3.45 There are limitations to what can be achieved in terms of general route positioning to reduce overflight of particular areas. These relate to:

- *Manoeuvrability* - aircraft fly at high speeds; this limits how tightly, and how often, aircraft can turn in order for the route to be considered flyable and safe (this is governed by international design standards)
- *Balancing conflicting requirements* - for example, flying a longer flight path in order to reduce the number of people affected by noise from low altitude traffic, versus the environmental impact of additional $CO_2$ emissions and the associated fuel cost (see paragraph 3.37)
- *Local environmental trade-offs* – avoiding overflight of one area would mean overflight of neighbouring ones. In particular avoiding overflight of a town will necessitate flying over neighbouring countryside which may be valued for its relative tranquillity. Part A describes the generic framework for determining how to position routes given the priorities for routes at certain altitudes. The question presented in section 4 seeks information on local issues that we should consider when applying the priorities and determining the position of routes

## 4 Local Considerations for Route Positioning

4.1 The application of PBN and Point Merge for London City and Gatwick Airport would result in changing traffic patterns; some areas would experience more flights overhead, some fewer, and some would experience little change. We are consulting early in the design process and have not yet fixed the position of the routes, so that your feedback on local issues can be considered in determining the position of these routes.

4.2 All the maps presented in this section are available to view on the website at www.londonairspaceconsultation.co.uk; these online maps can be interrogated using the postcode search function. You can also zoom in on maps and switch easily between the current day traffic picture and the consultation swathes for the new routes.

### How to use the maps and data to assess potential effect

4.3 We provide information to help answer the questions ''Would the change mean more overflights? And if so how many aircraft and what is the potential effect?". This information is in the form of maps and data that indicate potential noise and visual impacts across a consultation swathe covering all the options for the positioning of the new PBN routes described in this document, including the Point Merge structure as illustrated in Figure F8 (it does not cover existing routes/flight paths that are not subject to change). The consultation swathes themselves are shown in the maps found in Figures F9, F10 and F11, with supporting data provided on the preceding page. Figures F9, F10 and F11 may be directly compared to the maps in Figures F2 and F3 which show today's air traffic flows.

4.4 The noise and visual impact experienced at a given location will depend on where the route is positioned within the consultation swathe; high concentrations of traffic would be directly overhead only a small proportion of the overall area. We are asking you to consider that the routes in question could be positioned anywhere within the consultation swathe, and to be mindful therefore that anywhere within the consultation swathe has the potential for noise and visual impact[20].

4.5 Information on the scale of potential impact is presented; this information describes:

- The potential number of aircraft that would fly on the route and which may be overhead subject to the final route position within the consultation swathe; a summary is provided on the data page preceding each map and Appendix H provides further detail
- The altitude these aircraft would be[21]; this is shown by the shading on the maps themselves. This information is discussed in more detail in the paragraphs below
- A measurement of how loud aircraft at that height would sound at ground level (a metric referred to as $L_{max}$) – this would also be dependent on the aircraft types expected; a summary is provided on the data page preceding each map with links to further detail

### Altitude Data

4.6 The altitude information presented on the maps shows a worst case altitude and an indication of typical altitude for aircraft during normal operations[22]. The worst case represents the lowest altitude we would normally expect an aircraft to be on the flight path in question. For example, the start of the 'minimum 7,000ft' height band on the map for the departure route is the area by which we would normally expect all aircraft to have reached 7,000ft. This would include the worst case of a slow climbing aircraft whose climb had been restricted by the presence of other aircraft above (such as the Heathrow

[20] We have highlighted the position of AONBs and National Parks in the maps so that it is clear where the proposals have a potential impact on these designated areas.
[21] The maps show altitude which is height above mean sea level. Stakeholders should take account of the elevation of any area of interest when considering the maps and this data table. For example, if an area of interest is marked in the map beneath changes with minimum altitude of 8,000ft, but the ground level is 500ft, the actual minimum height the aircraft above would be is 7,500ft.
[22] Excluding any variation for safety reasons, or unusual circumstances such as extreme weather.

arrivals described in paragraph 2.13); a less restricted flight would climb earlier.

4.7 The typical altitude is shown to indicate that most aircraft will be significantly above the worst case; however, determining typical altitudes for aircraft across a wide swathe for a future airspace design is not an exact science. We have therefore erred on the side of caution with these typical values and so even they do not represent the true range of altitudes that aircraft may be. Additional maps showing the range of typical heights achieved today is provided in Appendix F; in general we expect the proposed changes to mean that for a given location aircraft will be at the same or higher altitudes than shown today in Appendix F.

4.8 Whilst this variation in altitudes would happen in reality it is difficult to represent in a consultation document; we therefore suggest that as a default, stakeholders should consider the potential impact of aircraft at the minimum altitude shown on Figures F9, F10 and F11.

**Tranquillity**

4.9 Another factor that may determine the significance of a potential impact is tranquillity. CAA guidance for airspace change does not provide a method for assessing tranquillity. Any assessment will therefore be subjective and dependent on the specific location in question. The Government guidance (see Appendix A) specifically mentions AONBs and National Parks and so we have highlighted them on the maps in Figures F3 and F5 for comparison with the consultation swathes in Figures F9, F10 and F11; you may wish to consider the potential effect on tranquillity when providing feedback.

**Assumptions**

4.10 In order to ensure you do not underestimate the potential impact on a particular location we ask you to assume that all aircraft are kept on the route in question rather than being vectored off it by air traffic control; in reality vectoring would still happen some of the time. This assumption, combined with the worst case assumptions regarding altitude described above, means that the potential impact may be overestimated. In turn, the result of this may be more feedback for us. However we believe that this assumption is prudent and favourable over one which risks that potential effects are underestimated.

4.11 It is also important to emphasise that the consultation swathes presented are much wider than the routes which will be positioned within them. The maximum number of overflights shown would apply only to the areas below the eventual route position; most of the consultation swathe will therefore have fewer overflights than today[23].

[23] The new routes will tend to concentrate traffic. If more air traffic is concentrated on or around the route, it means there would be fewer to overfly adjacent areas.

### General characteristics of proposed changes

4.12 Part A describes how we are consulting at a relatively early stage in the design process. This means we have not yet decided on the position of the routes we are seeking to change, and so we are presenting the wide consultation swathes which encompass all the options. The following paragraphs present the consultation swathes and describe the key factors that determine where they sit. The consultation swathes are all much wider than the routes that need to be positioned within them; hence we still have flexibility to consider different options based on feedback to this consultation.

4.13 The traffic data shown on the pages preceding Figures F9 and F10 show a forecast of the average hourly number of flights across a daytime period. This period is defined around the 0630-2200 period of operation for London City and London Biggin Hill airports on weekdays. The arrivals to either airport over Kent and Suffolk may be 15 minutes from reaching the airport, and so the first arrivals of the day could feasibly be over those areas from around 0615. Likewise departures will be over Essex and Kent 15 minutes after taking off. London City is not open on Saturday afternoons or Sunday mornings[24]. The 'daytime period' for this data therefore starts at 0615 for arrivals, and ends at 2215 for departures.

4.14 The page preceding Figure 11 shows the average hourly number of flights in both daytime and nightime periods as Gatwick Airport operates 24 hours a day. The daytime period for the Gatwick traffic is the standard daytime period of 0700-2300 as specified in the CAAs guidance on airspace change (See Appendix A).

4.15 The data shown preceding Figures F9, F10 and F11 presents headline traffic numbers which can help stakeholders quickly assess the potential impact. A full traffic breakdown can be found in Appendix H for London City and London Biggin Hill; Appendix G contains a full traffic breakdown for Gatwick traffic.

### Arrival routes for London City, London Biggin Hill and London Southend

4.16 Figure F9 shows the consultation swathe for positioning the proposed arrival routes including the Point Merge system, the routes feeding into it and holds for managing traffic in emergencies and particularly busy periods.

4.17 This area is located in a region east of London City Airport over the Thames Estuary, within which the Point Merge system (see Figure F8) would be positioned. The fan shape of the system is a good match for the geographic shape of the estuary, meaning that a large part of the route system can be positioned over the sea. We are limited by the Shoeburyness military area, marked on Figure F9 in red; this prevents us from positioning the Point Merge route system further north. NATS is investigating possibilities for sharing this airspace and allowing civil air traffic to access some parts on a temporary basis; however, the Ministry of Defence has indicated that it must remain

[24] For more details of flying hours at London City and London Biggin Hill airports respectively see www.lcacc.org/operations/operations.html#Hours and www.bigginhillairport.com/airport-information/opening-times/

available for military activities and it is therefore not appropriate for a permanent airspace structure such as the Point Merge route system.

4.18 The positioning of the Point Merge system dictates the requirements for positioning the arrival routes for London City and London Biggin Hill that feed into it. Today, arrivals from the north are generally descending below 7,000ft over Hertford and Essex, and then to 3,000 or 4,000ft over parts of London (see Figure F6).

4.19 Delivering this traffic into the Point Merge system would mean keeping it higher and rerouting it around the Shoeburyness Danger Area. This means positioning a route somewhere in the vicinity of Colchester and/or the Dedham Vale and Suffolk Coasts & Heaths AONBs. These aircraft would typically be medium sized jets such as the Embraer 170 at around 12,000ft, although occasionally as low as 9,000ft. Most London City and London Biggin Hill arrivals come from European destinations and approach from the south and east. On average, there would be only two flights per hour arriving from the north and west over Suffolk on this route, during daytime only (see Appendix H for further details on traffic numbers).

4.20 Today, Dedham Vale[25] and the Suffolk Coasts & Heaths AONBs are overflown by London Stansted and London Luton arrivals which generally take one of two paths across Suffolk:

- following the published route system up to a point near Ipswich before turning southwest towards a hold for Luton and Stansted arrivals in the vicinity of Sudbury, or
- flying from the east directly towards the hold in the vicinity of Sudbury, this flow is managed ‘tactically’ by air traffic control, which means they are following specific instructions given by air traffic control rather than the route system itself

4.21 These flows can be seen in Figures F2 and F3. The relatively few London City arrivals will not have a significant effect on the Stansted and Luton arrival flows. The Luton and Stansted flows will be considered further in Phase 2 of LAMP – see Part A for information on the phases of proposed changes in coming years.

4.22 Figures F2 and F3 show that London City arrivals from the south currently converge over the Kent Downs AONB northeast of Maidstone. These flights are typically descending to around 4,000-5,000ft. The proposed routes from the south for London City, London Biggin Hill and London Southend arrivals would still need to pass over or near the Kent Downs AONB (see Figure F9); however, as these are heading towards the Point Merge system rather than directly to the airport they would be typically 12,000ft, although occasionally they could be as low as 9,000ft.

**London City departure routes**

4.23 The consultation swathe for the proposed change to the London City departure route is shown in Figure F10 and we are aiming to climb these departures

[25] Dedham Vale AONB includes the Stour and Orwell estuaries

above the arrival routes (see Para 3.25). This means the route must be positioned further east than today so there is more time for departures to climb before crossing the arrivals coming in along the Thames Estuary. This requirement dictates the positioning of the consultation swathe heading out over Kent.

**London Gatwick arrival routes**

4.24 Figure F11 presents the map and data for London Gatwick arrivals from the east. These flights currently come in to the vicinity of Maidstone before turning southwest towards the London Gatwick holds south of the airport. In order to separate this traffic from busy Heathrow traffic flows in the vicinity of Maidstone, the area for the proposed route is further south. Traffic on this route would typically be at 12,000ft, but occasionally as low as 8,000ft.

**Please indicate which, if any, place(s) or area(s) within the consultation swathes you think require special consideration in the on-going design process. Please describe the characteristics of these locations, stating whether they should be considered due to concerns about noise impact, visual impact and/or any other impact?**

**Please refer to the consultation swathes highlighted on the maps in Figures F9, F10 and F11.**

**Please go to the online questionnaire at www.londonairspaceconsultation.co.uk to give your answers to these questions**

**Phase 2 changes**

4.25 Part A of the consultation document describes how this consultation is part of a phased development of airspace across a wide region of London and the South East.

4.26 This consultation is relevant for the Phase 1 proposals, and is also relevant for any further development of the same airspace required for Phase 2. Reconsultation on the areas covered here is not required for Phase 2 unless the Phase 2 design work identifies new effects that we have not captured in this consultation document. In the event of any new effects we will add them to the Phase 2 consultation. Regardless of this we will continue to engage with key representative bodies (such as consultative committees, planning authorities and aviation groups) as part of the Phase 2 development programme to ensure that the design process is transparent.

**Please provide any other information that you feel is relevant to the on-going development of the airspace covered by this consultation.**

**Please go to the online questionnaire at www.londonairspaceconsultation.co.uk to give your answers to these questions**

**Notes for Figure F9**

The coloured shading in Figure F9 denotes the consultation swathe for positioning the Point Merge structures and arrival routes for London City and London Biggin Hill airports above 7,000ft.

The final positions of the routes within these areas will be determined after consultation feedback has been analysed. The position of the routes will determine how areas within the shaded regions are impacted; areas beneath the final routes would expect more overflights than today, and areas away from the routes would expect fewer.

Table F1 shows the potential number of flights that could pass directly overhead *if* the route was positioned overhead. This is a pessimistic prediction as the numbers shown are for the busiest individual route and it assumes *all* aircraft are kept on the route in question rather than being vectored off it by air traffic control, which in reality would occur some of the time. A detailed traffic breakdown is provided in Appendix H.

| Route | 2016 | 2020 | 2025 |
|---|---|---|---|
| Arrival day time (0615-2200) | 10 | 11 | 11 |
| Arrival night time (2200-0615) | closed | | |

**Table F1: Forecast for route usage (London City)**

Numbers are hourly averages. See paragraph 4.13 for discussion of opening times and Appendix H for a more detailed traffic breakdown.

Table F2 provides $L_{max}$ noise information for the typical and noisiest aircraft regularly flying to/from London City and London Biggin Hill airports. More noise information can be found in Appendix J. $L_{max}$ is the maximum noise at ground level from an aircraft flying directly overhead. The $L_{max}$ values may be compared to Table F3 for everyday equivalents. Additional overflight videos are provided on the webpage to help stakeholders understand what aircraft at various altitudes may look and sound like.

| Aircraft type | % of flights | 7,000-8,000ft | 10,000–12,000ft | 15,000-16,000ft |
|---|---|---|---|---|
| **Typical Arrival** E190/E170[26] | 29.1 | <55dBA | <55dBA | <55dBA |
| **Noisiest Arrival** A318 | 1.5 | 55 - 56 dBA | <55dBA | <55dBA |

**Table F2: Typical Noise ($L_{max}$) at various heights**[27]

| Noise | Noise level (dBA) |
|---|---|
| Chainsaw, 1m distance | 110 |
| Disco, 1m from speaker | 100 |
| Diesel truck pass-by, 10m away | 90 |
| Kerbside of busy road, 5m away | 80 |
| Vacuum cleaner, distance 1m | 70 |
| Conversational speech, 1m | 60 |
| Quiet office | 50 |
| Room in quiet, suburban area | 40 |

**Table F3: Tables of $L_{max}$ Equivalents**

Source: Airports Commission, based substantially on www.sengpielaudio.com/TableOfSoundPressureLevels.htm

[26] Includes the following aircraft types: Embraer 170/175/190/195 (Ancon category, 70-90 seat regional jet)
[27] This table shows $L_{max}$ at a height above ground level. Local elevation should be taken into account. See footnote 21 on page 24.

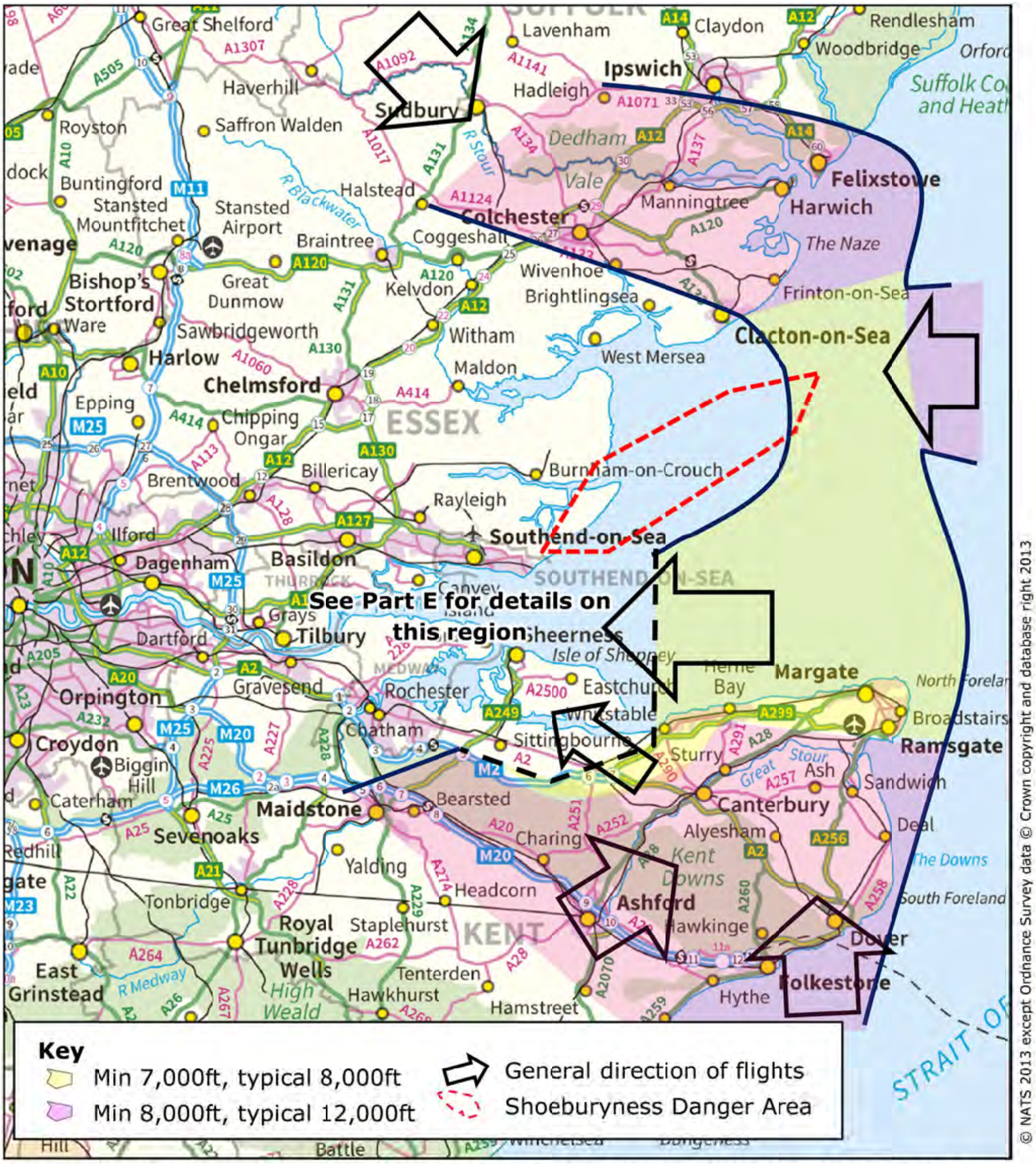


**Figure F9: Consultation swathe for London City Airport Arrival Routes above 7,000ft**

**Notes for Figure F10**

The coloured shading on Figure F10 denotes the consultation swathe for positioning the London City southbound departure routes above 7,000ft.

The final positions of the routes within these areas will be determined after consultation feedback has been analysed. The position of the routes will determine how areas within the shaded regions are impacted; areas beneath the final routes would expect more overflights than today, and areas away from the routes would expect fewer.

Table F4 shows the potential number of flights that could pass directly overhead *if* the route was positioned overhead. This is a pessimistic prediction as it assumes *all* aircraft are kept on the route in question rather than being vectored off it by air traffic control, which in reality would occur some of the time. A detailed traffic breakdown is provided in Appendix H.

| **Route** | **2016** | **2020** | **2025** |
|---|---|---|---|
| S'bound departure day time (0630-2215) | 4 | 5 | 5 |
| S'bound departure night time (2215-0630) | closed | | |

**Table F4: Forecast for route usage (London City)**

Numbers are hourly averages. See paragraph 4.13 for discussion of opening times and Appendix H for a more detailed traffic breakdown.

Table F5 provides $L_{max}$ noise information for the typical and noisiest aircraft regularly flying to/from London City Airport. More noise information can be found in Appendix J. $L_{max}$ is the maximum noise at ground level from an aircraft flying directly overhead. The $L_{max}$ values may be compared to Table F6 for everyday equivalents. Additional over-flight videos are provided on the webpage to help stakeholders understand what aircraft at various altitudes may look and sound like.

| **Aircraft type** | **% of flights** | **7,000-8,000ft** | **11,000–12,000ft** | **15,000-16,000ft** |
|---|---|---|---|---|
| **Typical Departure** E190/E170[28] | 29.1 | 56 dBA | <55dBA | <55dBA |
| **Noisiest Departure** A318 | 1.5 | 58-59dBA | 56dBA | <55dBA |

**Table F5: Typical Noise ($L_{max}$) at various heights**[29]

| **Noise** | **Noise level (dBA)** |
|---|---|
| Chainsaw, 1m distance | 110 |
| Disco, 1m from speaker | 100 |
| Diesel truck pass-by, 10m away | 90 |
| Kerbside of busy road, 5m away | 80 |
| Vacuum cleaner, distance 1m | 70 |
| Conversational speech, 1m | 60 |
| Quiet office | 50 |
| Room in quiet, suburban area | 40 |

**Table F6: Tables of Lmax Equivalents**

Source: Airports Commission, based substantially on www.sengpielaudio.com/TableOfSoundPressureLevels.htm

[28] Includes the following aircraft types: Embraer 170/175/190/195 (Ancon category, 70-90 seat regional jet)
[29] This table shows $L_{max}$ at a height above ground level. Local elevation should be taken into account. See footnote 21 on page F24.

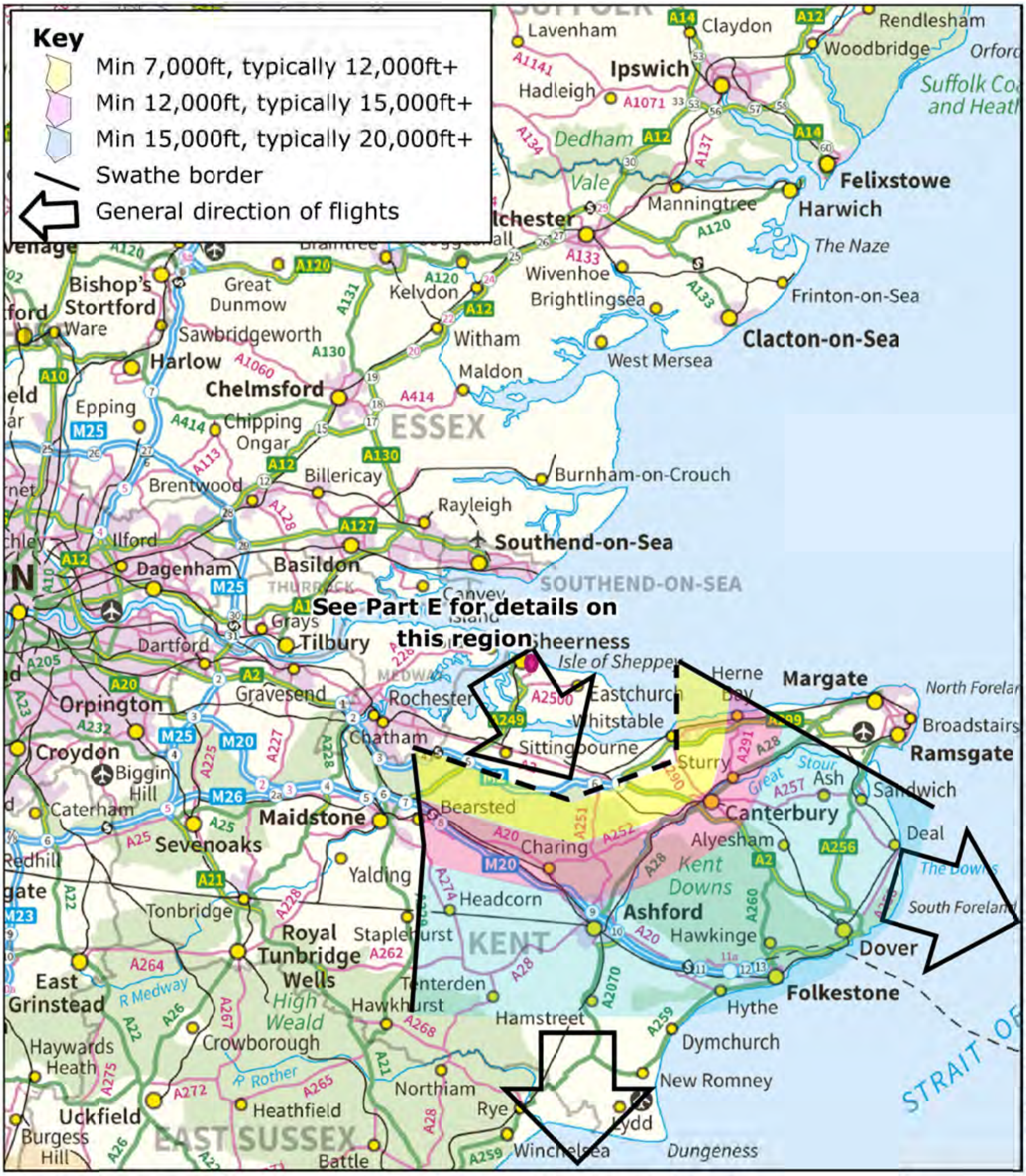


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**Figure F10: Consultation swathe for London City Airport departure routes to the south above 7,000ft**

**Notes for Figure F11**

The coloured shading on Figure F11 denotes the consultation swathe for positioning the Gatwick arrivals routes above 7,000ft.

The final positions of the routes within these areas will be determined after consultation feedback has been analysed. The position of the routes will determine how areas within the shaded regions are impacted; areas beneath the final routes would expect more overflights than today, and areas away from the routes would expect fewer.

Table F7 shows the potential number of flights that could pass directly overhead if the route was positioned overhead. This is a pessimistic prediction as it assumes all aircraft are kept on the route in question rather than being vectored off it by air traffic control; which in reality would occur some of the time. A detailed traffic breakdown is provided in Appendix G.

| Arrivals from the east/northeast | 2016 | 2020 | 2025 |
|---|---|---|---|
| Daytime average (0700-2300) | 4 | 4 | 4 |
| Night-time average (2300-0700) | <1 | <1 | <1 |

**Table F7: Forecast for route usage (arrivals from the east/northeast)**

Table F8 provides $L_{max}$ noise information for the typical and noisiest aircraft regularly flying to/from Gatwick. More noise information can be found in Appendix J. $L_{max}$ is the maximum noise at ground level from an aircraft flying directly overhead. The $L_{max}$ values may be compared to Table F9 for everyday equivalents. Additional over-flight videos are provided on the webpage to help stakeholders understand what aircraft at various altitudes may look and sound like.

| Aircraft type | % of flights | 7,000-8,000ft | 10,000–11,000ft | 15,000-16,000ft |
|---|---|---|---|---|
| **Typical Arrival** A320/B737 series[30] | 72.2% | 55 - 56 dBA | <55dBA | <55dBA |
| **Noisiest Arrival** B747-400 | 1.5% | 57 - 59 dBA | 55 - 56 dBA | <55dBA |

**Table F8: Typical Noise ($L_{max}$) at various heights**[31]

| Noise | Noise level (dBA) |
|---|---|
| Chainsaw, 1m distance | 110 |
| Disco, 1m from speaker | 100 |
| Diesel truck pass-by, 10m away | 90 |
| Kerbside of busy road, 5m away | 80 |
| Vacuum cleaner, distance 1m | 70 |
| Conversational speech, 1m | 60 |
| Quiet office | 50 |
| Room in quiet, suburban area | 40 |
| Quiet library | 30 |

**Table F9: Tables of $L_{max}$ Equivalents**

Source: Airports Commission, based substantially on www.sengpielaudio.com/TableOfSoundPressureLevels.htm

[30] Includes the following aircraft types: Airbus A318/319/320/321, Boeing 737-600/700/800/900 (Ancon category, 125-180 seat single-aisle 2-eng jet)

[31] This table shows $L_{max}$ at a height above ground level. Local elevation should be taken into account. See footnote 21 on page F24.

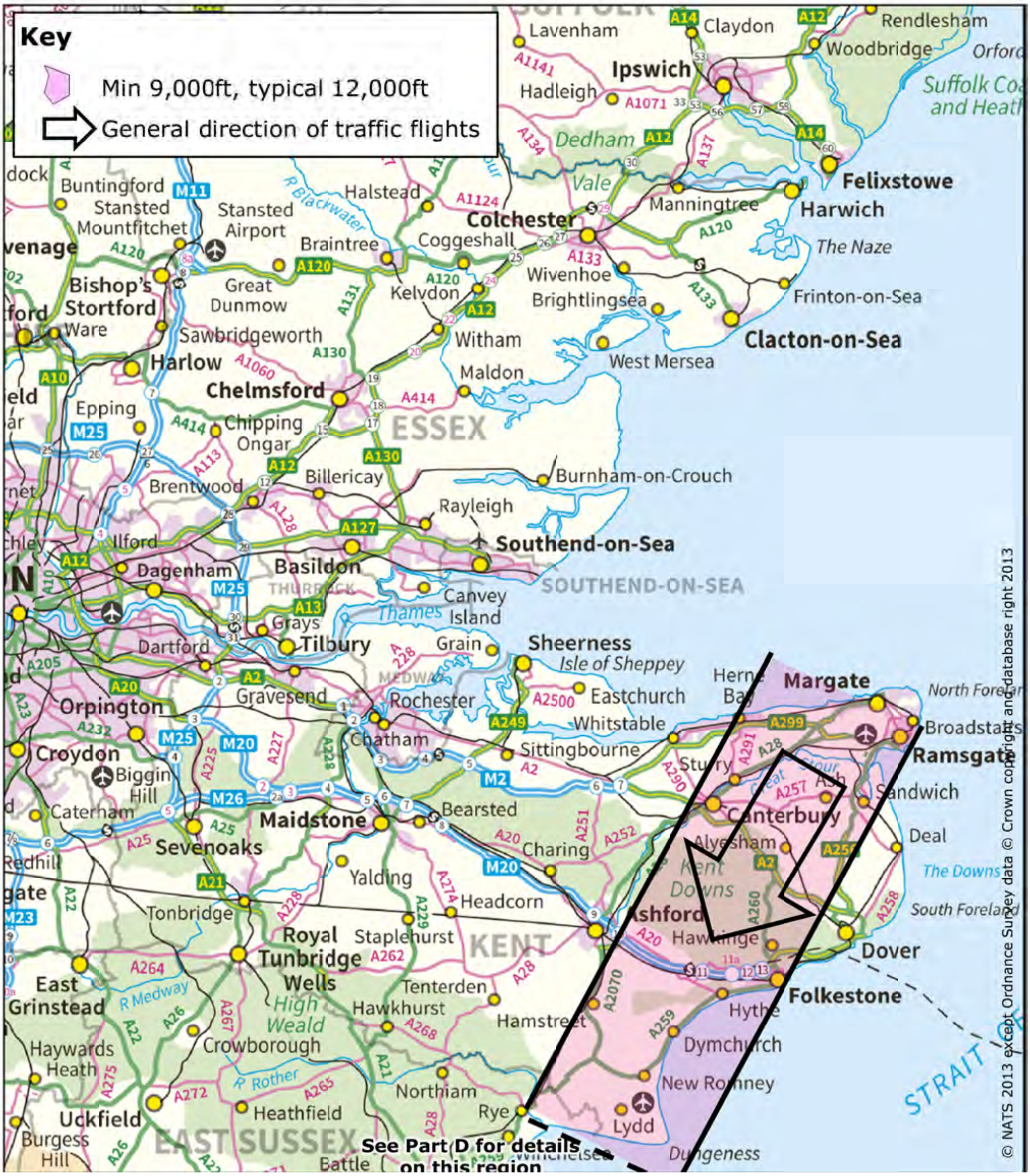


**Figure F11: Consultation swathe for London Gatwick Airport Arrival Routes above 7,000ft**