Proposed changes to

London Luton Airport Arrivals

Full Options Appraisal

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Unclassified

Roles

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References

Ref No	Description	Hyperlinks
1	SAIP AD6 CAA web page – progress through CAP1616	Link to portal
2	Stage 1 Statement of Need	Link to document
4	Stage 1 Assessment Meeting Minutes	Link to document
5	Stage 1 Design Principles	Link to document
6	Stage 2 Design Options	Link to document
7	Stage 2 Design Principle Evaluation	Link to document
8	Stage 2 Initial Options Appraisal and Safety Assessment	Link to document
10	Stage 3 Consultation Document	Link to portal, please navigate to Step 3b
11	Stage 3 Consultation Strategy	Link to portal, please navigate to Step 3b
12	Airspace change: Guidance on the regulatory process for changing the notified airspace design and planned and permanent redistribution of air traffic, and on providing airspace information CAP1616	Link to document
13	Environmental requirements technical annex CAP1616A	Link to document
14	Definition of Overflight CAP1498	Link to document
15	Airspace Modernisation Strategy AMS CAP1711	Link to document
16	UK Government Department for Transport's 2017 Guidance to the CAA on its environmental objectives when carrying out its air navigation functions, and to the CAA and wider industry on airspace and noise management (abbreviated to ANG2017)	Link to document

Contents

1. Introduction

1.1 NATS and London Luton Airport (LLA) are co-sponsors of this proposal. The scope of this project is to reduce the complexity of LLA arrivals (and their interacting relationship with London Stansted Airport arrivals), in turn reducing air traffic controller workload and assuring a safe and efficient operation for the future.

About London Luton Airport (LLA)

1.2 LLA is an important international centre for commercial, business and cargo aviation, as well as aircraft maintenance. In 2019 LLA handled 17.9 million passengers. The main aircraft types operating in 2019 were Airbus A320 and A321 aircraft, operated by easyJet and Wizz Air, with Ryanair operating Boeing 737s.

1.3 LLA has one runway which is 2,160 metres in length and has six main Noise Preferential Routes[1] (NPRs); three departing in an easterly direction and three departing in a westerly direction[2]. There are two main arrival flightpaths, one arriving to the runway from a westerly direction and one from the east, however both these arrival routes start at one of the two holding patterns, which are further east of LLA and are shared with Stansted (see below). The closest residential areas to the airport are those located to the west and southwest of Luton however the more densely populated areas are to the north. There are also several small villages near to the airport, for example Breachwood Green.

1.4 Due to the impact of the coronavirus pandemic on the aviation industry, the number of flights significantly reduced across the whole of the UK and Europe during the second and third quarters of 2020. Previously, demand for air travel across the UK had been increasing faster than predicted. In response to that growing demand, LLA has recently undertaken a redevelopment making the biggest investment in its history to transform the airport. The redevelopment of the terminal has brought huge benefits for passengers, but it is vitally important that the local community also shares in the success of the airport. This redevelopment is ready for the return to pre-pandemic passenger levels.

1.5 LLA's aim is to work constructively with the local community and partners to strike the right balance between maximising the positive social and economic benefits to the local area and the UK as a whole while minimising the negative impacts to the community and the environment.

About LLA and Stansted Airport's airspace relationship

1.6 Currently, LLA and London Stansted Airport - two of the five busiest airports in the UK in terms of air traffic movements - share exactly the same arrival flows to the same holds[3].

1.7 This is a unique situation – other airports sometimes share arrival routes, but one always has a much bigger proportion of movements (for example, London Heathrow and RAF Northolt, or London City and Biggin Hill). Splitting arrival flows is sustainable for those airports because only a small number of aircraft need to be redirected to the less-busy airport. LLA and Stansted are both major airports and all the arrival flows need splitting all the time. The interdependency between these two airports creates an especially complex situation for air traffic controllers to manage.

[1] Aircraft taking off from Luton follow specific flightpaths called NPRs, unless directed otherwise by air traffic control. The flightpath is designed to minimise the impact of noise on the local community.
[2] This consultation is not about departures – there would be no change under this proposal.
[3] When aircraft hold, they usually fly a racetrack shaped pattern at different heights, so they can all be contained in a stack and brought on to land when the air traffic controller decides it is best. These are known as holds, holding patterns or stacks and mean the same thing.

What is this document?

1.8 This Full Options Appraisal document is designed to provide detailed assessments on the costs and benefits of each option, with the do-nothing Option 0 as the baseline reference.

1.9 There are two complementary documents available; a full consultation document and a document on how this consultation will be conducted:

- Stage 3 Consultation Document (ref 10) which provides stakeholders with the history, impacts and benefits of this proposal.
- Stage 3 Consultation Strategy (ref 11), which provides details on how we will conduct the consultation.

How far is this proposal through the airspace change process?

1.10 It is currently in the third stage of the seven stage process.

1.11 Stage 1 Define has been completed, where the need for an airspace change was established, and the design principles underpinning it.

1.12 Stage 2 Develop and Assess has also been completed: where the initial options at upper and lower altitudes were developed, evaluated against the design principles from Stage 1 and an initial appraisal of each option was performed. This crucial stage of the airspace change process removed the least suitable potential airspace designs from further development: for example, those that were not as safe, those needing excessive volumes of airspace, or those not technically viable.

1.13 All previous material relating to Stages 1 and 2 is published on the CAA's airspace change portal at this link.

1.14 The design options that have progressed to the current stage are all viable and would resolve the current problem. This proposal is now at Stage 3 Consult, where stakeholders are asked for feedback on these options.

1.15 The following flowchart illustrates the airspace change process (known as CAP1616) on the left, with details of Stage 3 on the right:

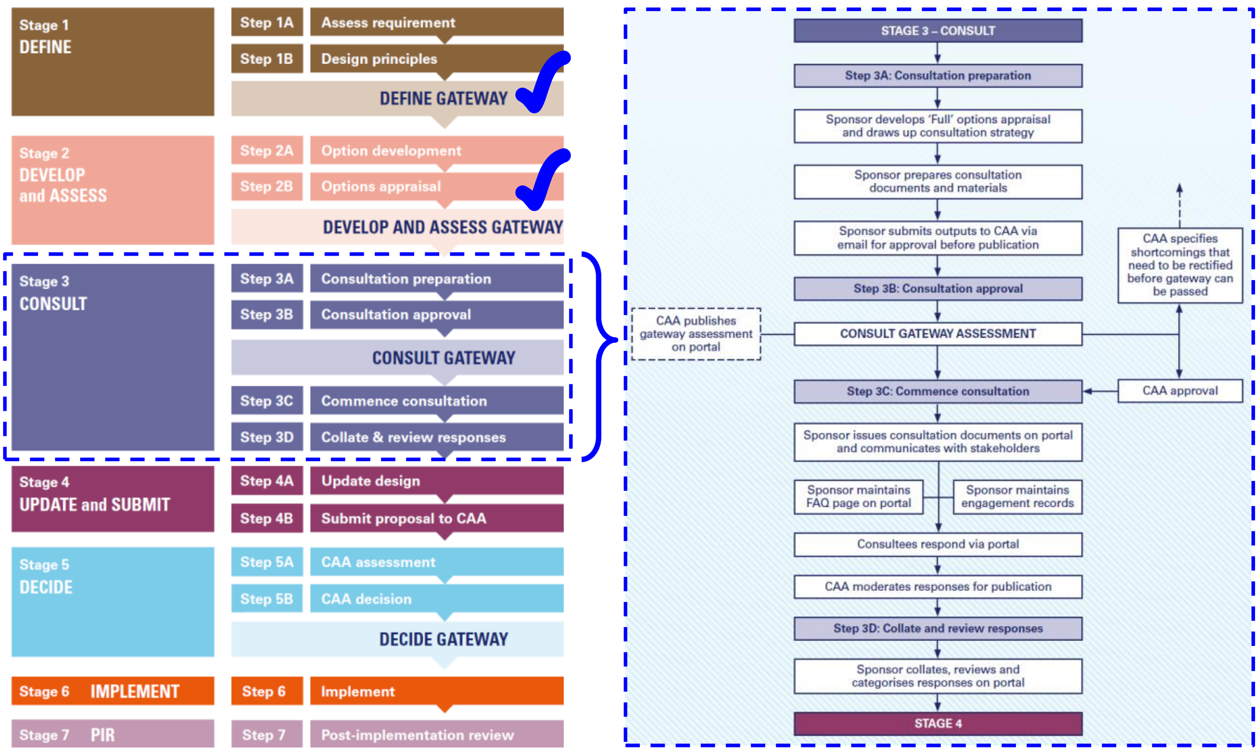

Figure 1 Overview of the Airspace Change Process CAP1616, and details of Stage 3 Consult

Has anything changed since Stage 2?

1.16 Some options have been refined following simulations. Stage 2's Initial Options Appraisal (ref 8) concluded that:

It is possible, indeed preferable, that some or all of the six lower options [that progressed through the initial options appraisal] could be combined into a system of options to convey Luton arrivals from the upper option to the runway.

1.17 Two combined options were developed, from the six that passed the previous assessment stage. Two key themes determined the combination of options for consultation. Firstly, to minimise change from today's flightpaths, which resulted in a system where air traffic controllers provide heading, altitude and speed instructions to pilots to transition aircraft from a hold to the runways. Secondly, alignment to the CAA's Airspace Modernisation Strategy (AMS)[4], which resulted in an option to introduce a combination of Performance Based Navigation (PBN)[5] transitions (predetermined flight paths) from a hold to the runways.

1.18 Some technical changes were made, to refine the Upper design (c.8,000ft[6] and above). These were driven by air traffic control simulations post-Stage-2, which gathered more evidence from a wider pool of air traffic control experts. This led to the revision of the dimensions and locations of some volumes of controlled airspace (CAS). These opportunities would not have been identified until those simulations were completed, and the additional expert opinions gathered. The Civil Aviation Authority and the stakeholders who would be impacted by these changes were engaged, to ensure transparency and understanding. Due to the technical nature of these changes, full details are described in Section 7 of the consultation document. Note that the technical changes between stages would have passed the design principle evaluation, and in doing so, would have progressed to this stage.

Analysis Forecasts and Methodology Summaries Analysis notes

1.19 Please refer to Section 6 from p.28 for a description of the forecasts and the analysis methodologies. It explains how the coronavirus pandemic has impacted this proposal, its forecasts and associated analyses (including WebTAG), and explains proposed proportional solutions to those impacts.

1.20 Also included is a description of how the arrivals were divided into shortcuts, vectors and PBN routes, summarised as:

- Option 0 Baseline and Option 1 Vectoring assume controllers offer shortcuts to 30% of arrivals. This means that the changes in vectoring due to this proposal would apply to 70% of arrivals under Option 1.
- Option 2 PBN Routes with Vectoring also assumes controllers offer shortcuts to 30% of arrivals. The PBN routes is expected to be used 49% of the time, with vectoring 21% of the time.

1.21 The analyses have accounted for these proportions, including typical easterly-westerly runway usage.

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[4] CAP1711, Airspace Modernisation Strategy, Paragraph 4.24. Airspace modernisation at lower altitudes (below c.7,000 feet) will provide sufficient capacity between the terminal airspace and runways, by implementing more precise and flexible satellite-based arrival and departure routes – while managing the impact of aircraft noise on local communities.

[5] A concept developed by ICAO that moves aviation away from the traditional use of aircraft navigating by ground-based beacons to a system more reliant on airborne technologies, utilising area navigation and global navigation satellite systems. (Air Navigation Guidance 2017). More specifically, area navigation based on performance requirements for aircraft operating along an ATS route, or an instrument approach procedure or in a designated airspace. (ICAO Doc 9613) https://www.icao.int

[6] Where we write 'c.' and then a number, this is short for 'circa', meaning 'approximately'.

2. Criteria against which the options have been assessed

2.1 During the earlier stages of the airspace change process a number of options were developed to address the identified issue. These were narrowed down following an assessment against the design principles. Full details of this process and the full range of options explored are available on the CAA airspace change portal.

2.2 The options taken forward to Full Options Appraisal have been assessed, as per the guidance provided in CAP1616a (ref 13). A summary of the full technical assessment of each option, and the conclusions, can be found in Section 9 from p. 37.

2.3 The same criteria have been used to assess the current day 'baseline' operation outlined as Option 3 on p. 11. This helps to compare the proposed options against what happens today. Below is a summary of the criteria against which each option has been assessed.

Monetising

2.4 Where possible and in accordance with government guidance, these impacts have been monetised. Monetising is a way of converting an impact into a value to enable comparison between different options.

London Luton Airport's application for a Development Consent Order (DCO)

2.5 Not within scope of this consultation are future growth plans at London Luton Airport, including the Development Consent Order (DCO) application for 32 million passengers per year. The growth aspiration to 32 million passengers per year is a separate project being conducted by London Luton Airport Limited (LLAL), the owners of the airport. This Airspace Change Proposal is co-sponsored by London Luton Airport Operations Limited (LLAOL) who are the current operators of the airport.

2.6 Over the past 12 months, LLAOL have submitted a scoping document and Environmental Screening request to the local planning authority (Luton Borough Council) for consideration to grow to 19 million passengers per annum. That is also not within the scope of this consultation or proposal.

2.7 The analysis for this FOA has considered the influence of increased passengers on increased air traffic movements in the forecasts. See Section 6 Analysis Forecasts and Methodology Summaries from p.28.

Noise

2.8 The impact of aviation noise is an important consideration to many communities, individuals and organisations, particularly at lower altitudes. These noise differences are explained as simply as possible.

2.9 How noise is perceived is highly subjective, and what may not be acceptable to one individual would be acceptable to another. In this document you will find a written summary and diagrams describing each option taken to Consultation, and summary tables of the noise assessments undertaken.

2.10 The key impact measures used to assess the noise impacts of each option are:

- Number of households overflown
- Number of households newly overflown
- Households experiencing increased day time noise
- Households experiencing decreased day time noise
- Households experiencing increased night-time noise
- Households experiencing decreased night-time noise

2.11 The impacts are described on how each option would change flightpaths, and you can interpret the maps to understand where aircraft could fly, how often, how high, and how much noise you may experience.

2.12 It should also be noted that the contours in this submission have all been created using the Federal Aviation Administration's (FAA) Aviation Environmental Design Tool (AEDT) version 3.0b. This software is different to the normal reporting undertaken by LLAOL, which uses the FAA's Integrated Noise Model

(INM) version 7.0d and therefore should not be directly compared. Instead, a baseline using the AEDT software has been used for comparison.

2.13 The Government has produced guidance (ANG2017, ref 16) on the relative priorities for the minimising of aviation noise, based on the altitude of the aircraft which is summarised as:

- Below 4,000ft the impact of aviation noise should be prioritised, with preference given to options which are most consistent with existing arrangements.
- Between 4,000ft-7,000ft minimising the impact of aviation noise should be prioritised unless this disproportionately increases CO_2 emissions; and
- From 7,000ft upwards the minimising of CO_2 emission is of greater priority than minimising noise.

Air Quality

2.14 Government guidance (ANG2017, ref 16) says that aircraft flying higher than 1,000ft are unlikely to have a significant impact on local air quality. For all options proposed, arriving aircraft would still descend through 1,000ft between 2 and 4 nautical miles (about 7-4km) from touchdown at either end of the runway as they do today. None of the options presented in this consultation will make any changes to aviation emissions (volume or location) below 1,000ft and therefore there will be no change to the impact on local air quality. It would be disproportionate to analyse this phase of flight where no change is proposed.

Greenhouse Gas and Fuel Burn

2.15 Key impact measures:

- Change in CO_2e compared to baseline
- Change in fuel burnt compared to baseline

2.16 A change in track distance flown would change the amount of fuel needed to fly that new distance – a longer route means more fuel burnt. A change in fuel burnt can be converted to CO_2 equivalent (CO_2e, using a standard multiplier of 3.18), which represents the estimated change in greenhouse gas impacts.

2.17 Often an increase in track mileage can be partially offset by keeping aircraft higher (where fuel efficiency is significantly better), and a longer route can result in fewer delays due to less holding. Using the analogy of driving a car, it can be more efficient to take a longer route to travel around a city by motorway, than to take a shorter route straight through the city centre. This is because a car operates more efficiently at a constant speed on a motorway than stop/start or crawling in traffic jams on the shorter route thereby burning less fuel.

2.18 Each option was reviewed in terms of total annual fuel burn/mass of CO_2 in metric tonnes emitted and this is detailed based on the current traffic levels and the traffic levels predicted for ten years after implementation.

Capacity and Delay

2.19 Delay was analysed to see how much can be avoided for each of the proposed options, measured in minutes. This is presented as a measure of the impact on capacity. Delay has been expressed by quantifying the impact to airlines, however, it is recognised that delay has a much broader impact to the travelling public, businesses and local communities, so this has been considered qualitatively during the assessment.

Resilience

2.20 Resilience in this context is the ability to react to unforeseen events that affect the air traffic network, such as a runway closure or bad weather. It is how quickly the air traffic controllers and the airspace they control can recover from disruption. There are many elements to resilience, including capacity, delay[7], staffing, the nature of the disruption, and airspace complexity.

[7] Capacity and delay are already considered separately within this document, thus cannot be considered again as part of resilience to avoid 'double accounting'.

2.21 These factors are so interlinked that a metric for the concept of resilience cannot be provided – it is not proportional to perform a quantitative assessment, nor to monetise it, and there are no market prices for air traffic control resilience. However, the ability of a controller to react to, and manage the impacts of, a disruptive event is an indicator of resilience. This is proportional to the balance of a controller's 'thinking time' vs. 'doing time', with that balance proportional to the number of radio transmissions the controller makes, per flight.

2.22 The expertise of senior air traffic control staff (a Group Supervisor of more than ten years' experience canvassed other experienced controllers qualified to work on the relevant sectors) was used to determine the typical number of radio exchanges an air traffic controller would make, for each option. This indicates the workload balance which is proportional to resilience. As a general rule the fewer radio exchanges per flight, the less complex the air traffic situation, the greater the ability of a controller to manage disruptive events, the greater the resilience.

Airspace Access

2.23 Controlled Airspace (CAS) is the name given to a specific volume of airspace which normally requires the pilot of an aircraft to obtain the permission from an air traffic controller prior to entry. The primary purpose of CAS is to provide an additional layer of protection for aircraft flying along air traffic routes. CAS boundaries and classifications have been qualitatively outlined, including any additional CAS that may be required in order to implement each option. This includes details on any CAS that would no longer be required and can be changed to uncontrolled airspace for each option.

Commercial Airlines / General Aviation

2.24 The number of minutes of delay that the options reduce, or increase compared to the baseline to assess the economic impact from increased effective capacity, has been analysed.

2.25 NATS has a standard cost-per-minute for delay of £3.68[footnote 8], from which the monetised annual cost or benefit of the delay avoided has been calculated.

Costs

2.26 Any airspace change will result in additional costs. The following key impact measures for each option have been qualitatively assessed:

- Training costs for airline crew
- Infrastructure costs for airports or ANSPs.
- Operational costs
- Deployment costs

Tranquillity

2.27 Tranquillity as a concept is generally considered by the CAP1616 process, and government guidance, with reference to impacts on Areas of Outstanding Natural Beauty (AONB) and National Parks.

2.28 There are no National Parks in the vicinity, but the Chilterns AONB is nearby. The impacts today's flightpaths currently have, and potential future flightpaths might have, on the Chilterns AONB, have been considered as part of the full options appraisal.

2.29 The Government's altitude-based guidance states 'Where practicable, it is desirable that airspace routes below 7,000ft should seek to avoid flying over Areas of Outstanding Natural Beauty (AONB) and National Parks'. However, where an AONB or National Park is close to an airport, (such as the Chilterns AONB to the west of LLA) it may not be practicable to avoid the AONB. As such, the overflight of the AONB is taken into consideration alongside other impacts such as overflight of populated areas.

[8] This is a standard cost to airlines, provided that delay is up to 15 minutes. For this proposal, delay avoided was assumed to be less than 15 minutes and the figure of £3.68 was used.

Biodiversity

2.30 From a biodiversity point of view and CAP1616, airspace changes at the altitudes proposed here would not have an impact on biodiversity because they do not involve ground infrastructure changes. Therefore, consideration of the biodiversity legislation or guidance is not required. Changes in greenhouse gas emissions, which may have a potential *indirect* impact on biodiversity, are described separately in this document.

Historic Environment

2.31 Historic environments, in this context, mean formally registered historic parks and gardens. The relevant places overflown below 4,000ft were identified the impact to these areas assessed in the full options appraisal.

3. Option 0 – Baseline do-nothing scenario

3.1 This combined baseline option (do-nothing option) is included for comparison purposes only. It is not an option to be progressed. These diagrams are the same as those in the consultation document.

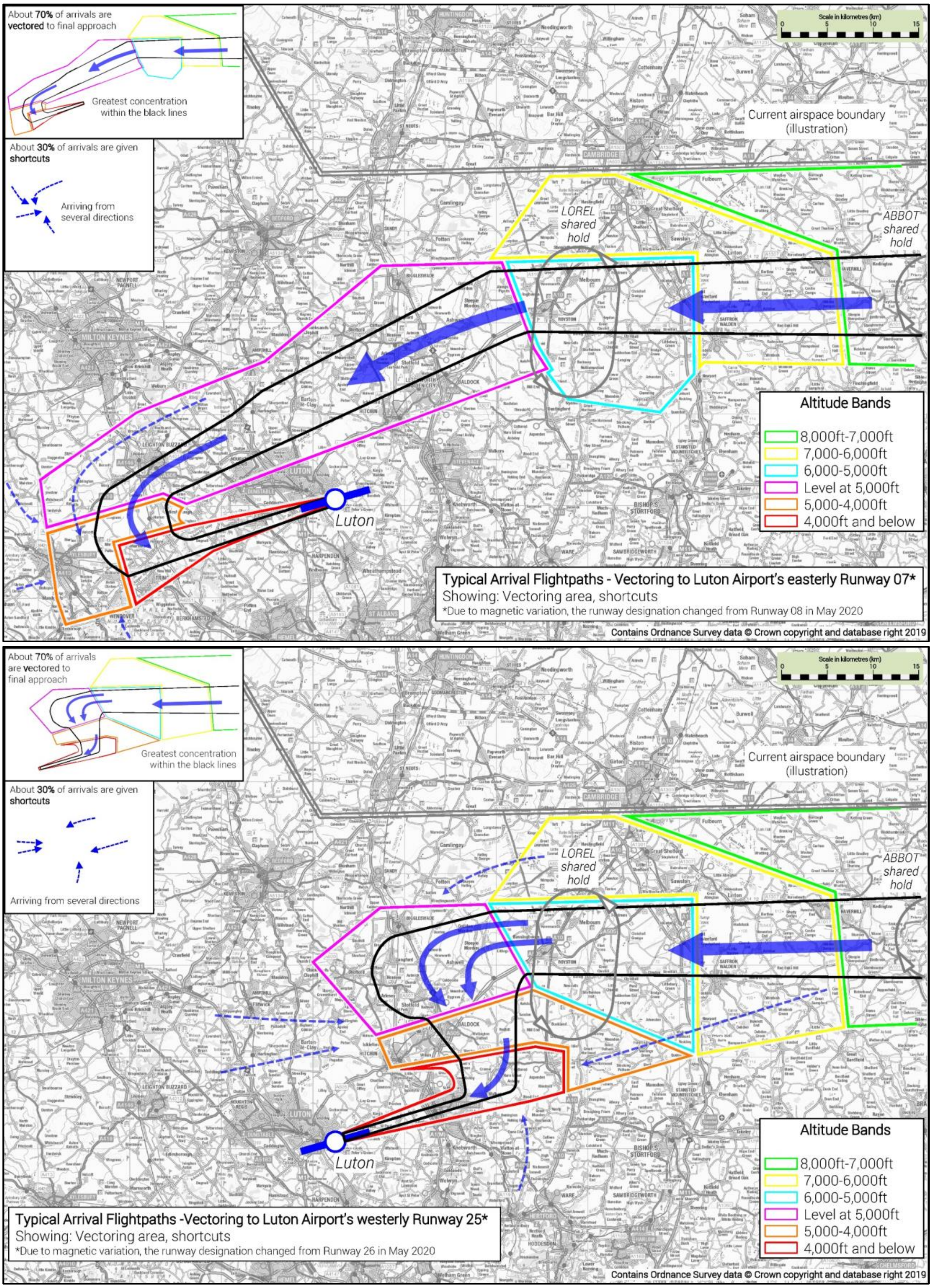


Figure 2 Illustration of Option 0 Vectoring Baseline, Runway 07 (top), Runway 25 (above)

Group	Impact	Level of Analysis	Evidence – see the row below each heading
Communities	Noise impact on health and quality of life	Quantitative impacts of LLA traffic Qualitative (other impacts)	Noise contour, area covered, population count Hospitals, places of worship and schools This includes impacts on tranquillity and visual intrusion (Chilterns AONB).

Noise Metric Images (contours) and Data Tables are provided in the consultation document. Annex D for 2022, Annex E for 2032 without DCO, and Annex F for 2032 with DCO. See Section 6 from p.28 for the analysis forecasts and methodology summaries.

Data types:

Contours and summary tables (images only, Excel tables supplied to CAA directly)

LAeq16hr Day, LAeq8hr Night   N65 Day   N60 Night   CAP1498 Overflight 48.5° angle Day   CAP1498 Overflight 48.5° angle Night

Numbers of hospitals, places of worship and schools

Data info:

Summer arrivals and departures (16 June to 15 Sept, forecast for the scenario years and types), average runway split (30% rwy 07, 70% rwy 25).

Fleet analysis assumptions: retire older/noisier aircraft and replace with equivalent newer quieter aircraft over the 10-year period (Fleet change is not due to this proposal, would happen regardless, and is common between analyses)

Population forecasts are from CACI[9], for 2021 and ten years later, 2031. Analysis using this population data was performed before the coronavirus pandemic caused a nine month delay to the planned implementation, to 2022. The population data for 2021 is a valid illustration for 2022, likewise 2031 for 2032, and it would be disproportionate to perform a new noise analysis.

WebTAG 10-year adverse impact cost data is based on differences from this baseline no-change option.

Tranquillity (quantitative estimate, qualitative discussion)

A 7-day sample of aircraft trajectories based on radar data was analysed (one 7-day sample per runway) from June 2019, to see how many aircraft overflew the Chilterns AONB below 7,000ft (see Consultation Document Annex G for illustrations).

The northern part of the AONB is overflown by some Rwy 07 arrivals below 7,000ft, mostly level at 5,000ft.

Number of overflights <5,000ft: 1+12=13
Number of overflights level 5,000ft: 705
Number of overflights 5,000ft-7,000ft: 30
Total overflights <7,000ft: 13+705+30=748

The southern part of the AONB is overflown by all Rwy 07 arrivals below 7,000ft and cannot be avoided by the final approach track.

Number of overflights <4,000ft: 11+211+720=942
Number of overflights 4,000ft-7,000ft: 447
Total overflights <7,000ft: 942+447=1,389

The southern part of the AONB is overflown by some Rwy 25 arrivals below 7,000ft, generally those shortcutting from the west direct to downwind right hand.

Number of overflights <4,000ft: 1
Number of overflights 4,000ft-7,000ft: 70
Total overflights <7,000ft: 1+70=71

This sets an estimated baseline for tranquillity, to allow for qualitative comparison.

Group	Impact	Level of Analysis	Evidence
Communities	Air quality	Qualitative	See also Government guidance Air Navigation Guidance 2017 (ANG 2017).

Government guidance (ANG 2017) says that aircraft flying higher than 1,000ft are unlikely to have a significant impact on local air quality.

Today, arriving aircraft descend through 1,000ft between 4 and 2 nautical miles (about 7-4km) from touchdown at either end of the runway. This is close to landing, in the very final stages of the approach.

[9] CACI is the company that supplied the population and household data for the analysis

Option 0 Baseline Continued…

Communities	Historic environment	Quantitative estimate, qualitative discussion	Overflight of registered historic parks and gardens below 4,000ft

A 7-day sample of aircraft tracks based on radar data (one 7-day sample per runway) was analysed from June 2019, to see how many aircraft overflew historic parks and gardens below 4,000ft (see Consultation Document Annex H for illustrations).

Easterly arrivals:

Mentmore Towers: 481 overflights, of which 47+1=48 were below 4,000ft

10% of flights over this place were below 4,000ft, for this data sample

Luton Hoo (northern edge): 1,440 overflights, all but one of which was below 4,000ft

99.9% of flights over this place were below 4,000ft, for this data sample (indeed, were below 1,000ft)

This place is directly adjacent to final approach about 1-2nm from the runway

Westerly arrivals:

Julians: 394 overflights of which 68+8+2=78 were below 4,000ft

20% of flights over this place were below 4,000ft, for this data sample

Garden House: 169 overflights of which 96+47+4=147 were below 4,000ft

87% of flights over this place were below 4,000ft, for this data sample

St Paul's Walden Bury is extremely close to the final approach track and the runway, where all arriving aircraft are typically below 2,000ft

This sets an estimated baseline for overflight of the historic environment below 4,000ft, to allow for qualitative comparison.

Wider society	Greenhouse gas impact	Quantitative	Fuel simulation analysis

The options described later on use the NATS recognised fuel analysis tool to compare the differences from this baseline, which is the no-change option. From this, the greenhouse gas impacts can be estimated because the differences in aviation fuel burnt are proportional to the CO_2 equivalent emitted (for each kg of aviation fuel burnt, 3.18kg of CO_2 equivalent is emitted).

Wider society	Capacity/ resilience	Quantitative/ qualitative	Monitoring value (MV) Minutes of delay avoided due to improved traffic flows Changes in number of radio exchanges

Capacity (quantified)

All arrivals to LLA are entwined with arrivals to Stansted for most of their time in UK airspace, until they reach the holds. Only after leaving the holds are they separated into their respective arrival flows.

This means that LLA arrivals are highly dependent on Stansted arrivals and vice-versa.

For example, if a Stansted flight is at the lowest level in the hold and LLA aircraft are holding in the levels above, then any delay at Stansted Airport (like a temporarily closed runway) means the LLA arrivals are stuck and Air Traffic Controllers will find it difficult to extract them from the holds. This applies the other way around, should Stansted traffic get stuck above LLA traffic. The dependencies on each other cause capacity and resilience issues which we intend to solve through this airspace change proposal. So the main comparison will be, do the other options improve the situation compared to this baseline do-nothing scenario.

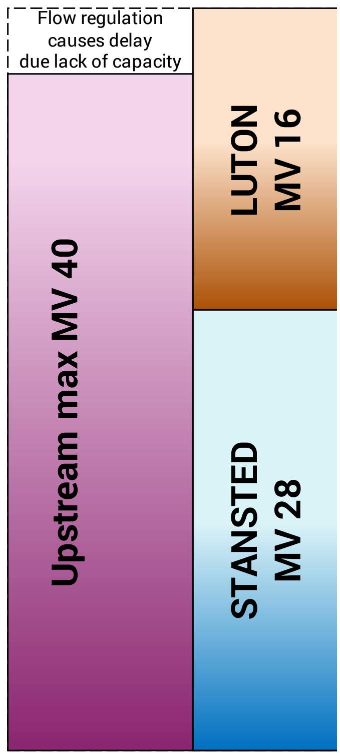
Broadly, MV indicates the number of movements per hour which can be safely handled by the controllers operating the flows in each associated airspace sector.

These are not necessarily geographical 'boxes', but they describe how certain arrival flows are measured and managed. The current upstream (the flow of arriving traffic before reaching LUTON or STANSTED) flow group has a Monitoring Value (MV) of 40. When the actual number of upstream movements per hour approaches the MV (known as over-demand), safety is highest priority so the air traffic control supervisor considers applying flow regulations.

This stabilises the number of movements until the expected peak subsides. That action causes delay to the air traffic yet to arrive at the airports, which in turn generates more delay for both arriving and departing traffic.

The LUTON arrival flow has an MV of 16, STANSTED an MV of 28, totalling 44, which is greater than the upstream MV.

This means flow regulation is more likely to be applied when both LUTON and STANSTED are busy. The LUTON and STANSTED arrival flows cannot be separated without changing the airspace design.



Option 0 Baseline do-nothing flow management illustration (see Consultation Document Annex I)

Option 0 Baseline Continued…			

Under this baseline no-change option, the MVs could not change, the intertwining of LLA arrivals with Stansted arrivals would continue, and there would be no opportunity to rebalance the workload. As traffic increases, it is more likely that the upstream MV would be breached, leading to flow regulations more often and for longer periods, causing extra complexity and workload for controllers and pilots. This is predicted to have a potential latent safety impact (unsustainable periods of over-demand) if the airspace design is not changed, hence this proposal's planned implementation before the main summer period of 2022.

See this section in each option for the forecast benefits.

Capacity (qualitatively assessed)

The broader impact of delay to the travelling public, businesses and local communities would not improve. The forecast increase in air traffic is likely to increase this impact in the future.

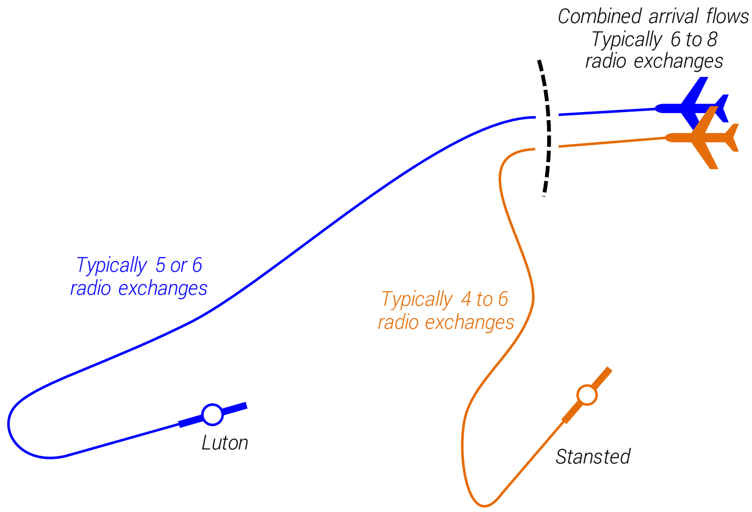
Resilience (quantified estimates, qualitatively discussed)

As described above, complexity for air traffic controllers builds rapidly for arrivals heading to LLA and Stansted as the arrival traffic increases.

Air traffic controllers can manage aircraft by providing heading and level instructions, which is referred to as vectoring. Vectoring is highly manual, tactical and intense because each instruction to the pilot must be read back by the pilot to the controller to ensure accuracy. Therefore, a single radio exchange to an aircraft involves at least two radio transmissions (one call, one response), or at least four if an error needs to be corrected (call, incorrect response, correction call, correct response).

The lower the need for radio exchanges per flight, the more resilient the airspace system because controllers can spend more time managing the overall flows and less time making constant adjustments to individual flights. Should there be any disruption, the lower the complexity, the easier it is to recover. See paragraphs 2.20-2.22 on p.8 for more details.

The illustration below is an extract from the consultation document Annex I (the full diagram shows all three options side by side).



The upstream controller works both upper Luton and Stansted arrivals in a combined complex flow, and separates them into one flow per airport, then passes each flight on to the next controller.

The Luton or Stansted controller vectors their respective flight to the runway in a similar way to today.

Option 0 Baseline do-nothing
(Luton and Stansted flows are combined)
Easterly runway illustration (westerly is similar)

The typical number of radio exchanges per flight for this scenario would be 12-16 (upper, 6-8 x2), 5-6 (LLA) and 4-6 (Stansted).

Under this Option 0 baseline, controllers working with arrivals in the complex do-nothing system would typically require 21-28 radio exchanges. The number of radio exchanges for the westerly runways would be comparable.

General Aviation	Access	Qualitative	
The options described later on will estimate the differences from this baseline, which is the no-change option.			
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Quantified, monetised estimate	Cost per minute of delay avoided
The options described later on will estimate the differences from this baseline, which is the no-change option.			

Option 0 Baseline Continued…

General Aviation/ commercial airlines	Fuel Burn	Quantified, monetised estimate
The options described later on will estimate the differences from this baseline, which is the no-change option.		
Commercial airlines	Training costs	Qualitative
The options described later on will estimate the differences from this baseline, which is the no-change option.		
Commercial airlines	Other costs	Qualitative
The options described later on will estimate the differences from this baseline, which is the no-change option.		
Airport/ ANSP	Infrastructure costs	Qualitative
The options described later on will estimate the differences from this baseline, which is the no-change option.		
Airport/ ANSP	Operational costs	Qualitative
The options described later on will estimate the differences from this baseline, which is the no-change option.		
Airport/ ANSP	Deployment costs	Qualitative
The options described later on will estimate the differences from this baseline, which is the no-change option.		
Government policy	Alignment with AMS	Qualitative
This baseline Option 0 is not aligned with the AMS.		

End of Baseline Option 0 table

4. Option 1 – Hold to the North of LLA and aircraft vectored to each Runway

4.1 This option introduces a new hold to the North of LLA. Aircraft would transition from the hold to the runway by following air traffic control heading, altitude and speed instructions. Typically, 30% of arrivals would be offered a shortcut, and 70% would expect to be vectored from the proposed hold, consistent with Option 0.

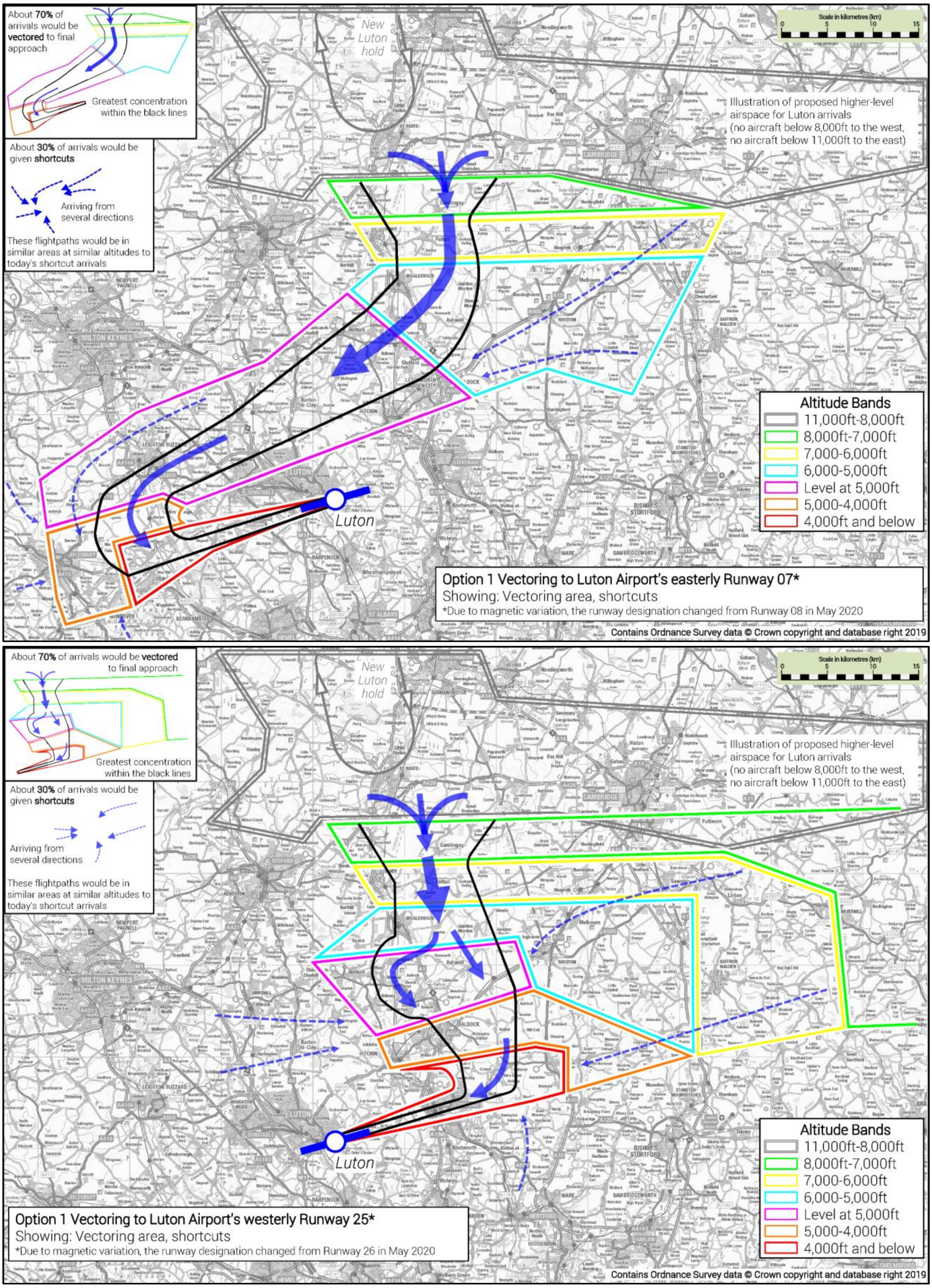


Figure 3 Illustration of Option 1 Vectoring, Runway 07 (top), Runway 25 (above)

Group	Impact	Level of Analysis	Evidence – see the row below each heading
Communities	Noise impact on health and quality of life	Quantitative impacts of LLA traffic Qualitative (other impacts)	Noise contour, area covered, population count Hospitals, places of worship and schools This includes impacts on tranquillity and visual intrusion (Chilterns AONB). (Biodiversity is covered on p. 5).

Noise Metric Images (contours) and Data Tables are provided in the consultation document. Annex D for 2022, Annex E for 2032 without DCO, and Annex F for 2032 with DCO. See Section 6 from p.28 for the analysis forecasts and methodology summaries.

Data types:

Contours, overflight areas and summary tables (images only, Excel tables supplied to CAA directly)

LAeq16hr Day, LAeq8hr Night N65 Day N60 Night CAP1498 Overflight 48.5° angle Day CAP1498 Overflight 48.5° angle Night

Numbers of hospitals, places of worship and schools

Data info:

Summer arrivals & departures (16 June-15 Sept, forecast for the scenario years and types), average runway split (30% rwy 07, 70% rwy 25).

Fleet analysis assumptions: retire older/noisier aircraft and replace with equivalent newer quieter aircraft over the 10-year period (Fleet change is not due to this proposal, would happen regardless, and is common between analyses)

Population forecasts are from CACI, for 2021 and ten years later, 2031. Analysis using this population data was performed before the coronavirus pandemic caused a nine month delay to the planned implementation, to 2022. The population data for 2021 is a valid illustration for 2022, likewise 2031 for 2032, and it would be disproportionate to perform a new noise analysis.

WebTAG 10-year adverse impact cost data is based on differences from the baseline no-change option and the comparison is made using 2021-2031 analyses which we contend are valid illustrations for 2022-2032. See Section 6 from p.28 for a detailed explanation.

The base year has been set to 2010 because it aligns with the most recent official valuations of health impacts on environmental noise exposure and is consistent with the example used in CAP1616a.

The full Excel WebTAG sheets will be supplied directly to the CAA.

Description *positive value reflects a **net benefit** (i.e. a reduction in noise)	**2032 No DCO Option 1**		**2032 With DCO Option 1**	
	WebTAG assessment	Sensitivity test excluding impacts below 51 dB (for aviation proposals only)	WebTAG assessment	Sensitivity test excluding impacts below 51 dB (for aviation proposals only)
Net present value of change in noise (£, 2010 prices):	£532,201	-£34,125	£646,127	£454,597
Net present value of impact on sleep disturbance (£, 2010 prices):	£266,991	£111,673	-£118,937	£138,655
Net present value of impact on amenity (£, 2010 prices):	£318,814	-£92,194	£681,713	£232,591
Net present value of impact on AMI (£, 2010 prices):	£5,470	£5,470	£13,365	£13,365
Net present value of impact on stroke (£, 2010 prices):	-£23,480	-£23,480	£27,977	£27,977
Net present value of impact on dementia (£, 2010 prices):	-£35,594	-£35,594	£42,009	£42,009
Households experiencing increased daytime noise in forecast year:	2252		2798	
Households experiencing reduced daytime noise in forecast year:	2959		3858	
Households experiencing increased night time noise in forecast year:	872		979	
Households experiencing reduced night time noise in forecast year:	1156		934	

Tranquillity (quantitative estimate, qualitative discussion)

This Option 1 would not change the likelihood of overflight of the Chilterns AONB by LLA arrivals, compared with the quantified estimates provided in baseline Option 0. The proportions would be broadly similar, and at similar altitudes. (See Consultation Document Annex G for illustrations).

Group	Impact	Level of Analysis	Evidence
Communities	Air quality	Qualitative	See also Government guidance ANG2017.

Government guidance says that aircraft flying higher than 1,000ft are unlikely to have a significant impact on local air quality.

Arriving aircraft would still descend through 1,000ft between 4 and 2 nautical miles (about 7-4km) from touchdown at either end of the runway. This is close to landing, in the very final stages of the approach, and there are no proposed changes this close to touchdown.

Option 1 New Hold and Vectors Continued...

Group	Impact	Level of Analysis	Evidence – see the row below each heading
Communities	Historic environment	Quantitative estimate, qualitative discussion	Overflight of registered historic parks and gardens below 4,000ft

See Consultation Document Annex H for illustrations. Vectoring is unlikely to change significantly below 4,000ft, compared with Option 0.

The proportions would be broadly similar, and at similar altitudes.

For Runway 07:

Mentmore Towers is still likely to be overflown by c.10% of LLA arrivals below 4,000ft

The northern edge of Luton Hoo is still likely to be overflown by all arrivals below 4,000ft, indeed below 1,000ft, due to its location directly adjacent to final approach.

For Runway 25:

Julians Gardens is still likely to be overflown by c.20% of LLA arrivals below 4,000ft

Garden House is still likely to be overflown by c.87% of LLA arrivals below 4,000ft

St Paul's Walden Bury would continue to be overflown by all LLA arrivals below 2,000ft.

Group	Impact	Level of Analysis	Evidence
Wider society	Greenhouse gas impact	Quantitative	Fuel simulation analysis

The change in distance at the upper levels, and the descent profile, is common to both options, as is the likelihood of holding for both airports. ATC and analytics experts determined that the distances and altitudes flown from the hold to each runway would proportionally be the same, regardless of the method used to get there (Option 1 vectoring, Option 2 PBN routes with vectoring). Feeding common parameters into the fuel analysis simulator would cause the results to also be common.

Therefore, there would be no difference in fuel burnt and associated CO_2e emissions between Options 1 and 2.

This section provides data applicable to both Options 1 and 2 using the 2032 no-DCO and 2032 with-DCO traffic forecasts.

See Section 6 from p.28 for more details on LLA and Stansted arrival forecasts, with and without LLA's DCO.

In 2022, the changes would apply to a total of 172,459 combined LLA and Stansted arrivals, resulting in a net increase of 18,574 tonnes of CO_2e. These figures are the sum of forecast 70,740 LLA arrivals, total increase of 20,129t, combined with forecast 101,719 Stansted arrivals, total benefit of 1,555t.

In 2032 without LLAL's DCO, the changes would apply to a total of 173,150 combined LLA and Stansted arrivals, resulting in a net increase of 16,596 tonnes of CO_2e. These figures are the sum of forecast 70,740 LLA arrivals, total increase of 20,129t, combined with forecast 102,410 Stansted arrivals, total benefit of 3,533t.

In 2032 with LLAL's DCO, the changes would apply to a total of 193,910 combined LLA and Stansted arrivals, resulting in a net increase of 19,687 tonnes of CO_2e. These figures are the sum of forecast 91,500 LLA arrivals, total increase of 23,220t, combined with forecast 102,410 Stansted arrivals, total benefit of 3,533t.

WebTAG was used to assess the greenhouse gas impact over time from the proposed changes. Both options would yield a negative Net Present Value which reflects a disbenefit, i.e. a CO_2e increase.

Without LLAL's DCO, there would be an increase of CO_2e in the opening year (2022) of 18,574t which would, over a 60 year appraisal period, total 193,441t.

WebTAG was also used to calculate the overall Net Present Value of CO_2e emissions increase for the non-traded sector at £1,368,555.

With LLAL's DCO, there would be an increase of CO_2e in the opening year (2022) of 18,574t which would, over a 60 year appraisal period, total 210,425t.

WebTAG was also used to calculate the overall Net Present Value of CO_2e emissions increase for the non-traded sector at £1,481,807.

Traded and non-traded flights were categorised as intra-EU for traded (82.1% for LLA, 86.1% for Stansted) and all other flights as non-traded (17.9% for LLA, 13.9% for Stansted). These figures were calculated by analysing the origins and destinations for LLA and Stansted flights for 2019 and factored into the calculations, assuming the ratios remain constant for the WebTAG period.

The disbenefit primarily arises from the longer tracks flown by LLA arrivals, partially offset by the arrivals remaining higher for longer and less likely to enter the hold. Also there is some benefit to Stansted arrivals due to the separation from LLA arrivals at an early, higher stage of flight.

Option 1 New Hold and Vectors Continued…

Wider society	Capacity/ resilience	Quantitative/ qualitative	Monitoring value (MV) Minutes of delay avoided due to improved traffic flows Changes in number of radio exchanges

Capacity (quantified)

All arrivals to LLA are entwined with arrivals to Stansted for most of their time in UK airspace, until they reach the holds. Only after leaving the holds are they separated into their respective arrival flows. This means that LLA arrivals are highly dependent on Stansted arrivals and vice-versa. For example, if a Stansted flight is at the lowest level in the hold and LLA aircraft are holding in the levels above, then any delay at Stansted Airport (like a temporarily closed runway) means the LLA arrivals are stuck and Air Traffic Controllers will find it difficult to extract them from the holds. This applies the other way around, should Stansted traffic get stuck above LLA traffic. The dependencies on each other cause capacity and resilience issues which we intend to solve through this airspace change proposal. So the main comparison will be, do the other options improve the situation compared to this baseline do-nothing scenario. Broadly, MV indicates the number of movements per hour which can be safely handled by the controllers operating the flows in each associated airspace sector.

These are not necessarily geographical 'boxes', but they describe how certain arrival flows are measured and managed.

The current upstream (the flow of arriving traffic before reaching LUTON or STANSTED) flow group has a Monitoring Value (MV) of 40.

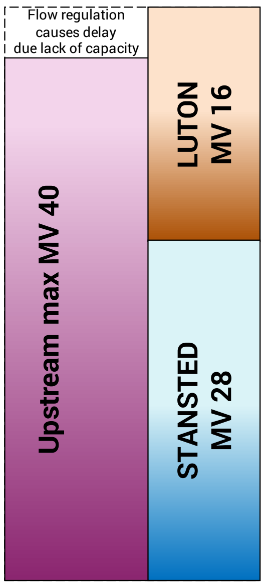
When the actual number of upstream movements per hour approaches the MV (known as over-demand), safety is highest priority, so the air traffic control supervisor considers applying flow regulations.

This stabilises the number of movements until the expected peak subsides. That action causes delay to the air traffic yet to arrive at the airports, which in turn generates more delay for both arriving and departing traffic.

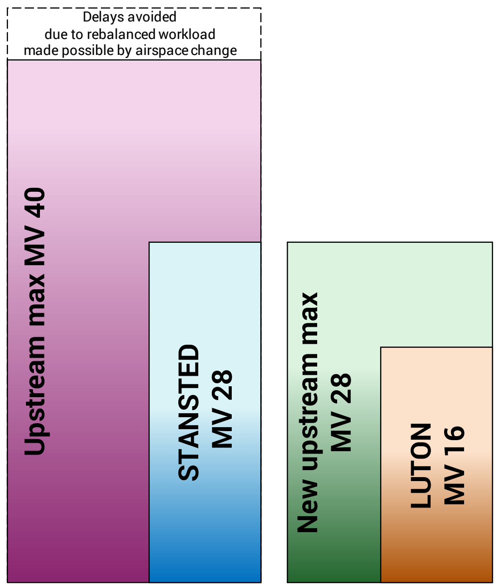
The LUTON arrival flow has an MV of 16, STANSTED an MV of 28, totalling 44, which is greater than the upstream MV. This means flow regulation is more likely to be applied when both LUTON and STANSTED are busy.

The LUTON and STANSTED arrival flows cannot be separated without changing the airspace design.

Under Option 1 and Option 2 of this proposal, the LUTON flow is separated from the STANSTED flow and it would be moved into a new upstream flow, thus separating the flow dependency.



Option 0 Baseline do-nothing flow management illustration (left)



Option 1 and Option 2 flow management illustration (right)

(See also see Consultation Document Annex I). The extra capacity created by separating the LLA flow from the Stansted upstream flow removes the probability of upstream delay.

In 2022 the forecast shows an estimated net delay avoidance (reduction) of c.10,200 minutes given either Option 1 or Option 2.

In 2032 this forecast rises to an estimated saving of c.11,200 minutes (with or without LLAL's DCO).

Capacity (qualitatively assessed)

The broader impact of delay to the travelling public, businesses and local communities would reduce. There would be additional capacity to absorb delay to cater for the forecast increase in air traffic.

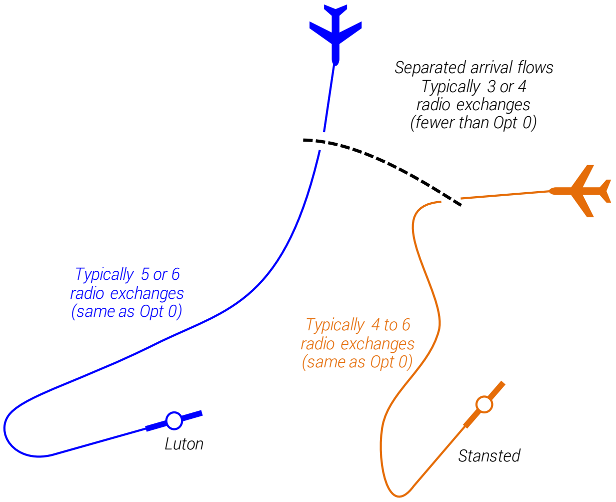
Resilience (quantified estimates, qualitatively discussed)

Air traffic controllers can manage aircraft by providing heading and level instructions, which is referred to as vectoring. Vectoring is highly manual, tactical and intense because each instruction to the pilot must be read back by the pilot to the controller to ensure accuracy. Therefore, a single radio exchange to an aircraft involves at least two radio transmissions (one call, one response), or at least four if an error needs to be corrected (call, incorrect response, correction call, correct response).

Option 1 New Hold and Vectors Continued…

Radio exchanges are an indicator for resilience. The lower the need for radio exchanges per flight, the more resilient the airspace system because controllers can spend more time managing the overall flows and less time making constant adjustments to individual flights. Should there be any disruption, the lower the complexity, the easier it is to recover. See paragraphs 2.20-2.22 on p.8 for more details.

The illustration below is an extract from the consultation document Annex I (the full diagram shows all three options side by side).



The new upstream controller works both upper Luton and Stansted arrivals, which are already in two separate flows. They then pass each flight on to the next controller.

The Luton or Stansted controller vectors their respective flight to the runway in a similar way to today.

Option 1 Vectoring
(Luton and Stansted flows are pre-separated)
Easterly runway illustration (westerly is similar)

The typical number of radio exchanges per flight for this scenario would be **6-8** (upper, 3-4 x2), **5-6** (Luton) and **4-6** (Stansted).

Under this Option 1, controllers working with arrivals from the simplified upper system would typically require **15-20** radio exchanges which is **6-8 fewer** than Option 0's 21-28 radio exchanges.

This makes Option 1 more resilient than Option 0 by the predicted removal of 6-8 radio exchanges from the controllers' workloads.

The number of radio exchanges for the westerly runway configurations would be comparable.

The lower the need for radio exchanges per flight, the more resilient the airspace system because controllers can spend more time managing the overall flows and recovering from the disruptive event, and less time making constant adjustments to individual flights.

Should there be any disruption, the lower the complexity, the easier it is to recover.

General Aviation (GA)	Access	Qualitative	

This Option 1 requires an increase in the volume of controlled airspace – see the consultation document's aviation technical section 7 for full details, summarised as four new volumes of CAS with bases FL75, FL85, FL105, FL125 and the raising of two low-altitude CAS bases southeast of Stansted Airport.

Qualitatively this impact would be a potential increased access restriction on GA who fly FL75 and above in the region, compared with the baseline do-nothing upper Option 0, but a reduced restriction at lower altitudes near Stansted.

Although not a requirement under CAP1616, this section of the table considers impacts on military aviation. Qualitatively this impact would be a potential increased access restriction on the MoD, specifically USAFE operating from RAF Lakenheath and RAF Mildenhall who fly FL75 and above in the region, compared with the baseline do-nothing upper Option 0.

General Aviation/ commercial airlines	Economic impact from increased effective capacity	Quantified, monetised estimate	Cost per minute of delay avoided

Earlier in this table, capacity was discussed and quantified. Since April 2018, NATS monetises airline delay costs at £3.68/min where delay ≤ 15 mins and £53.50/min where delay > 15 mins.

In both Option 1 and Option 2 we presume the individual delays avoided are ≤ 15 mins, at £3.68/min, and the costs shown here assume no change year on year.

In 2022 the forecast shows an estimated net delay avoidance (reduction) of c.10,200 minutes given either Option 1 or Option 2.

This monetises at 10,200x£3.68=£37,500pa

In 2032 this forecast rises to an estimated saving of c.11,200 minutes (with or without LLAL's DCO).

This monetises at 11,200x£3.68=£41,200pa

Option 1 New Hold and Vectors Continued…

General Aviation/ commercial airlines	Fuel Burn	Quantified, monetised estimate

This section provides data applicable to both Options using the no-DCO and with-DCO traffic forecasts and is calculated using the same data as the Greenhouse Gas section earlier in this table. The ratio of 1kg fuel burnt emits 3.18kg of CO_2e. Each tonne of jet fuel in Europe cost 356.76GBP based on IATA jet fuel website, at 457.38USD converted to GBP at 0.78 using XE.com's rate (both as of 28 Feb 2020).

The overall fuel cost disbenefit would be c.£2.1m in 2022, £1.9m in 2032 (no DCO) or £2.2m in 2032 (with DCO) – see left panel of table below. This would be apportioned as per the forecasts described in the Greenhouse Gas section earlier, duplicated here.

In 2022, the changes would apply to a total of 172,459 combined LLA and Stansted arrivals, resulting in a net increase of 5,841 tonnes of fuel. These figures are the sum of forecast 70,740 LLA arrivals, total increase of 6,330t, combined with forecast 101,719 Stansted arrivals, total benefit of 489t.

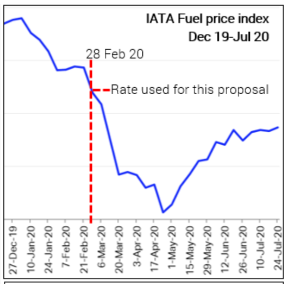
In 2032 without LLAL's DCO, the changes would apply to a total of 173,150 combined LLA and Stansted arrivals, resulting in a net increase of 5,219 tonnes of fuel. These figures are the sum of forecast 70,740 LLA arrivals, total increase of 6,330t, combined with forecast 102,410 Stansted arrivals, total benefit of 1,111t.

In 2032 with LLAL's DCO, the changes would apply to a total of 193,910 combined LLA and Stansted arrivals, resulting in a net increase of 6,191 tonnes of fuel. These figures are the sum of forecast 91,500 LLA arrivals, total increase of 7,302t, combined with forecast 102,410 Stansted arrivals, total benefit of 1,111t.

Summary table:

	Fuel per year, tonnes, negative is disbenefit		
Scenario	2022	2032 No DCO	2032 With DCO
Do Nothing	Baseline	Baseline	Baseline
Option 1	-5,841	-5,219	-6,191
Option 2	-5,841	-5,219	-6,191
	CO_2 equivalent (3.18 conversion)		
Do Nothing	Baseline	Baseline	Baseline
Option 1	-18,574	-16,596	-19,687
Option 2	-18,574	-16,596	-19,687
Scenario	Overall Fuel cost (at £356.76/tonne) IATA jet fuel cost USD457.38, USD to GBP 0.78 Rates dated 28 Feb 2020		
Do Nothing	Baseline	Baseline	Baseline
Option 1	-£2,084,000	-£1,862,000	-£2,209,000
Option 2	-£2,084,000	-£1,862,000	-£2,209,000

Average change in fuel cost per flight (LLA Arrivals)			
Scenario	2022	2032 No DCO	2032 With DCO
Num flights	70,740	70,740	91,500
t fuel total	-6,330	-6,330	-7,302
t fuel per flight	-0.089	-0.089	-0.080
t CO2e per flight	-0.285	-0.285	-0.254
£/flt Opt 1	-£31.92	-£31.92	-£28.47
£/flt Opt 2	-£31.92	-£31.92	-£28.47
Average change in fuel cost per flight (Stansted Arrivals)			
Num flights	101,719	102,410	102,410
t fuel total	489	1,111	1,111
t fuel per flight	0.005	0.011	0.011
t CO2e per flight	0.015	0.034	0.034
£/flt Opt 1	£1.72	£3.87	£3.87
£/flt Opt 2	£1.72	£3.87	£3.87



The blue graph above illustrates the IATA aviation fuel price index and its fluctuations caused by the coronavirus pandemic.
The IATA index is proportional to the specific fuel cost per tonne used in the calculation assumptions for this document.
The rate was taken on 28 Feb 20 as per the red dashed line.

These costs assume no change in fuel cost per tonne and currency exchange rate from 28 Feb 2020.
Qualitatively, Option 1 is not expected to cause any fuel cost disbenefit to GA.

Commercial airlines	Training costs	Qualitative

Qualitatively, flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. This proposal is not anticipated to require additional training costs for airlines.

Commercial airlines	Other costs	Qualitative

No other airline costs are foreseen.

Airport/ ANSP	Infrastructure costs	Qualitative

This proposal is not expected to change airport or ANSP infrastructure, beyond the initial deployment phase which would require some systems engineering amendments.

Airport/ ANSP	Operational costs	Qualitative

This proposal is not expected to change airport or ANSP operational costs.

Airport/ ANSP	Deployment costs	Qualitative

This proposal is expected to require significant air traffic controller training, in the order of 120-150 controllers and c.50 assistants at NATS Swanwick, the extensive use of the NATS simulator facility, also 25 controllers and 5 assistants based at LLA.

Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availabilty of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery.

Other costs include that of the end to end CAP1616 process.

Government policy	Alignment with AMS	Qualitative

This Option 1 is partially aligned with the AMS because the upper-altitude arrivals are systemised using appropriate PBN routes. It is not fully aligned because the lower-altitude arrivals are not systemised at all, and operate in the same way as baseline Option 0.

End of Option 1 table.

5. Option 2 – Hold to the North of LLA with two PBN routes available to each Runway

5.1 This option introduces a new hold to the north of LLA. Controllers would be able to instruct a proportion of arrivals to follow a pre-programmed PBN flightpath from the proposed hold to the runway.

5.2 Typically, 49% of arrivals would be expected to follow one of the available PBN routes, 30% would be offered a shortcut, and the remaining 21% would require partial or total vectoring.

5.3 These diagrams are thumbnails of those in the consultation document.

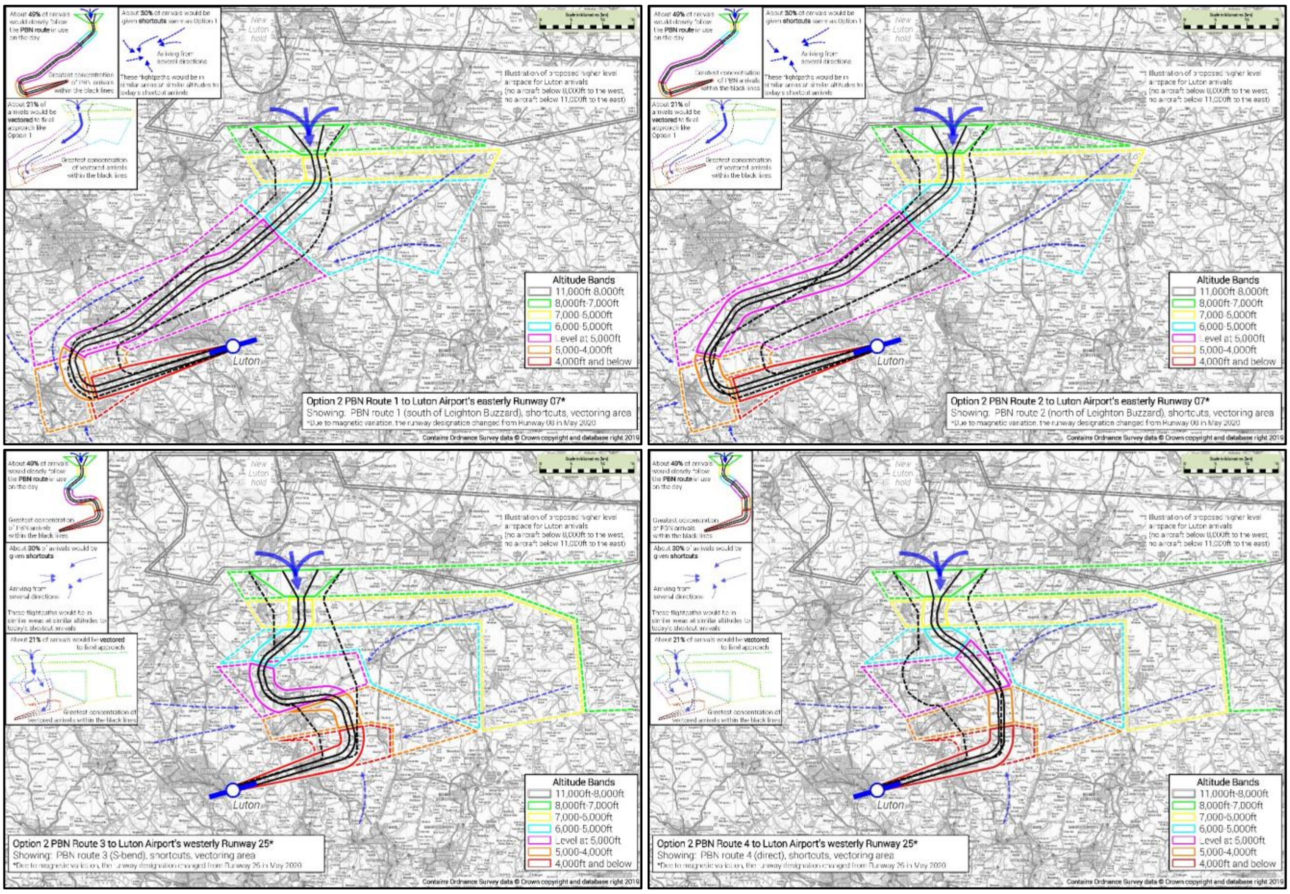


Figure 4 Illustration of Option 2 programmed PBN routes and vectoring areas, two to each runway end, Runway 07 (top) and Runway 25 (above)

Group	Impact	Level of Analysis	Evidence – see the row below each heading
Communities	Noise impact on health and quality of life	Quantitative impacts of LLA traffic Qualitative (other impacts)	Noise contour, area covered, population count Hospitals, places of worship and schools This includes impacts on tranquillity and visual intrusion (Chilterns AONB). (Biodiversity is covered on page 5).

Noise Metric Images (contours) and Data Tables are provided in the consultation document. Annex D for 2022, Annex E for 2032 without DCO, and Annex F for 2032 with DCO. See Section 6 from p.28 for the analysis forecasts and methodology summaries.

Data types:

Contours, overflight areas and summary tables (images only, Excel tables supplied to CAA directly)

LAeq16hr Day, LAeq8hr Night N65 Day N60 Night CAP1498 Overflight 48.5° angle Day CAP1498 Overflight 48.5° angle Night

Numbers of hospitals, places of worship and schools

Data info:

Summer arrivals & departures (16 June-15 Sept, forecast for the scenario years and types), average runway split (30% rwy 07, 70% rwy 25).

Fleet analysis assumptions: retire older/noisier aircraft and replace with equivalent newer quieter aircraft over the 10-year period (Fleet change is not due to this proposal, would happen regardless, and is common between analyses)

Population forecasts are from CACI, for 2021 and ten years later, 2031. Analysis using this population data was performed before the coronavirus pandemic caused a nine month delay to the planned implementation, to 2022. The population data for 2021 is a valid illustration for 2022, likewise 2031 for 2032, and it would be disproportionate to perform a new noise analysis.

WebTAG 10-year adverse impact cost data is based on differences from the baseline no-change option and the comparison is made using 2021-2031 analyses which we contend are valid illustrations for 2022-2032. See Section 6 from p.28 for a detailed explanation.

The base year has been set to 2010 because it aligns with the most recent official valuations of health impacts on environmental noise exposure and is consistent with the example used in CAP1616a.

The full Excel WebTAG sheets will be supplied directly to the CAA.

Description *positive value reflects a **net benefit** (i.e. a reduction in noise)	2032 No DCO Option 2		2032 With DCO Option 2	
	WebTAG assessment	Sensitivity test excluding impacts below 51 dB (for aviation proposals only)	WebTAG assessment	Sensitivity test excluding impacts below 51 dB (for aviation proposals only)
Net present value of change in noise (£, 2010 prices):	-£1,414,348	-£648,080	-£852,718	-£309,106
Net present value of impact on sleep disturbance (£, 2010 prices):	-£663,767	-£88,820	-£634,150	-£222,270
Net present value of impact on amenity (£, 2010 prices):	-£579,977	-£388,656	-£196,366	-£64,633
Net present value of impact on AMI (£, 2010 prices):	-£1,615	-£1,615	-£8,095	-£8,095
Net present value of impact on stroke (£, 2010 prices):	-£67,330	-£67,330	-£5,663	-£5,663
Net present value of impact on dementia (£, 2010 prices):	-£101,659	-£101,659	-£8,444	-£8,444
Households experiencing increased daytime noise in forecast year:	1411		2070	
Households experiencing reduced daytime noise in forecast year:	582		1859	
Households experiencing increased night time noise in forecast year:	661		794	
Households experiencing reduced night time noise in forecast year:	81		340	

Tranquillity (qualitative discussion) – See Consultation Document Annex G for illustrations

Runway 07 PBN route to final approach, northern

Aircraft using this route are likely to narrowly avoid overflying the northern section of the Chilterns AONB at 5,000ft, but will continue to overfly the southern section on final approach below 4,000ft.

Runway 07 PBN route to final approach, southern

Aircraft using this route are likely to overfly the north-western tip of the northern section of the Chilterns AONB at 5,000ft, and will continue to overfly the southern section on final approach below 4,000ft.

Runway 25, both PBN routes to final approach

Aircraft using this route are likely to avoid overflying the Chilterns AONB.

Controller intervention - shortcut and vectored arrivals

These manually-controlled aircraft are likely to behave in the same way they do under Option 0 (similar locations and altitudes), however they would be a smaller proportion of flights because c.49% of arrivals would follow the active PBN route for the runway in use.

Communities	Air quality	Qualitative	See also Government guidance ANG2017.

Government guidance says that aircraft flying higher than 1,000ft are unlikely to have a significant impact on local air quality.

Arriving aircraft would still descend through 1,000ft between 4 and 2 nautical miles (about 7-4km) from touchdown at either end of the runway. This is close to landing, in the very final stages of the approach, and there are no proposed changes this close to touchdown.

Option 2 New Hold and PBN Routes Continued…

Communities	Historic environment	Quantitative estimate, qualitative discussion	Overflight of registered historic parks and gardens below 4,000ft

See Consultation Document Annex H for illustrations

For Runway 07:

Mentmore Towers would be avoided by both PBN routes below 4,000ft.

Luton Hoo's northern tip lies under the final approach path close to the runway, and will continue to be overflown below 1,000ft.

For Runway 25:

Julians Gardens would not be overflown by either PBN route below 4,000ft.

Garden House would be overflown by the S-bend PBN route, and narrowly avoided by the Direct PBN route, between 4,000ft and 3,000ft.

St Paul's Walden Bury would continue to be overflown by all LLA arrivals below 2,000ft.

Controller intervention - shortcut and vectored arrivals

These manually-controlled aircraft are likely to behave in the same way they do under Option 0 (similar locations and altitudes), however they would be a smaller proportion of flights because c.49% of arrivals would follow the active PBN route for the runway in use.

Wider society	Greenhouse gas impact	Quantitative	Fuel simulation analysis

The change in distance at the upper levels, and the descent profile, is common to both options, as is the likelihood of holding for both airports. ATC and analytics experts determined that the distances and altitudes flown from the hold to each runway would proportionally be the same, regardless of the method used to get there (Option 1 vectoring, Option 2 PBN routes with vectoring). Feeding common parameters into the fuel analysis simulator would cause the results to also be common.

Therefore, there would be no difference in fuel burnt and associated CO_2e emissions between Options 1 and 2.

This section provides data applicable to both Options 1 and 2 using the 2032 no-DCO and 2032 with-DCO traffic forecasts.

See Section 6 from p.28 for more details on LLA and Stansted arrival forecasts, with and without LLA's DCO.

In 2022, the changes would apply to a total of 172,459 combined LLA and Stansted arrivals, resulting in a net increase of 18,574 tonnes of CO_2e. These figures are the sum of forecast 70,740 LLA arrivals, total increase of 20,129t, combined with forecast 101,719 Stansted arrivals, total benefit of 1,555t.

In 2032 without LLAL's DCO, the changes would apply to a total of 173,150 combined LLA and Stansted arrivals, resulting in a net increase of 16,596 tonnes of CO_2e. These figures are the sum of forecast 70,740 LLA arrivals, total increase of 20,129t, combined with forecast 102,410 Stansted arrivals, total benefit of 3,533t.

In 2032 with LLAL's DCO, the changes would apply to a total of 193,910 combined LLA and Stansted arrivals, resulting in a net increase of 19,687 tonnes of CO_2e. These figures are the sum of forecast 91,500 LLA arrivals, total increase of 23,220t, combined with forecast 102,410 Stansted arrivals, total benefit of 3,533t.

WebTAG was used to assess the greenhouse gas impact over time from the proposed changes. Both options would yield a negative Net Present Value which reflects a disbenefit, i.e. a CO_2e increase.

Without LLAL's DCO, there would be an increase of CO_2e in the opening year (2022) of 18,574t which would, over a 60 year appraisal period, total 193,441t.

WebTAG was also used to calculate the overall Net Present Value of CO_2e emissions increase for the non-traded sector at £1,368,555.

With LLAL's DCO, there would be an increase of CO_2e in the opening year (2022) of 18,574t which would, over a 60 year appraisal period, total 210,425t.

WebTAG was also used to calculate the overall Net Present Value of CO_2e emissions increase for the non-traded sector at £1,481,807.

Traded and non-traded flights were categorised as intra-EU for traded (82.1% for LLA, 86.1% for Stansted) and all other flights as non-traded (17.9% for LLA, 13.9% for Stansted). These figures were calculated by analysing the origins and destinations for LLA and Stansted flights for 2019 and factored into the calculations, assuming the ratios remain constant for the WebTAG period.

The disbenefit primarily arises from the longer tracks flown by LLA arrivals, partially offset by the arrivals remaining higher for longer and less likely to enter the hold. Also there is some benefit to Stansted arrivals due to the separation from LLA arrivals at an early, higher stage of flight.

Option 2 New Hold and PBN Routes Continued…

Wider society	Capacity/ resilience	Quantitative/ qualitative	Monitoring value Minutes of delay avoided due to improved traffic flows Changes in number of radio exchanges

Capacity (quantified)

All arrivals to LLA are entwined with arrivals to Stansted for most of their time in UK airspace, until they reach the holds. Only after leaving the holds are they separated into their respective arrival flows. This means that LLA arrivals are highly dependent on Stansted arrivals and vice-versa. For example, if a Stansted flight is at the lowest level in the hold and LLA aircraft are holding in the levels above, then any delay at Stansted Airport (like a temporarily closed runway) means the LLA arrivals are stuck and Air Traffic Controllers will find it difficult to extract them from the holds. This applies the other way around, should Stansted traffic get stuck above LLA traffic. The dependencies on each other cause capacity and resilience issues which we intend to solve through this airspace change proposal. So, the main comparison will be, do the other options improve the situation compared to this baseline do-nothing scenario. Broadly, MV indicates the number of movements per hour which can be safely handled by the controllers operating the flows in each associated airspace sector.

These are not necessarily geographical 'boxes', but they describe how certain arrival flows are measured and managed.

The current upstream (the flow of arriving traffic before reaching LUTON or STANSTED) flow group has a Monitoring Value (MV) of 40.

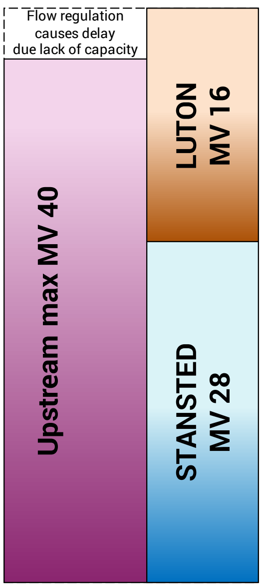
When the actual number of upstream movements per hour approaches the MV (known as over-demand), safety is highest priority, so the air traffic control supervisor considers applying flow regulations.

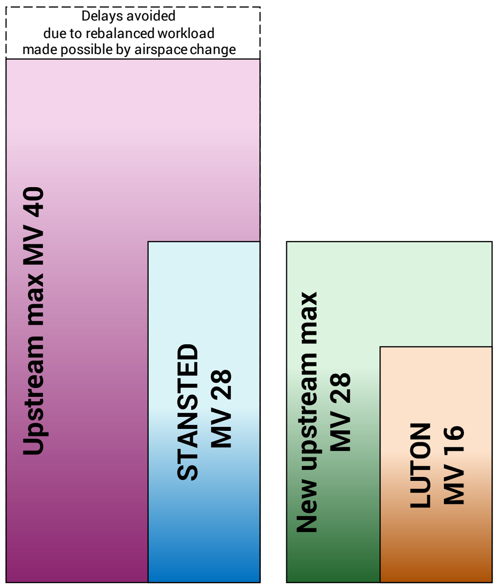
This stabilises the number of movements until the expected peak subsides. That action causes delay to the air traffic yet to arrive at the airports, which in turn generates more delay for both arriving and departing traffic.

The LUTON arrival flow has an MV of 16, STANSTED an MV of 28, totalling 44, which is greater than the upstream MV. This means flow regulation is more likely to be applied when both LUTON and STANSTED are busy.

The LUTON and STANSTED arrival flows cannot be separated without changing the airspace design.

Under Option 1 and Option 2 of this proposal, the LUTON flow is separated from the STANSTED flow and it would be moved into a new upstream flow, thus separating the flow dependency.





Option 0 Baseline do-nothing flow management illustration (left) Option 1 and Option 2 flow management illustration (right)

(See also see Consultation Document Annex I). The extra capacity created by separating the LLA flow from the Stansted upstream flow removes the probability of upstream delay.

In 2022 the forecast shows an estimated net delay avoidance (reduction) of c.10,200 minutes given either Option 1 or Option 2.

In 2032 this forecast rises to an estimated saving of c.11,200 minutes (with or without LLAL's DCO).

Capacity (qualitatively assessed)

The broader impact of delay to the travelling public, businesses and local communities would reduce. There would be additional capacity to absorb delay to cater for the forecast increase in air traffic.

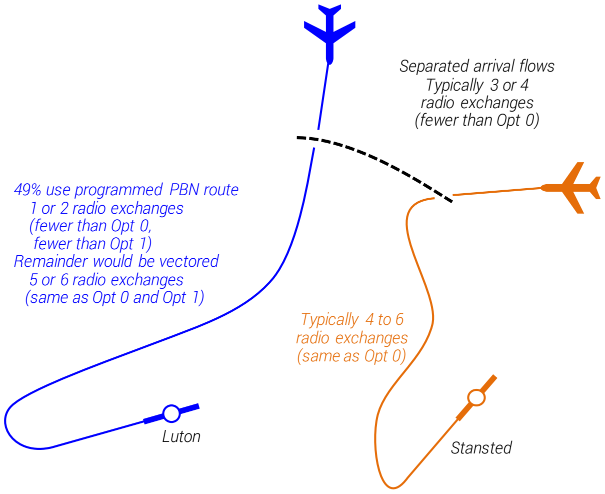
Resilience (quantified estimates, qualitatively discussed)

Air traffic controllers can manage aircraft by providing heading and level instructions, which is referred to as vectoring. Vectoring is highly manual, tactical and intense because each instruction to the pilot must be read back by the pilot to the controller to ensure accuracy. Therefore, a single radio exchange to an aircraft involves at least two radio transmissions (one call, one response), or at least four if an error needs to be corrected (call, incorrect response, correction call, correct response).

Option 2 New Hold and PBN Routes Continued…

Radio exchanges are an indicator for resilience. The lower the need for radio exchanges per flight, the more resilient the airspace system because controllers can spend more time managing the overall flows and less time making constant adjustments to individual flights. Should there be any disruption, the lower the complexity, the easier it is to recover. See paragraphs 2.20-2.22 on p.8 for more details.

The illustration below is an extract from the consultation document Annex I (the full diagram shows all three options side by side).



The new upstream controller works both upper Luton and Stansted arrivals, which are already in two separate flows.
They then pass each flight on to the next controller.

The Luton controller would use the programmed PBN route 49% of the time and shortcutting or vectoring for the remainder, depending on the specific traffic arrangement at the time.
The Stansted controller would vector their arrivals to the runway in a similar way.

Option 2 PBN routes and Vectoring
(Luton and Stansted flows are pre-separated)
Easterly runway illustration (westerly is similar)

The typical number of radio exchanges per flight for this scenario would be 6-8 (upper, 3-4 x2), 1-6 (Luton) and 4-6 (Stansted).

Under this Option 2, controllers working with arrivals from the simplified upper system would typically require 11-20 radio exchanges which is up to 10 fewer than Option 0's 21-28 radio exchanges and up to 4 fewer than Option 1's 15-20.

This makes Option 2 more resilient than both Option 0 and Option 1, by the predicted removal of up to 10 radio exchanges from the controllers' workloads.

The number of radio exchanges for the westerly runway configurations would be comparable.

The lower the need for radio exchanges per flight, the more resilient the airspace system because controllers can spend more time managing the overall flows and recovering from the disruptive event, and less time making constant adjustments to individual flights.

Should there be any disruption, the lower the complexity, the easier it is to recover.

General Aviation	Access	Qualitative	

This Option 2 requires an increase in the volume of controlled airspace – see the consultation document's aviation technical section 7 for full details, summarised as five new volumes of CAS with bases 4,500ft, FL75, FL85, FL105, FL125 and the raising of two low-altitude CAS bases southeast of Stansted Airport.

Qualitatively this impact would be a potential increased access restriction on GA who fly in a small region at 4,500ft and larger regions FL75 and above, compared with the baseline do-nothing upper Option 0, but a reduced restriction at lower altitudes near Stansted. This option is more restrictive to a particular stakeholder group who are known to fly in the Option 2-specific 4,500ft region.

Although not a requirement under CAP1616, this section of the table considers impacts on military aviation. Qualitatively this impact would be a potential increased access restriction on the MoD, specifically USAFE operating from RAF Lakenheath and RAF Mildenhall who fly FL75 and above in the region, compared with the baseline do-nothing upper Option 0.

General Aviation/ commercial airlines	Economic impact from increased effective capacity	Quantified, monetised estimate	Cost per minute of delay avoided

Earlier in this table, capacity was discussed and quantified. Since April 2018, NATS monetises airline delay costs at £3.68/min where delay ≤ 15 mins and £53.50/min where delay > 15 mins.

In both Option 1 and Option 2 we presume the individual delays avoided are ≤ 15 mins, at £3.68/min, and the costs shown here assume no change year on year.

In 2022 the forecast shows an estimated net delay avoidance (reduction) of c.10,200 minutes given either Option 1 or Option 2.

This monetises at 10,200*£3.68=£37,500pa

In 2032 this forecast rises to an estimated saving of c.11,200 minutes (with or without LLAL's DCO).

This monetises at 11,200*£3.68=£41,200pa

Option 2 New Hold and PBN Routes Continued…

General Aviation/ commercial airlines	Fuel Burn	Quantified, monetised estimate	

This section provides data applicable to both Options using the no-DCO and with-DCO traffic forecasts and is calculated using the same data as the Greenhouse Gas section earlier in this table. The ratio of 1kg fuel burnt emits 3.18kg of CO_2e. Each tonne of jet fuel in Europe cost 356.76GBP based on IATA jet fuel website, at 457.38USD converted to GBP at 0.78 using XE.com's rate (both as of 28 Feb 2020).

The overall fuel cost disbenefit would be c.£2.1m in 2022, £1.9m in 2032 (no DCO) or £2.2m in 2032 (with DCO) – see left panel of table below. This would be apportioned as per the forecasts described in the Greenhouse Gas section earlier, duplicated here.

In 2022, the changes would apply to a total of 172,459 combined LLA and Stansted arrivals, resulting in a net increase of 5,841 tonnes of fuel. These figures are the sum of forecast 70,740 LLA arrivals, total increase of 6,330t, combined with forecast 101,719 Stansted arrivals, total benefit of 489t.

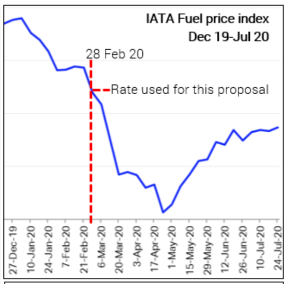
In 2032 without LLAL's DCO, the changes would apply to a total of 173,150 combined LLA and Stansted arrivals, resulting in a net increase of 5,219 tonnes of fuel. These figures are the sum of forecast 70,740 LLA arrivals, total increase of 6,330t, combined with forecast 102,410 Stansted arrivals, total benefit of 1,111t.

In 2032 with LLAL's DCO, the changes would apply to a total of 193,910 combined LLA and Stansted arrivals, resulting in a net increase of 6,191 tonnes of fuel. These figures are the sum of forecast 91,500 LLA arrivals, total increase of 7,302t, combined with forecast 102,410 Stansted arrivals, total benefit of 1,111t.

Summary table:

	Fuel per year, tonnes, negative is disbenefit		
Scenario	2022	2032 No DCO	2032 With DCO
Do Nothing	Baseline	Baseline	Baseline
Option 1	-5,841	-5,219	-6,191
Option 2	-5,841	-5,219	-6,191
	CO_2 equivalent (3.18 conversion)		
Do Nothing	Baseline	Baseline	Baseline
Option 1	-18,574	-16,596	-19,687
Option 2	-18,574	-16,596	-19,687
Scenario	Overall Fuel cost (at £356.76/tonne) IATA jet fuel cost USD457.38, USD to GBP 0.78 Rates dated 28 Feb 2020		
Do Nothing	Baseline	Baseline	Baseline
Option 1	-£2,084,000	-£1,862,000	-£2,209,000
Option 2	-£2,084,000	-£1,862,000	-£2,209,000

	Average change in fuel cost per flight (LLA Arrivals)		
Scenario	2022	2032 No DCO	2032 With DCO
Num flights	70,740	70,740	91,500
t fuel total	-6,330	-6,330	-7,302
t fuel per flight	-0.089	-0.089	-0.080
t CO2e per flight	-0.285	-0.285	-0.254
£/flt Opt 1	-£31.92	-£31.92	-£28.47
£/flt Opt 2	-£31.92	-£31.92	-£28.47
	Average change in fuel cost per flight (Stansted Arrivals)		
Num flights	101,719	102,410	102,410
t fuel total	489	1,111	1,111
t fuel per flight	0.005	0.011	0.011
t CO2e per flight	0.015	0.034	0.034
£/flt Opt 1	£1.72	£3.87	£3.87
£/flt Opt 2	£1.72	£3.87	£3.87



The blue graph above illustrates the IATA aviation fuel price index and its fluctuations caused by the coronavirus pandemic.
The IATA index is proportional to the specific fuel cost per tonne used in the calculation assumptions for this document.
The rate was taken on 28 Feb 20 as per the red dashed line.

These costs assume no change in fuel cost per tonne and currency exchange rate from 28 Feb 2020.
Qualitatively, Option 2 is not expected to cause any fuel cost disbenefit to GA.

Commercial airlines	Training costs	Qualitative	

Qualitatively, flight procedures change worldwide with each AIRAC cycle and airlines would update their procedures accordingly, training if required. This proposal is not anticipated to require additional training costs for airlines.

Commercial airlines	Other costs	Qualitative	

No other airline costs are foreseen.

Airport/ ANSP	Infrastructure costs	Qualitative	

This proposal is not expected to change airport or ANSP infrastructure, beyond the initial deployment phase which would require some systems engineering amendments.

Airport/ ANSP	Operational costs	Qualitative	

This proposal is not expected to change airport or ANSP operational costs.

Airport/ ANSP	Deployment costs	Qualitative	

This proposal is expected to require significant air traffic controller training, in the order of 120-150 controllers and c.50 assistants at NATS Swanwick, the extensive use of the NATS simulator facility, also 25 controllers and 5 assistants based at LLA.

Support staff are required to run the simulator – planning, training staff, data preparation and testing, pseudo pilots, safety analysts, outputs to be recorded and reported etc. Some staff may only require briefings. There may be occasions where the reduced availabilty of operational controllers during their conversion training could mean operational rostering becomes a factor when considering continuous service delivery.

Other costs include that of the end to end CAP1616 process.

Government policy	Alignment with AMS	Qualitative	

This Option 2 is generally aligned with the AMS because the upper-altitude arrivals are systemised using appropriate PBN routes and the lower-altitude arrivals have appropriate PBN routes available for use by the controller. Vectoring and shortcuts would still be used to complement the use of PBN routes.

End of Option 2 table.

6. Analysis Forecasts and Methodology Summaries

6.1 The analysis for the Full Options Appraisal (FOA) has considered the influence of increased passengers on increased air traffic movements within our forecasts. At the time analysis was started, 2018 was the most complete and appropriate base year from which to derive the forecasts. Annual movements at LLA in 2018 were 136,270 (68,135 arrivals).

6.2 The number of arrivals at LLA for 2022 is assumed to be 70,740 for the purpose of these analyses.

6.3 Should the application for LLAL's DCO not succeed, the same number of arrivals is assumed for 2032 (ten years from implementation) because the 18 million passengers per annum limit is already reached and the number of arrivals could not increase.

6.4 Should LLAL's application for the DCO succeed, the number of LLA arrivals is forecast to be 91,500 aircraft in 2032. This proposal is not directly related to LLAL's DCO; however the traffic forecasts and analyses used here must be consistent with the forecasts publicly available as part of the separate DCO process – see below for further details.

6.5 The noise and fuel/CO_2e analyses were performed pre-pandemic, assuming this proposal's originally-planned implementation year of 2021, with a ten-year forecast up to 2031 as required by the airspace change process CAP1616 (ref 12). Those forecasts were consistent with the forecast non-DCO traffic levels and with LLAL's published DCO traffic forecasts, for 2021-2031. The purpose of fuel/CO_2e and noise modelling analyses is to illustrate the differences between the potential impacts of different airspace design options, and their respective methodology assumptions are summarised later in this section.

6.6 The coronavirus pandemic has caused impacts on the aviation industry which has meant that the original timescale to implement this proposal in May 2021, subject to CAA approval, has moved to February 2022, nine months later. We have assumed the remainder of 2020 and 2021 will now be stabilisation and recovery years, where traffic levels return to pre-pandemic levels.

6.7 The forecast period for this airspace change must therefore now run from 2022-2032 and must still be consistent with LLAL's DCO forecast. There is a small difference in LLAL's DCO forecast arrivals between 2031 and 2032, rising from 90,500 in 2031 to 91,500 in 2032, an increase of 1,000 arrivals per year, c.2.8 per day, or a 1.1% increase.

6.8 The analyses must be realigned with LLAL's DCO 2022-2032 forecast; however this presents significant challenges of proportionality, given that small difference. The with-DCO analyses must also be consistent with the non-DCO forecast years.

- From a fuel/CO_2e analysis point of view, the original 2021-2031 results can be adapted to account for this small difference, to directly illustrate the 2032 with-DCO scenario. It would not be proportionate to re-run the analysis in full using a slightly-revised traffic forecast, this would require several weeks of expensive work, and result in a minimal difference which would not affect stakeholders' understanding of the likely impacts.
- From a noise analysis point of view (contours, overflight swathes, population and sensitive-building data) the 2021-2031 modelled results cannot be adapted to account for this small difference and cannot directly illustrate the 2032 with-DCO scenario. It would not be proportionate to re-run the analysis in full using a slightly-revised traffic forecast for the reasons stated in the paragraph above.
    - The 2031 noise analyses represent the most up-to-date, credible, clearly referenced source of data with modelling carried out in line with best practice described in CAP1616 (ref 12) and CAP1616a (ref 13).
    - The noise modelling methodology acknowledges that its output is a representation of what may occur given the potential influences, and should not be taken as definitive (see summary of noise modelling later in this Annex).
    - We contend that a qualitative assessment of the difference between the 2031 and 2032 noise scenarios is proportionate.

- We contend that the small differences between 2031 and 2032 noise scenarios would be outweighed by the uncertainties inherent in the non-definitive nature of the modelling, discussed above.
- We contend that the 2031 noise scenarios are sufficiently representative of the 2032 noise scenarios for stakeholders to understand and make informed decisions about the differences between Option 1 and Option 2, in line with Gunning's second principle of consultation.
- Population counts were embedded in the noise analysis methodology, and conducted using data supplied by CACI for 2021-2031. We must assume this to be representative of likely 2022-2032 populations.
- There have been unprecedented impacts on NATS, LLA, and the entire aviation industry due to the coronavirus pandemic. We contend these statements on proportionality are reasonable and do not reduce the effectiveness of the data to illustrate its intended purpose.

6.9 From a fuel/CO_2e point of view for Stansted, annualised figures are based on a linear growth from the NATS traffic forecast from 2021 to 2031 to calculate the 2022 and 2032 traffic figures. From this, in 2022 Stansted is forecast to have 101,719 arrivals and, in 2032, 102,410 arrivals. There would be no noise impacts for Stansted aircraft, and Stansted's traffic is assumed not to be impacted by LLAL's DCO.

6.10 Therefore, each analysis considers 2021 as a recovery year, the implementation year of 2022, 2032 non-DCO and 2032 with-DCO, using the above arrival numbers for LLA, and Stansted arrival numbers where needed to form part of the analysis. The exception is for LLA arrival noise 2022-2032, which we assume to be the same as 2021-2031 as explained above.

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
LLA Arrivals No DCO		70,470	70,470	70,470	70,470	70,470	70,470	70,470	70,470	70,470	70,470	70,470
LLA Arrivals With DCO	Recovery period	70,470	70,470	70,470	79,000	79,000	80,500	83,500	86,500	89,500	90,500	91,500
Stansted Arrivals NERL Base Case		101,650	101,719	101,788	101,857	101,926	101,996	102,065	102,134	102,203	102,272	102,341

Table 1 Forecast arrivals 2021-2032 including recovery period and intermediate years

6.11 LLA's arrival forecast with DCO expects no change for the first three years due to the timetable of the DCO submission and expected planning decisions, for full details see the separate DCO process.

6.12 This table has used linear interpolation for Stansted arrivals from 2022-2032.

The application of WebTAG workbooks in this document

6.13 As described above, the noise and CO_2e analyses were completed before the coronavirus pandemic caused this proposal's planned implementation year to change from 2021 to 2022, and the forecasts must align with those already published under the DCO process. Therefore, the forecasts, instead of 2021-2031, must align with the DCO to 2022-2032 the associated analyses would be adapted to follow.

6.14 The CO_2e results for 2021-2031 can be adapted to directly illustrate 2022-2032.

6.15 The noise results for 2021-2031 cannot be adapted to directly illustrate 2022-2032. We provide an argument above that the 2021-2031 noise analysis is sufficiently representative of 2022-2032 for stakeholders to make informed decisions about the differences between Option 1 and Option 2.

6.16 In both cases, CO_2e and noise, the WebTAG workbooks have been completed using 2022 and 2032 as the opening year and forecast year. The relevant sections of the WebTAG workbooks have been extracted and used in the cost benefit analysis tables in Section 7 p.32.

6.17 Fuel/CO_2e Analysis Methodology Summary

The airspace change has been modelled using the fast-time simulation software AirTOp.

The following dates were used as a traffic sample; 14th June, 27th June, 25th July, 30th July, 27th September and the 28th September 2021 and 2031(flight plans were grown from 2018 data using LLAL's DCO growth forecast for Luton traffic and NATS Stansted forecast for Stansted traffic). Annualised traffic figures for LLA are based on their 2022 and 2032 DCO forecast. Annualised figures for Stansted are based on a linear growth from the NATS Stansted traffic forecast from 2021 to 2031 to calculate the 2022 and 2032 traffic figures.

The traffic sample contained all aircraft which arrived and departed at either LLA (EGGW) or Stansted (EGSS) airport. The fuel burn was modelled for both an easterly and westerly runway direction. The results are weighted 70/30% in favour of westerly operations.

The fuel burn for the baseline and options was calculated using Base of Aircraft Data (BADA) v4.2.

Fuel uplift is included in the assessment.

The Baseline traffic data was based on flight plan data and not actual flown data. This ensured that network constraints associated with excessive demand did not mask underlying demand requirements on the airspace.

When undertaking comparative analysis between the options, the traffic samples remained the same as that in the Baseline scenario. This was to ensure any observed differences were due to the airspace design, not due to changes in the traffic sample.

A 'blue sky' weather picture with no wind was assumed.

Unconstrained demand was modelled thereby excluding the naturally occurring influence of flow restrictions, minimum departure intervals or departure slot compliance.

Controller tasks were completed instantaneously with each controller able to control multiple aircraft simultaneously (no workload constraints or response limitations applied).

AirTOp version 2.3.28B159 was used.

The average fuel burn benefit per aircraft is calculated using only the traffic and aircraft types observed on the particular traffic flows relevant to the scenario.

The airline fuel burn results were calculated by taking their procedural benefit/disbenefit. The average path-stretching for each arrival airport was calculated and it was assumed that this would take place at FL80 for all aircraft as this was the average holding level pulled from NATS data. This was then added to the procedural fuel burn to give a fuel figure for each airline that assumes the holding is the same per aircraft.

Fuel burn modelling has been undertaken using the KERMIT emissions model. The KERMIT model uses BADA data which has been made available by the European Organisation for the Safety of Air Navigation (EUROCONTROL). All rights reserved. The AirTOp simulation model also uses BADA aircraft performance data.

6.18 Noise Modelling Methodology Summary

All noise modelling undertaken for this airspace change has had regard for CAA guidance as provided in CAP1616a (ref 13). The modelling has also taken into account the categories of noise modelling described in the CAA's 2020 consultation on the minimum requirements.

All noise modelling has been carried out using the Federal Aviation Administration's (FAA) Aviation Environmental Design Tool (AEDT) version 3.0b.A1.4. The construction and validation aspects of the noise modelling have been carried out with the support of Noise Consultants Ltd (NCL)'s OnTrack software suite.

It is stressed that modelling of these forecasts has been carried out to provide an indication of the impact of the airspace change in combination with other forecast changes at LLA over the next 10 years. The consideration of the forecasts provides some insight into the potential influence that other infrastructure projects current being planned for LLA could also have on aircraft noise. It should also be noted that the forecasts provided present a representation of what may occur and should therefore not be taken as a definitive impact from infrastructure change or changes to LLA's existing consents.

To determine the proportions of flights used in the tables below, the average proportion of typical flights that arrive into LLA during the day and night was assessed. Annual average runway-use data was used to understand the percentage of the time that each runway is used, based primarily on the wind direction.

6.19 The proportion of aircraft that are vectored and those which use shortcuts (Option 1) and those which would also use the PBN routes (Option 2) was estimated, using senior air traffic control experts (minimum ten years' experience as a Group Supervisor). These proportions have been factored into the noise analysis in the Full Options Appraisal to represent typical behaviour but are not a guarantee of the proportions for any particular period.

	Day				Night			
	90% of flights				10% of flights			
	RWY 25 Day		RWY 07 Day		RWY 25 Night		RWY 07 Night	
	70% of flights		30% of flights		70% of flights		30% of flights	
	Shortcut	Vectoring	Shortcut	Vectoring	Shortcut	Vectoring	Shortcut	Vectoring
Proportion %	30.0	70.0	30.0	70.0	30.0	70.0	30.0	70.0
Multiplied by RWY %	21.0	49.0	9.0	21.0	21.0	49.0	9.0	21.0
Overall time %	18.9	44.1	8.1	18.9	2.1	4.9	0.9	2.1

Table 2 Indicative air traffic proportions for Option 1

	Day						Night					
	90% of flights						10% of flights					
	RWY 25 Day			RWY 07 Day			RWY 25 Night			RWY 07 Night		
	70% of flights			30% of flights			70% of flights			30% of flights		
	Shortcut	PBN	Vectoring	Shortcut	PBN	Vectoring	Shortcut	PBN	Vectoring	Shortcut	PBN	Vectoring
Proportion %	30.0	49.0	21.0	30.0	49.0	21.0	30.0	49.0	21.0	30.0	49.0	21.0
Multiplied by RWY %	21.0	34.3	14.7	9.0	14.7	6.3	21.0	34.3	14.7	9.0	14.7	6.3
Overall time %	18.9	30.87	13.23	8.10	13.23	5.67	2.10	3.43	1.47	0.90	1.47	0.63

Table 3 Indicative air traffic proportions for Option 2

7. Cost-Benefit Analysis

7.1 Four cost-benefit analysis tables are provided, giving the Net Present Value (NPV)[10] for each option without and with LLAL's DCO. A summary of the differences between cost benefit analyses is presented in Table 4 rounded to the nearest £1,000. Negative numbers indicate a cost or disbenefit.

7.2 For the conclusions drawn, see Section 9 on p. 37.

Without DCO	NPV
Option 1 (Table 5)	-£23,861,000
Option 2 (Table 6)	-£24,270,000
Difference (Option 2 minus Option 1)	-£409,000

With DCO	NPV
Option 1 (Table 7)	-£25,918,000
Option 2 (Table 8)	-£26,264,000
Difference (Option 2 minus Option 1)	-£346,000

Table 4 Rounded summary of cost benefit analyses showing the differences in NPVs

7.3 The tables on the following pages are based on the example provided in CAP1616 Table E3 using a social time preference rate to discount at 3.5%.

[10] Applies to a series of cash flows occurring at different times. The present value of a cash flow depends on the interval of time between now and the cash flow. It also depends on the discount rate. NPV accounts for the time value of money. It provides a method for evaluating and comparing projects such as an airspace change. The Net Present Value of each option is calculated as the difference in total impacts between the option and the baseline scenario.

Negative values are cost or disbenefit	2022	2023	2024	2025	2026	202$7$	2028	2029	2030	2031	2032	Net
Year	0	1	2	3	4	5	6	7	8	9	10	Present
Discount factor	1	0.9662	0.9335	0.9019	0.8714	0.8420	0.8135	0.7860	0.7594	0.7337	0.7089	Value
Option 1 Without DCO												
Net community benefit (Noise)	-£5,282	-£3,069	-£957	£1,068	£3,015	£4,894	£6,711	£8,470	£10,178	£11,832	£13,430	
Net community benefit (CO_2)	-£140,249	-£136,293	-£132,375	-£128,577	-£124,819	-£121,178	-£119,086	-£115,539	-£112,037	-£116,600	-£121,803	
Net airspace users benefit (CO_2)	-£235,823	-£283,708	-£326,808	-£357,796	-£392,582	-£423,454	-£444,049	-£468,137	-£489,078	-£507,063	-£527,761	
Net airspace users benefit (Fuel costs)	-£2,084,000	-£2,062,000	-£2,039,000	-£2,017,000	-£1,995,000	-£1,973,000	-£1,951,000	-£1,929,000	-£1,906,000	-£1,884,000	-£1,862,000	
Net airspace users benefit (Delay)	£37,500	£37,870	£38,240	£38,610	£38,980	£39,350	£39,720	£40,090	£40,460	£40,830	£41,200	NPV
Present value (rounded to nearest whole £1,000, NPV is sum of unrounded data)	-£2,428,000	-£2,379,000	-£2,328,000	-£2,270,000	-£2,219,000	-£2,168,000	-£2,111,000	-£2,060,000	-£2,008,000	-£1,964,000	-£1,927,000	**-£23,861,000**

Table 5 Cost Benefit Analysis Option 1 without DCO

Negative values are cost or disbenefit	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Net
Year	0	1	2	3	4	5	6	7	8	9	10	Present
Discount factor	1	0.9662	0.9335	0.9019	0.8714	0.8420	0.8135	0.7860	0.7594	0.7337	0.7089	Value
Option 2 Without DCO												
Net community benefit (Noise)	-£36,442	-£35,490	-£34,620	-£33,821	-£33,079	-£32,389	-£31,745	-£31,127	-£30,550	-£29,981	-£29,420	
Net community benefit (CO_2)	-£140,249	-£136,293	-£132,375	-£128,577	-£124,819	-£121,178	-£119,086	-£115,539	-£112,037	-£116,600	-£121,803	
Net airspace users benefit (CO_2)	-£235,823	-£283,708	-£326,808	-£357,796	-£392,582	-£423,454	-£444,049	-£468,137	-£489,078	-£507,063	-£527,761	
Net airspace users benefit (Fuel costs)	-£2,084,000	-£2,062,000	-£2,039,000	-£2,017,000	-£1,995,000	-£1,973,000	-£1,951,000	-£1,929,000	-£1,906,000	-£1,884,000	-£1,862,000	
Net airspace users benefit (Delay)	£37,500	£37,870	£38,240	£38,610	£38,980	£39,350	£39,720	£40,090	£40,460	£40,830	£41,200	NPV
Present value (rounded to nearest whole £1,000, NPV is sum of unrounded data)	-£2,459,000	-£2,411,000	-£2,362,000	-£2,305,000	-£2,255,000	-£2,205,000	-£2,150,000	-£2,099,000	-£2,048,000	-£2,006,000	-£1,970,000	**-£24,270,000**

Table 6 Cost Benefit Analysis Option 2 without DCO

Negative values are cost or disbenefit	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Net
Year	0	1	2	3	4	5	6	7	8	9	10	Present
Discount factor	1	0.9662	0.9335	0.9019	0.8714	0.8420	0.8135	0.7860	0.7594	0.7337	0.7089	Value
Option 1 With DCO												
Net community benefit (Noise)	-£5,282	-£2,748	-£329	£1,990	£4,222	£6,375	£8,459	£10,476	£12,436	£14,332	£16,165	
Net community benefit (CO_2)	-£140,249	-£136,293	-£132,375	-£137,136	-£133,198	-£130,872	-£131,653	-£130,727	-£129,725	-£136,133	-£143,447	
Net airspace users benefit (CO_2)	-£235,823	-£283,708	-£326,808	-£382,419	-£419,916	-£458,693	-£492,917	-£532,595	-£570,196	-£596,741	-£627,097	
Net airspace users benefit (Fuel costs)	-£2,084,000	-£2,062,000	-£2,039,000	-£2,155,000	-£2,133,000	-£2,136,000	-£2,164,000	-£2,192,000	-£2,220,000	-£2,214,000	-£2,209,000	
Net airspace users benefit (Delay)	£37,500	£37,870	£38,240	£38,610	£38,980	£39,350	£39,720	£40,090	£40,460	£40,830	£41,200	NPV
Present value (rounded to nearest whole £1,000, NPV is sum of unrounded data)	-£2,428,000	-£2,378,000	-£2,327,000	-£2,426,000	-£2,374,000	-£2,349,000	-£2,344,000	-£2,344,000	-£2,343,000	-£2,313,000	-£2,291,000	**-£25,918,000**

Table 7 Cost Benefit Analysis Option 1 with DCO

Negative values are cost or disbenefit	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Net
Year	0	1	2	3	4	5	6	7	8	9	10	Present
Discount factor	1	0.9662	0.9335	0.9019	0.8714	0.8420	0.8135	0.7860	0.7594	0.7337	0.7089	Value
Option 2 With DCO												
Net community benefit (Noise)	-£36,442	-£33,909	-£31,526	-£29,272	-£27,129	-£25,084	-£23,126	-£21,237	-£19,422	-£17,657	-£15,940	
Net community benefit (CO_2)	-£140,249	-£136,293	-£132,375	-£137,136	-£133,198	-£130,872	-£131,653	-£130,727	-£129,725	-£136,133	-£143,447	
Net airspace users benefit (CO_2)	-£235,823	-£283,708	-£326,808	-£382,419	-£419,916	-£458,693	-£492,917	-£532,595	-£570,196	-£596,741	-£627,097	
Net airspace users benefit (Fuel costs)	-£2,084,000	-£2,062,000	-£2,039,000	-£2,155,000	-£2,133,000	-£2,136,000	-£2,164,000	-£2,192,000	-£2,220,000	-£2,214,000	-£2,209,000	
Net airspace users benefit (Delay)	£37,500	£37,870	£38,240	£38,610	£38,980	£39,350	£39,720	£40,090	£40,460	£40,830	£41,200	NPV
Present value (rounded to nearest whole £1,000, NPV is sum of unrounded data)	-£2,459,000	-£2,410,000	-£2,358,000	-£2,458,000	-£2,405,000	-£2,380,000	-£2,376,000	-£2,376,000	-£2,375,000	-£2,345,000	-£2,323,000	**-£26,264,000**

Table 8 Cost Benefit Analysis Option 2 with DCO

8. Safety Assessments

This section provides a brief, qualitative overview of the impact of each option on aviation safety and is the same as that provided in Stage 2, in line with CAP1616 paragraph E53 on p. 199.

0. Do-nothing baseline option

The region is a complex system of LLA and Stansted arrivals with a high controller workload. Separating the shared arrival routes and holds requires intense and complex air traffic control interactions to be solved within congested airspace, mostly at lower altitudes from 8-7,000ft and below.

A 'controller interaction' is typically a radio transmission (RT) with a pilot or a telephone call with a controller colleague, within the same centre or to the control tower at the airport. Each time a controller interacts with either a pilot or a controller, the other party must repeat the decision/instruction to ensure accuracy. Thus, a single controller interaction is comprised of at least two events – the outbound instruction or request, and the returning confirmation check, known as a 'readback'. When controller interactions with pilots get busy, it is known as a high RT loading. RT loading is one of the major limiting factors to the operating efficiency of an air traffic control sector and this region is especially complex.

Aircraft holding for one airport also depend on those holding for the other airport, a uniquely complex situation.

During periods where workload and RT loading is predicted to become too intense, safety dictates that we apply temporary limits to the numbers of flights entering the region before the number exceeds safe limits, causing delays and different complexity problems for air traffic controllers, the airports and airlines.

This is the current situation and is managed safely but is not sustainable in the medium term hence the initiation of this airspace change proposal and the reason why this combination of options was discounted during the design principles evaluation Step 2A (ii).

1. Controller vectoring to Runway 07 and 26 respectively, from a new hold to the north of LLA

This option separates out the LLA arrivals from the Stansted arrivals with separate holds for each airport, removing the dependencies of each airport's arrivals on the other at a high level and by route design. No particular action by the controller is needed to initiate the separation, which occurs as a consequence of the route flight planning to end at the hold, dedicated to LLA arrivals only. Stansted arrivals would follow the same arrival routes to the same two holding patterns as today, known as LOREL and ABBOT.

Flights would arrive at the dedicated delay absorption area from each direction and the controller would tactically vector each flight into the sequence of arrivals. This is a manual task, with the controller directing each flight's heading and altitude into an appropriate landing order correctly spaced. There would be less complexity which is anticipated to significantly reduce the number of controller interactions. This would reduce the likelihood of approaching the limit of controller workload, meaning fewer temporary limits on aircraft movements through the sector would be applied, reducing those consequential complexity problems. Therefore, this option is considered sustainable and safe.

2. Performance Based Navigation routes to final approach, from a new hold to the north of LLA

This option separates out the LLA arrivals from the Stansted arrivals with separate holds for each airport, removing the dependencies of each airport's arrivals on the other at a high level and by route design.

Flights would arrive at the dedicated hold from each direction and the controller would instruct each flight to follow the appropriate PBN route. Where there is a need to keep the runway fed with a desired landing rate, controllers may need to tactically adjust the spacing between aircraft by vectoring, causing some additional controller-pilot interactions. There would be less complexity which is anticipated to significantly reduce the number of controller interactions. Where there is no need to set a landing rate, for example when the arrival times of aircraft are naturally appropriately spaced, that single instruction to follow the PBN route would likely be the only controller-pilot interaction until the aircraft reaches final approach.

This would lead to a lower likelihood of approaching the limit of controller workload, meaning fewer temporary limits would be applied on aircraft movements through the sector, reducing those consequential complexity problems. Therefore, this option is considered sustainable and safe.

These would be formally-defined PBN routes, meaning that route spacing rules and route containment must be considered. Appropriate safety cases will be produced as part of the ACP submission, as will a study of each route against other routes and flows (including departures).

9. Summary and conclusions

9.1 Conclusions will be drawn from assessing the geographical and numerical analyses described fully in the consultation document's Annexes, additional consideration of the Government's Airspace Modernisation Strategy (AMS), cost-benefit analyses performed for this proposal, and additional consideration of resilience.

Geographical and numerical analyses

9.2 These analyses are provided in the Annexes to the consultation document, WebTAG summaries are provided within the tables in Sections 1 and 2, and all are summarised in this table:

Subject	Analysis type	Assessment Summary Description
Area of contours	LAeq16hr day LAeq8hr night	Contour areas are similar - differences generally 0.5% or less. At 51dB the areas are the same.
	N65 day N60 night	Contour areas are similar - differences range from Opt 2 having a 2.1% smaller to 2.5% larger area than Opt 1.
CAP1498 Overflight 48.5° Population and Household counts	Day	Under Opt 2, the people overflown up to 19 times per day decreases, and those overflown 20 times per day or more increases.
	Night	Under Opt 2, the people overflown up to 4 times per night decreases, those overflown 5-19 times per night increases, and those overflown 20 times or more are near-identical.
Noise Metrics Household counts	LAeq16hr day	Without DCO, under the WebTAG metric "Number of households experiencing **increased** daytime noise", Opt 2 would provide a smaller increase (therefore a smaller disbenefit) than Opt 1, with 841 households experiencing an increase in noise based on assessment contours for 2032. Without DCO, under the WebTAG metric "Number of households experiencing **reduced** daytime noise", Opt 2 would provide a smaller reduction (therefore a smaller benefit) than Opt 1, with 2,378 households experiencing a decrease in noise based on the assessment contours for 2032. With DCO, under the WebTAG metric "Number of households experiencing **increased** daytime noise", Opt 2 would provide a smaller increase (therefore a smaller disbenefit) than Opt 1, with 728 households experiencing an increase in noise based on the assessment contours for 2032. With DCO, under the WebTAG metric "Number of households experiencing **reduced** daytime noise", Opt 2 would provide a smaller reduction (smaller benefit) than Opt 1, with 1,999 households experiencing a decrease in noise based on the assessment contours for 2032. Opt 2 would produce a smaller disbenefit for the first metric, but a smaller benefit for the second metric.
	LAeq8hr night	Without DCO, under the WebTAG metric "Number of households experiencing **increased** daytime noise", Opt 2 would provide a smaller increase (therefore a smaller disbenefit) than Opt 1, with 210 households experiencing an increase in noise based on assessment contours for 2032. Without DCO, under the WebTAG metric "Number of households experiencing **reduced** daytime noise", Opt 2 would provide a smaller reduction (therefore a smaller benefit) than Opt 1, with 1,075 households experiencing a decrease in noise based on the assessment contours for 2032. With DCO, under the WebTAG metric "Number of households experiencing **increased** daytime noise", Opt 2 would provide a smaller increase (therefore a smaller disbenefit) than Opt 1, with 185 households experiencing an increase in noise based on the assessment contours for 2032. With DCO, under the WebTAG metric "Number of households experiencing **reduced** daytime noise", Opt 2 would provide a smaller reduction (smaller benefit) than Opt 1, with 594 households experiencing a decrease in noise based on the assessment contours for 2032. Opt 2 would produce a smaller disbenefit for the first metric, but a smaller benefit for the second metric.
	N65 day	Generally Opt 2 overflies fewer people up to 49 times per day, with differences c.1%. Opt 2 overflies slightly more people from 50-99 per day, then fewer again from 100-199 per day (absolute numbers are small, <150). Opt 2 overflies slightly more people >200 times per day (absolute numbers are small, <300). The absolute sum overflown is less under Opt 2.
	N60 night	Generally Opt 2 overflies fewer people per night at the frequencies in this analysis, except in year 2022 where 0.4% (<300 people) would be overflown from 20-49 times per night.
Noise Metrics POI counts Hospitals, Places of Worship, Schools	LAeq16hr day LAeq8hr night	Absolute differences are small, (<3), % differences negligible.
	N65 day N60 night	Absolute differences are small, (<=3), % differences negligible
CAP1498 Overflight 48.5° POIs Hospitals	Day	Absolute differences are small (max 1) but always fewer under Opt 2
CAP1498 Overflight 48.5° POIs Places of Worship		Under Opt 2, the places of worship overflown up to 49 times per day decreases, and those overflown 50 times per day or more increases.
CAP1498 Overflight 48.5° POIs Schools		Under Opt 2, the schools overflown up to 19 times per day decreases, and those overflown 20 times per day or more increases.
CAP1498 Overflight 48.5° POIs Hospitals	Night	No change
CAP1498 Overflight 48.5° POIs Places of Worship		Under Opt 2, the places of worship overflown up to 4 times per day decreases, and those overflown 5 times per day or more increases.
CAP1498 Overflight 48.5° POIs Schools		Under Opt 2, the schools overflown up to 4 times per day decreases, and those overflown 5 times per day or more increases.
Fuel and Greenhouse Gas Emissions	Fuel differences converted to CO_2 equivalent, as a measure of greenhouse gas emissions	The modelling assumptions were necessarily the same for both Options
Delay and capacity	Delay costs per minute, and how much delay can be avoided due to the proposal	The modelling assumptions were necessarily the same for both Options
Resilience	Radio exchanges as a measure of controller workload	Opt 2 would reduce the number of radio exchanges by up to 4 per flight, compared with Opt 1.
Monetising of noise impacts	WebTAG	Opt 1 results in benefit, Opt 2 results in disbenefit

Table 9 Analysis Assessment Summary

9.3 This table is not a stand-alone decision-making tool, but it can be used to understand the general results of the numerical analyses.

9.4 Note that the last metric in the table, WebTAG monetising of noise impacts, heavily favoured Option 1. This metric essentially quantifies the difference between keeping the low-altitude arrivals similar to today's arrangements (as per ANG2017 altitude-based priorities, noted previously in this document) and making a change which would tend to systemise and concentrate flights and noise impacts.

9.5 Adding extra weight to this particular item was considered, as conclusions were being drawn from the data, however CAP1616 Appendix E paragraph E3 was also considered:

E3. The CAA acknowledges that airspace change decisions cannot be reduced to an entirely numerical exercise. Numerical values are not a substitute for policy direction on which outcomes are important in the design of airspace. For example, a determination as to whether a negative noise or carbon impact should prevent a change that would have a positive economic impact is something that should be set in policy objectives. However, a systematic process that includes quantification of as many of the costs and benefits of a particular airspace change proposal as possible helps to provide consistency in options appraisal for all concerned. It also provides additional data helping the CAA to make the optimal decision against a background of increasing scarcity of airspace capacity.

Consideration of Government policy direction – the Airspace Modernisation Strategy AMS

9.6 The previous paragraph leads directly to this paragraph.

9.7 In the consultation document Section 2 there is a description of this (shorter-term) proposal's relationship with other medium to longer term airspace change proposals driven by Government policy under the AMS, known as FASI-S proposals. The FASI-S proposal in progress by LLA, along with many other airports, encompassing changes to departure and arrival flightpaths at all altitudes, was also discussed.

9.8 The AMS states that the aviation industry must deliver the changes required to achieve its objectives. The AMS is a significant Government policy, which acknowledges that, like road and rail networks, airspace is a crucial part of the UK's transport infrastructure:

'Airspace must be maintained and enhanced to provide more choice and value for consumers, through the capacity for airlines to add new flights, reduced flight delays and enhanced global connections that can help boost the UK economy, while continuing to improve safety standards. Unlocking the benefits of modernisation will make journeys faster and more environmentally friendly. Better airspace design can help with the management of noise impacts and improve access for other airspace users'
Extract from CAP1711 Airspace Modernisation Strategy, Executive Summary paragraph 1, page 5.

9.9 AMS initiative 4 (Terminal airspace redesign in Southern England – Fundamental redesign of the terminal route network using precise and flexible satellite navigation) and AMS initiative 8 (Satellite navigation route redesign: redesign of new arrival and departure routes using satellite-based navigation standards) need to be considered in this shorter-term proposal.

9.10 Both Option 1 and Option 2 align with AMS Initiative 4 because the en route arrival structures for LLA – the STARs at upper altitudes – have been fundamentally redesigned to provide systemisation using PBN.

9.11 Only Option 2 aligns with AMS Initiative 8 because it would introduce PBN routes to connect the hold to final approach for the landing runway. This proposal has been clear that it could not operate solely using RNAV1 transitions, and that vectoring and shortcuts remain necessary and desirable. Option 2 provides these structures to the controller for them to use when possible. Option 1 does not provide any such structure.

9.12 The greatest impact on local communities would be changes to flightpaths at altitudes below 7,000ft, as per Government guidance. Making multiple changes to low-altitude flightpaths would be even more disruptive to those affected more than once.

9.13 The options in this proposal could be modified by consultation feedback – that is the overall reason for consultation. From an airspace design concept point of view, the primary difference between Option 1 and Option 2 is the availability of low-altitude PBN routes to final approach, thus modified versions of Option 1 would not include PBN routes to final approach, and modified versions of Option 2 would include PBN routes to final approach.

9.14 In the consultation document Section 2 it was stated that, should a version of Option 1 progress, another significant change to low altitude arrival flightpaths is more likely to be required in the medium to longer term. That second significant change would progress under LLA's separate FASI-S proposal, because Option 1 does not fully align with the AMS.

9.15 It was also stated that, should a version of Option 2 progress, the likelihood or scope of a significant change to low altitude arrival flightpaths is reduced because Option 2 is much more aligned with the AMS than Option 1. As a reminder, one of the design principles from Stage 1 – DP8 – reads *Minimise the requirement to change future low altitude arrival flows within the next ten years*.

9.16 This proposal should give greater weight to the option aligning most with the AMS initiatives, and which has the lowest likelihood to cause a second significant change to low altitude arrival flightpaths.

- Government policy direction to the aviation industry is to deliver airspace changes to meet the objective of the AMS.
    - A version of Option 2 would align far more with the AMS than a version of Option 1.
- The likelihood or scope of a second significant change to low altitude arrival flightpaths is reduced (but not eliminated) if PBN routes to final approach are progressed under this proposal.
    - A version of Option 2 would include PBN routes to final approach.
    - A version of Option 2 would align more closely with Design Principle DP8.

Cost-benefit analyses and Net Present Values NPV

9.17 See Section 7's Table 4 Rounded summary of cost benefit analyses showing the differences in NPVs on p.32.

9.18 If the DCO does not progress, Option 2 would cause c.£409k NPV more disbenefit than Option 1. If the DCO does progress, Option 2 would cause c.£346k NPV more disbenefit than Option 1.

9.19 The scope and scale of this proposal means the differences between the cost-benefit analyses of Option 1 and Option 2 are relatively small, given the orders of magnitude of other costs.

Consideration of Resilience

9.20 Throughout the development of the options the impact to resilience has been considered (see p.8), which provides an indication of the ability to react to unforeseen events that affect the air traffic network, such as a runway closure or bad weather. Due to the unpredictable nature of these events and the many complex factors that can influence the level of resilience, it is not proportional to monetise these impacts. However, considering the radio transmission quantification used in this document, the benefit of each option can be quantified as a percentage improvement against the baseline. Using this measure, Option 1 would improve resilience by up to c.30%, while Option 2 would improve it by up to c.50% (which is up to c.20% improved over Option 1).

9.21 If PBN routes were introduced, the controller can simply instruct the pilot to follow the route rather than transmit several heading, level and speed instructions to establish the aircraft on final approach for c.49% of arrivals. This means the controller has more capacity to react to, and manage, a disruptive event. A controller with more capacity to minimise disruption following such an event would also reduce the consequential impact on the travelling public and the region's air route network.

9.22 Improving resilience provides a significant benefit to controllers and the overall air traffic system – it helps to improve safety, reduce delays and reduce fuel burn and CO_2 emissions should a disruption occur.

Conclusion

9.23 Under paragraphs 9.2-9.5 above, the summary of analysis metrics does not allow for the straightforward drawing of clear conclusions except where the WebTAG monetising of noise impacts heavily favours Option 1. As noted, this metric essentially quantifies the difference between keeping the low-altitude arrivals similar to today's arrangements and making a change which would tend to systemise and concentrate flights and noise impacts.

9.24 However, under paragraphs 9.6-9.16 above, Government policy direction via the AMS is to use precise and flexible satellite navigation. Airports in the South (including LLA) are already working on their FASI-S airspace changes to align their arrival and departure routes with the AMS by using satellite-based navigation standards. These changes are coming in the medium to longer term. The more this shorter-term proposal is aligned with the FASI-S proposal, the lesser the likelihood or scope of a significant change to low altitude arrival flightpaths in the medium to longer term.

9.25 Under paragraphs 9.17-9.19 above it was explained that, when comparing the NPVs of both options, the difference in disbenefit is relatively small.

9.26 Under paragraphs 9.20-9.22 above, the resilience of Option 2 is greater than that of Option 1

9.27 Taking all these into account, including the safety assessments in Section 8 on page 35, the outcome of the full options appraisal is that the preferred option is Option 2, a new RNAV hold north of LLA with PBN routes to final approach, shortcuts and vectoring all available for controllers to use.

End of document

