Swanwick Airspace Improvement Programme
Airspace Development 6

LTC Essex Sector Safety Improvement
and Luton Airport Arrival Routes

SAIP AD6 TC Essex-Luton Arrivals

Gateway documentation:
Stage 2 Develop & Assess

Step 2B Options Appraisal
(Phase 1 Initial)
including Safety Considerations

Roles

Action	Role	Date
Produced	Airspace Change Specialist NATS Airspace and Future Operations	15/11/2019
Produced	Airspace and Noise Performance Manager London Luton Airport	15/11/2019
Reviewed Approved	Manager Airspace Change Compliance & Delivery NATS Directorate of Airspace & Future Operations	15/11/2019
Reviewed Approved	ATC Lead NATS Swanwick Development	15/11/2019
Reviewed Approved	Operations Director London Luton Airport	15/11/2019

Drafting and Publication History

Issue	Month/Year	Changes this issue
1.0	Nov 2019	Published to CAA Portal

Contents

Introduction

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

This document forms part of the document set required for the CAP1616 airspace change process: Stage 2 Develop and Assess, Step 2B Options Appraisal (Phase 1 Initial) including Safety Considerations.
Its purpose is to consider the shortlist of airspace design options which have progressed through the Step 2A (ii) Design Principle Evaluation, to provide comparisons of each option via qualitative assessment or, if available and proportional, quantitative analysis. Under Stage 2 the designs are not yet fully developed so the granularity of the analysis may be broad.
There are six design options in this document, plus the baseline do-nothing scenario. The options to have progressed to this stage are Lower options 2.3, 2.4, 2.5, 2.7, 2.8 and 2.9, all of which can be combined with Upper option 1.4.
This document should be read in conjunction with the Step 2A (i) Design Options document which gives maps and descriptions of each option.

Where are we in the airspace change process?

We have completed Stage 1 Define, where we established the need for an airspace change and the design principles underpinning it. We are now in Stage 2; Develop and Assess. This document is part of Step 2B.

The left hand side of this flowchart is an extract from the CAP1616 document, edition 2, describing how a sponsor generally identifies and narrows the list of options.	The right hand side describes additional work we have done for this proposal.

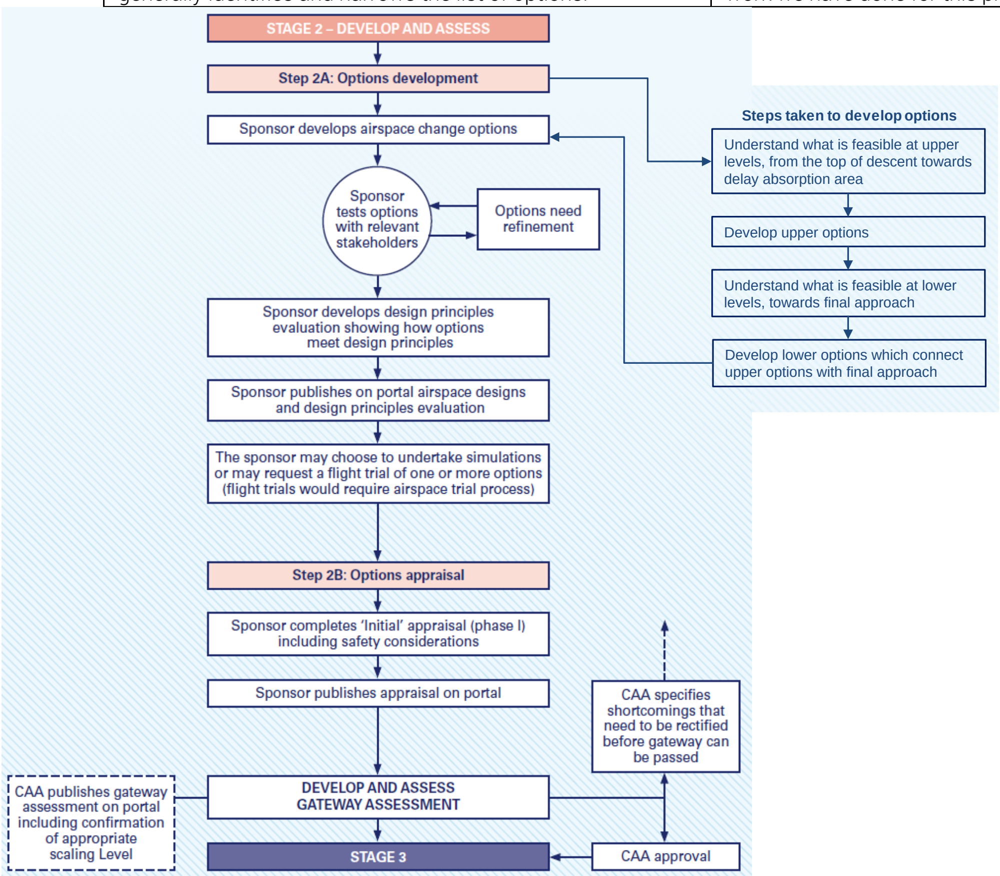

Figure 1 Airspace Change Process Stage 2

How to read this document – illustrations of current and potential impacts

The following tables were based on CAP1616 2nd edition, Table E2, pages 161-163.

In this document we provide a table for the baseline do-nothing scenario, plus tables for each of the six design options. Note that the combined baseline do-nothing scenario (called Option Zero here) is included for comparison purposes only. It would not address the latent risk, so it failed to progress to the next step and has been ruled out of further consideration.

Each table lists stakeholder groups alongside types of impact each design might have on that group.

We describe broadly what we expect the scale of impact might be, for each type of impact. This is qualitative, and uses some initial numerical analysis and estimates, available to view separately in the document "Step 2B Technical Appendix". That initial numerical analysis is based on the broad design concepts, and may be subject to refinement before the next stage, so the numbers may change as the design is refined or the analysis method itself is improved. This is proportional and in line with the expectations of CAP1616 Stage 2[footnote 1].

Criteria against which the options have been assessed

Where relevant we referred to the Department for Transport's WebTAG guidance to inform the methods used during the initial options appraisal.

Noise

We understand that the impact of aviation noise, particularly at lower altitudes is extremely important to many people. We also want to explain, as simply as possible, any differences in how much noise you might hear.

How noise is perceived is highly subjective, and what may not be acceptable to one individual would be acceptable to another. In this document we explain how you can use the information, with the illustrations in the Step 2A (i) Design Options document, and the tables describing each option. This will help you to gauge the impacts each option might have on where you live or work.
We will qualitatively describe how we think each future 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.

The Government has produced guidance on the relative priorities for the minimising of aviation noise, based on the altitude of the aircraft. The lower an aircraft is as it flies over a given location, the louder it is to an observer on the ground.
Briefly summarising the Government's altitude-based guidance[2]:

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

How might this impact tranquillity, biodiversity and historic environments?

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

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, can be interpreted using the maps in the Step 2A (i) Design Options document and the information in this section.

The Government's altitude-based guidance[2] 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.

---

[1] CAP1616, 2nd edition, page 42 paragraph 142 and page 157 paragraph E12
[2] The altitude-based priorities for impacts due to noise vs emissions are set by the Government in the Department for Transport's 2017 paper "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", known as ANG2017, section 3 para 3.3.

However where an AONB or National Park is close to an airport, (such as the Chilterns AONB to the west of Luton Airport) 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.

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

Historic environments, in this context, mean formally registered historic parks and gardens. We identified the relevant places overflown below 4,000ft and mention them in this initial options appraisal.

Where would they fly, and how narrow might the flightpath be?

Look at the headings in this document and compare them with the equivalent Step 2A (i) Design Options document. You can use the map to find where you live or work or take leisure time, see where flights currently go, how high and how broad or narrow today's flightpath is, then compare it with where we predict they would go, how high and how broad or narrow each option's flightpath would be. This is what we will do as part of this initial options appraisal, describing qualitatively how each option works, and comparing with others. We will also estimate the population overflown, using the CAA definition of overflight as defined in CAP1498.

We have considered the concept of visual intrusion as well as the potential noise impacts – a narrow flightpath might mean seeing and hearing aircraft in the same place more often than a broader dispersed flightpath, but it could also overfly fewer people, who may receive a greater proportion of those noise and visual impacts.

Why are we showing routes in isolation, rather than combined?

We wanted to demonstrate the individual options because it is possible to combine a lot of them together in many different ways, and it would not be proportional to attempt to describe every possible permutation. Once the individual options have been described here, we might withdraw the worst performing ones. Then we could think about how the remaining options might be combined, and consult on those combinations at the next stage of the CAP1616 airspace change process.

How loud might they be?

Most aircraft that operate at London Luton Airport fall into the category of "125-180 seat single-aisle twin jet" which comprise similar types with similar noise, i.e. Airbus A320 and Boeing 737 versions, with A320 variants being the most common.

The next table illustrates the typical noise in decibels (Lmax dBA) that an observer on the ground might expect to experience, from arriving aircraft. It is the same table as the one previously provided in Step 2A (i) but this one is colour banded to highlight the three priorities based on altitude:
Noise up to 4,000ft, noise from 4,000ft-7,000ft, and noise from 7,000ft and above.

Height (ft)	Turboprop	50 seat regional jet	70-90 seat regional jet	125-180 seat single-aisle 2-eng jet	250 seat twin-aisle 2-eng jet	300-350 seat twin-aisle jet	400 seat 4-eng jet	500 seat 4-eng jet
1,000-2,000	79-70	73-63	77-67	77-69	84-74	83-73	86-77	85-78
2,000-3,000	70-66	63-56	67-61	69-64	74-68	73-67	77-71	78-72
3,000-4,000	66-64	56-55	61-57	64-61	68-64	67-63	71-67	72-68
4,000-5,000	64-62		57-56	61-59	64-60	63-60	67-64	68-65
5,000-6,000	62-61		56-55	59-57	60-58	60-57	64-61	65-62
6,000-7,000	61-59			57-56	58-56	57-56	61-59	62-60
7,000-8,000	59-57			56-55	56-55	56-56	59-57	60-58
8,000-9,000	57-57					56-55	57-56	58-56
9,000-1,0000	57-56						56-56	56-55
1,0000-11,000	56-55						56-55	

Table 1 Arrival noise Lmax dBA by aircraft grouping.

Note: measurements stop at 55dBA since below that threshold aircraft noise is at a similar magnitude to the background noise, hence the accuracy of readings is difficult to maintain.

Typical sound	Approximate noise level Lmax dBA	Typical sound	Approximate noise level Lmax dBA
Pneumatic Drill 7 metres away	95	Busy general office	60
Heavy diesel lorry at 40kmh, 7 metres away	85	Quiet office	50
Medium aircraft descending at 1,000ft	70	Quiet bedroom, library	35

Table 2 Table of comparison sounds:

How many arrival flights? When? How frequently?

In 2018 there were between c.150-210 arrivals at Luton Airport per day, based on monthly arrival figures.
In July 2019 the average number of flights per day increased to 216, and the peak day (4th July) was 241.

Table 3 illustrates the average number of arrivals per hour of the day (from 0001 to 2359), showing you the peak arrival times averaged from January–December 2018 and again from January–October 2019.

Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
2018	5	4	2	1	1	0	3	12	6	6	7	9	11	11	9	9	10	12	12	13	11	10	10	9
JAN-OCT 2019	6	5	2	1	1	0	2	13	7	6	7	9	13	12	10	9	11	14	13	12	10	11	12	10

Table 3 Average arrivals per hour

If there was a single arrival route, and where all arrival routes converge (i.e. on final approach) there would be a similar number of overflights per hour at present traffic levels. The busiest peak hour was 14, averaged over this year to the time of writing this document, typically between 1700 (5pm) and 1759 (just before 6pm). The absolute peak hour in 2019 was on the busiest day of the year, 4th July, with 21 arrivals between 1400 (2pm) and 1459 (just before 3pm).

How might these options change the amount of fuel burnt and greenhouse gas emitted?

In the options appraisal tables, there are rows relating to greenhouse gas impacts and fuel costs. This section explains how we have estimated the differences in fuel burnt per flight for each option.

A change in track distance flown would change the mass 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, which represents the estimated change in greenhouse gas impacts. The difference in track distance for each option would mean the amount of fuel an airline needs to buy per flight would vary, thus fuel costs would also change.

Often an increase in track mileage can be partially offset by keeping aircraft higher (where fuel efficiency is significantly better), and a longer systemised routing can result in fewer delays due to 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.

At this stage in the design process the best way to assess the impact of fuel burn and greenhouse gas emissions is to make some assumptions and work out the changes in average track distances due to each option in this proposal. The full options appraisal exercise, under Stage 3 of the process, will produce more accurate figures of greenhouse gas emissions and fuel burn. So this initial options appraisal is simple, qualitative, and takes no account of the expected reduction in airborne delays which would increase predictability and punctuality. All of this airborne improvement would lead to fewer delays on the ground and other potential benefits, which are not considered at this stage.

There is only one upper option available, 1.4. The other upper options were rejected at Step 2A (ii).
So the differences between upper option 1.4, compared with the upper do-nothing baseline option 1.1, will be common to all the viable options in the lower region. Upper option 1.4 pushes Luton's arrival flows further north than today's baseline option 1.1, to separate the Luton arrivals from the Stansted arrivals much earlier. All the Luton arrivals in the upper region need to travel further to get to the final waypoint before starting their approach.

We also know today's proportions of arrivals from each direction, to each of today's final waypoints LOREL and ABBOT. We know that arrivals via ABBOT must then fly beneath the LOREL hold to get to Luton, this is standard air traffic control procedure. We can think of each ABBOT arrival as being equivalent to a LOREL arrival, just by adding the distance between ABBOT and LOREL to compare like with like.

The proportions of Luton arrivals from each direction in the upper regions is not expected to change due to this proposal, so the impacts on each arrival direction can be averaged and weighted in accordance with those proportions. Instead of having to calculate the differences for each flight from each upper arrival direction, we can calculate a "hybrid" average upper flight. This hybrid average upper flight can be thought of as a single aircraft representing arrivals from any direction, flying the weighted average distance, to reach the final waypoint in the upper region. This final waypoint in the upper region becomes the first waypoint in the lower region, allowing us to then compare the lower options to each runway end.

We have used the same average upper flight to illustrate the differences between the lower options. The last page of the Step 2B Technical Appendix contains the raw data allowing you to compare these track distance differences in any combination you wish. If you are interested in flights arriving from a particular direction – for example, an arrival from the west or northwest via waypoint CLIPY combined with options 2.3 or 2.5 to runway 08 would provide the best case, and an arrival from the south via waypoint VATON combined with option 2.8 to runway 26 would provide the worst case.

0. Baseline do-nothing scenario

This combined baseline option (which comprises Upper Option 1.1, Lower Option 2.1 and 2.2) is included for comparison purposes only. It is not an option to be progressed.

Group	Impact	Level of Analysis	Evidence – see the row below each heading
Communities	Noise impact on health and quality of life	Qualitative, quantify people overflown below 7,000ft	This includes impacts on tranquillity. See Document 2A (i) Design Options for illustrations of arrivals from Upper Option 1.1 with Lower Options 2.1 (runway 08 easterly) or 2.2 (runway 26 westerly)
The options described later on will estimate the differences from this baseline, which is the no-change option. <u>Upper Option 1.1 Combined Luton and Stansted arrivals at upper levels</u> Luton and Stansted traffic both arrive from all directions at high levels into the shared holding patterns called LOREL (near Royston, Herts) and ABBOT (near Great and Little Yeldham, Essex) and descend to about 8,000ft. Each holding pattern contains a mix of traffic, for example two Luton arrivals may be held above a Stansted arrival at LOREL, with the opposite at ABBOT, or any combination. Government guidance does not prioritise minimising the impacts of noise of aircraft at and above 7,000ft. <u>Lower Option 2.1 Runway 08 easterly arrivals</u> Runway 08 is used about 30% of the time. The controllers descend the holding traffic, then separate out the Luton traffic from each hold, vectoring it from 5,000ft near Royston heading west between Letchworth and Biggleswade. The Luton arrival flow continues west level at 5,000ft for about 40-50km, over the northern part of the Chilterns AONB, with the controller vectoring most aircraft south of Leighton Buzzard (but some are vectored to the north). As the traffic reaches an area northeast of Aylesbury the controller turns the aircraft left, roughly perpendicular to the extended runway centreline, and descends it to 4,000ft, then turns left and descends once more to establish on final approach, typically somewhere between the east of Stoke Mandeville area around 4,000ft and Pitstone Hill around 3,000ft. Vectoring naturally causes some dispersion, but the central third of the swathe is typically the most commonly used flightpath. The swathe generally gets narrower until it aligns with the runway on final approach. The final approach path to runway 08 always overflies part of the Chilterns AONB, from Pitstone Hill to Kensworth Common, in a very narrow swathe. When runway 08 is in use, about 288,000 people are overflown more than 10 times per day below 7,000ft. <u>Lower Option 2.2 Runway 26 westerly arrivals</u> Runway 26 is used about 70% of the time. The controllers descend the holding traffic, then separate out the Luton traffic from each hold, vectoring it from 5,000ft near Royston heading west between Letchworth and Biggleswade. The Luton arrival flow may continue generally west level at 5,000ft for about 15km before the controller turns it south (Biggleswade, Henlow), or they may turn it south soon after passing Royston, but generally somewhere in between. That turn to the south might be in an S-shape, or it may be straight. As the traffic reaches the Letchworth-Baldock-Wallington area the controller turns the aircraft roughly perpendicular to the extended runway centreline, and descends it to 4,000ft, then turns right and descends once more to establish on final approach typically around Buntingford from 4,000ft to 3,000ft and Stevenage 3,000ft and below. Vectoring naturally causes some dispersion, but the central third of the swathe is typically the most commonly used flightpath. The swathe generally gets narrower until it aligns with the runway on final approach. The final approach path to runway 26 always overflies Ardeley, Walkern, Stevenage and St Paul's Walden in a very narrow swathe. When runway 26 is in use, about 163,000 people are overflown more than 10 times per day below 7,000ft.			
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. 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.			
Communities	Historic environment	Qualitative	Overflight of registered historic parks and gardens below 4,000ft
Mentmore Towers and Luton Hoo are both overflown below 4,000ft by today's arrivals to Runway 08 Easterly. Julians Garden and The Garden House Cottered, are both overflown below 4,000ft by today's arrivals to Runway 26 Westerly.			
Wider society	Greenhouse gas impact	Qualitative	
The options described later on will estimate the differences from this baseline, which is the no-change option. We will estimate how much further or shorter the arrival tracks could be, and estimate the difference in fuel use for a typical flight between the design option and this baseline. From this, we can estimate greenhouse gas impacts because the differences in aviation fuel burnt are proportional to the CO_2 equivalent emitted.			

Continued…

Group	Impact	Level of Analysis	Evidence – see the row below each heading
Wider society	Capacity/ resilience	Qualitative	
All arrivals to Luton are entwined with arrivals to Stansted for most of their time in UK airspace, until they reach the LOREL and ABBOT holds. Only after leaving the holds are they separated into their respective arrival flows. This means that Luton 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 Luton aircraft are holding in the levels above, then any delay at Stansted Airport (like a temporarily closed runway) means the Luton arrivals are stuck and our controllers will find it difficult to extract them from the holds. This applies the other way around, should Stansted traffic get stuck above Luton traffic. The dependencies on each other cause capacity and resilience issues which we intend to fix 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.			
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	Qualitative	
The options described later on will estimate the differences from this baseline, which is the no-change option.			
General Aviation/ commercial airlines	Fuel Burn	Qualitative	
The options described later on will estimate the differences from this baseline, which is the no-change option. We will estimate how much further or shorter the arrival tracks could be, and estimate the difference in fuel use for a typical flight between the design option and this baseline.			
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.			

2. Viable Design Options – all including Upper Option 1.4

2.3 Controller vectoring to Runway 08 (easterly) from Upper Option 1.4

2.4 Controller vectoring to Runway 26 (westerly) from Upper Option 1.4

These options assume that arrivals would be vectored in a similar manner and distribution to the baseline options 2.1 and 2.2, instead commencing from the end of upper option 1.4 rather than the current common location of LOREL.

<table>
<tr><th>Group</th><th>Impact</th><th>Level of Analysis</th><th>Evidence – see the row below each heading</th></tr>
<tr><td>Communities</td><td>Noise impact on health and quality of life</td><td>Qualitative, quantify people overflown below 7,000ft</td><td>This includes impacts on tranquillity. There are no expected impacts on biodiversity (see page 5).
See Document 2A (i) Design Options for illustrations of arrivals from Upper Option 1.4 with Lower Options 2.3 (runway 08 easterly) or 2.4 (runway 26 westerly)</td></tr>
<tr><td colspan="4"><u>Upper Option 1.4 Luton arrivals separated at upper levels, new delay absorption area to the north of Luton</u>
Luton traffic is separated into flows using new volumes of controlled airspace, towards a new Luton-only delay absorption area in the vicinity of Grafham Water, descending to about 8,000ft. Stansted arrivals would not change.
Government guidance does not prioritise minimising the impacts of noise of aircraft at and above 7,000ft.
<u>Lower Option 2.3 Runway 08 easterly vectoring</u>
Runway 08 is used about 30% of the time. The controllers would take most of the Luton arrivals at 8,000ft and direct them south of Grafham Water past St Neots, to the east of the A1 main road and roughly parallel with it. To the east of Sandy, the controllers would descend the arrivals to 5,000ft and turn them right (in the vicinity of Biggleswade or Henlow), mostly north of the A1-A505 junction near Letchworth similar to today. The Luton arrival flow continues west, level at 5,000ft for about 40km, over the northern part of the Chilterns AONB, with the controller vectoring most aircraft south of Leighton Buzzard (but some are vectored to the north).
As the traffic reaches an area northeast of Aylesbury the controller turns the aircraft left, roughly perpendicular to the extended runway centreline, and descends it to 4,000ft, then turns left and descends once more to establish on final approach typically somewhere between the east of Stoke Mandeville area around 4,000ft and Pitstone Hill around 3,000ft.
The swathe generally gets narrower until it aligns with the runway on final approach. The final approach path to runway 08 always overflies part of the Chilterns AONB, from Pitstone Hill to Kensworth Common, in a very narrow path.
Vectoring naturally causes some dispersion, and our controllers expect the areas described here to be the most commonly overflown below 7,000ft – the population overflown was estimated based on this opinion, see Step 2B Technical Appendix. Some could be vectored in from the east similar to today, or to the north of Leighton Buzzard like today.
When runway 08 is in use, about 139,000 people could be overflown more than 10 times per day below 7,000ft.
<u>Lower Option 2.4 Runway 26 westerly vectoring</u>
Runway 26 is used about 70% of the time. The controllers would take most of the Luton arrivals at 8,000ft and direct them south of Graffham Water past St Neots, to the east of the A1 main road and roughly parallel with it, some traffic heading further east, so the 8,000ft arrivals may be spread between the east of Sandy and the west of Bourn.
The controllers would descend the traffic to 5,000ft in this same spread, between Biggleswade and Royston, where it would likely stay level at 5,000ft for about 10-15km. The controllers would turn the traffic to the south, either in an S-shape, or it may be straight.
As the traffic reaches the Letchworth-Baldock-Wallington area the controller turns the aircraft roughly perpendicular to the extended runway centreline, and descends it to 4,000ft, then turns right and descends once more to establish on final approach typically around Buntingford from 4,000ft to 3,000ft and Stevenage 3,000ft and below.
The swathe generally gets narrower until it aligns with the runway on final approach. The final approach path to runway 26 always overflies Ardeley, Walkern, Stevenage and St Paul's Walden in a very narrow path.
Vectoring naturally causes some dispersion, and our controllers expect the areas described here to be the most commonly overflown below 7,000ft – the population overflown was estimated based on this opinion, see Step 2B Technical Appendix. Some could be vectored in from the east similar to today.
When runway 26 is in use, about 144,000 people could be overflown more than 10 times per day below 7,000ft.</td></tr>
<tr><td>Communities</td><td>Air quality</td><td>Qualitative</td><td>See also Government guidance ANG2017.</td></tr>
<tr><td colspan="4">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 on final approach, 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 is no change from today.</td></tr>
<tr><td>Communities</td><td>Historic environment</td><td>Qualitative</td><td>Overflight of registered historic parks and gardens below 4,000ft</td></tr>
<tr><td colspan="4">Mentmore Towers and Luton Hoo would both be overflown below 4,000ft by vectored arrivals to Runway 08 Easterly.
Julians Garden and The Garden House Cottered, would both be overflown below 4,000ft by vectored arrivals to Runway 26 Westerly.
No change from today.</td></tr>
</table>

Continued…

Group	Impact	Level of Analysis	Evidence – see the row below each heading
Wider society	Greenhouse gas impact	Quantified estimate	
Note the introductory paragraph on page 6 describing the weighted average, single upper flight methodology. Under this methodology we estimate: An arriving A320 via upper option 1.4 and lower option 2.3 (runway 08) would expect to emit an additional 450kg of CO_2 equivalent. An arriving A320 via upper option 1.4 and lower option 2.4 (runway 26) would expect to emit an additional 590kg of CO_2 equivalent.			
Wider society	Capacity/ resilience	Qualitative	
All arrivals to Luton would be separated from Stansted arrivals in the upper region. This removes the dependency between the airports, reducing the complexity of the region and increasing its capacity and resilience. Holding is likely to be significantly reduced. Vectoring is an effective method of ensuring capacity is maximised – even though it is also very manual, the reduced complexity would increase the ability of the controller to safely handle traffic thus reducing the likelihood of needing to apply flow regulation measures.			
General Aviation	Access	Qualitative	
This option requires an increase in controlled airspace. Our developed proposal is for one volume with a base of FL75 and another with a base of FL125. The bases of these volumes are as high as possible for the needs of the predicted Luton arrival operation, to minimise impacts on GA. The bases may impact some higher flying GA, such as gliders. Glider logs supplied by BGA indicate few glider flights would actually be impacted by these bases but the possibility remains. Generally in the UK, powered GA tends to fly lower than FL75 thus is less likely to be impacted by the lowest base of FL75. The proposed airspace classification is not yet set, but we do not expect to request Class A which precludes VFR flight. All other classes allow for VFR access subject to appropriate ATC clearance. Qualitatively this would be an increased restriction on GA compared with the baseline do-nothing upper option 1.1.			
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Qualitative	
Qualitatively the increased effective capacity would have a positive economic impact on commercial air traffic compared with the baseline do-nothing options 1.1-2.1/2.2.			
General Aviation/ commercial airlines	Fuel Burn	Quantified estimate, monetised estimate	
Note the introductory paragraph on page 6 describing the weighted average, single upper flight methodology. Under this methodology we estimate: An arriving A320 via upper option 1.4 and lower option 2.3 (runway 08) would expect to burn an additional 142kg of fuel, costing about £68[3]. An arriving A320 via upper option 1.4 and lower option 2.4 (runway 26) would expect to burn an additional 186kg of fuel, costing about £90.			
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.			

[3] Based on IATA jet fuel cost USD615.99 per metric tonne, converted to GBP at 0.78USD/GBP. All fuel costs in this document are based on these figures.

Continued…

Group	Impact	Level of Analysis	Evidence – see the row below each heading
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, and 28 controllers & 5 assistants at Luton Airport. 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.			

2.5 PBN route south of Leighton Buzzard to Runway 08 (easterly) from Upper Option 1.4

This option assumes all arrivals use this PBN route. Some vectoring would be required to fine tune the arrival spacing but the main concentration of arrivals would closely follow this flightpath when runway 08 is in use.

Group	Impact	Level of Analysis	Evidence – see the row below each heading
Communities	Noise impact on health and quality of life	Qualitative, quantify people overflown below 7,000ft	This includes impacts on tranquillity. There are no expected impacts on biodiversity (see page 5). See Document 2A (i) Design Options for illustrations of arrivals from Upper Option 1.4 with Lower Option 2.5 (runway 08 easterly)
Upper Option 1.4 Luton arrivals separated at upper levels, new delay absorption area to the north of Luton Luton traffic is separated into flows using new volumes of controlled airspace, towards a new delay absorption area in the vicinity of Grafham Water, descending to about 8,000ft. Stansted arrivals would not change. Government guidance does not prioritise minimising the impacts of noise of aircraft at and above 7,000ft. Lower Option 2.5 PBN route south of Leighton Buzzard to Runway 08 easterly Runway 08 is used about 30% of the time. The controllers would take most of the Luton arrivals at 8,000ft and direct them to follow the PBN route south of Grafham Water to the east of St Neots, remaining to the east of the A1 main road and roughly parallel with it until passing east of Potton. The flight would automatically turn right past the southern edge of Biggleswade and descend through 6,000ft to 5,000ft at Henlow. It would remain at 5,000ft for the next c.37km heading southwest, grazing the very northern edge of the Chilterns AONB near Harlington, past the M1 motorway at Toddington, the A505 at Billington remaining south of Leighton Buzzard, then reaching Ledburn where the flight would make a left turn and start to descend perpendicular to the extended runway centreline. The turn would stay east of the A418 road and west of Wingrave and Long Marston. It would intercept final approach in the vicinity of Puttenham and Marsworth then Pitstone Hill, where it would be about 3,000ft. The final approach path to runway 08 always overflies part of the Chilterns AONB, from Pitstone Hill to Kensworth Common, in a very narrow path. Note that, in the vicinity of Stanbridge and the expected left turn at Ledburn, some vectoring may be required to achieve efficient spacing, hence some variation is likely. Tactical action may also be necessary elsewhere along the route, however we expect most flights to follow this narrower flightpath. Should this flightpath be flown accurately by all flights with minimal vectoring, about 42,000 people could be overflown below 7,000ft.			
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 is no change from today.			
Communities	Historic environment	Qualitative	Overflight of registered historic parks and gardens below 4,000ft
Luton Hoo would be overflown below 4,000ft by these arrivals to Runway 08 Easterly.			
Wider society	Greenhouse gas impact	Quantified estimate	
Note the introductory paragraph on page 6 describing the weighted average, single upper flight methodology. Under this methodology we estimate: An arriving A320 via upper option 1.4 and lower option 2.5 (runway 08) would expect to emit an additional 450kg of CO_2 equivalent.			
Wider society	Capacity/ resilience	Qualitative	
All arrivals to Luton would be separated from Stansted arrivals in the upper region. This removes the dependency between the airports, reducing the complexity of the region and increasing its capacity and resilience. Holding is likely to be significantly reduced. A defined PBN arrival route at Luton may need some tactical vectoring in order to maximise runway capacity. However, this would still reduce the likelihood of needing to apply flow regulation measures.			
General Aviation	Access	Qualitative	
This option requires an increase in the volume of controlled airspace. Our developed proposal is for one volume with a base of FL75 and another with a base of FL125. The bases of these volumes are as high as possible for the needs of the predicted Luton arrival operation, to minimise impacts on GA. The bases may impact some higher flying GA, such as gliders. Glider logs supplied by BGA indicate few glider flights would actually be impacted by these bases but the possibility remains. Generally in the UK, powered GA tends to fly lower than FL75 thus is less likely to be impacted by the lowest base of FL75. The proposed airspace classification is not yet set, but we do not expect to request Class A which precludes VFR flight. All other classes allow for VFR access subject to appropriate ATC clearance. Qualitatively this would be an increased restriction on GA compared with the baseline do-nothing upper option 1.1.			

Continued...

Group	Impact	Level of Analysis	Evidence – see the row below each heading
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Qualitative	
Qualitatively the increased effective capacity would have a positive economic impact on commercial air traffic compared with the baseline do-nothing options 1.1-2.1/2.2.			
General Aviation/ commercial airlines	Fuel Burn	Quantified estimate, monetised estimate	
Note the introductory paragraph on page 6 describing the weighted average, single upper flight methodology. Under this methodology we estimate: An arriving A320 via upper option 1.4 and lower option 2.5 (runway 08) would expect to burn an additional 142kg of fuel, costing about £68.			
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, and 28 controllers & 5 assistants at Luton Airport. 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.			

2.7 PBN route north of Leighton Buzzard to Runway 08 (easterly) from Upper Option 1.4

This option assumes all arrivals use this PBN route. Some vectoring would be required to fine tune the arrival spacing but the main concentration of arrivals would closely follow this flightpath when runway 08 is in use.

<table>
<tr><th>Group</th><th>Impact</th><th>Level of Analysis</th><th>Evidence – see the row below each heading</th></tr>
<tr><td>Communities</td><td>Noise impact on health and quality of life</td><td>Qualitative, quantify people overflown below 7,000ft</td><td>This includes impacts on tranquillity. There are no expected impacts on biodiversity (see page 5).
See Document 2A (i) Design Options for illustrations of arrivals from Upper Option 1.4 with Lower Option 2.7 (runway 08 easterly)</td></tr>
<tr><td colspan="4"><u>Upper Option 1.4 Luton arrivals separated at upper levels, new delay absorption area to the north of Luton</u>
Luton traffic is separated into flows using new volumes of controlled airspace, towards a new delay absorption area in the vicinity of Grafham Water, descending to about 8,000ft. Stansted arrivals would not change.
Government guidance does not prioritise minimising the impacts of noise of aircraft at and above 7,000ft.
<u>Lower Option 2.7 PBN route south of Leighton Buzzard to Runway 08 easterly</u>
Runway 08 is used about 30% of the time. The controllers would take most of the Luton arrivals at 8,000ft and direct them to follow the PBN route south of Grafham Water to the east of St Neots, remaining to the east of the A1 main road and roughly parallel with it until passing east of Potton. The flight would automatically turn right past the southern edge of Biggleswade and descend through 6,000ft to 5,000ft at Stanford. It would remain at 5,000ft for the next c.40km heading southwest, staying about ¾km north of the Chilterns AONB between Harlington and Westoning, past the M1 motorway north of Toddington, the A5 and A416 over Heath And Reach north of the Leighton Buzzard Golf Club and the town itself, turning slightly left on crossing the A4146 until on a southwest track near Burcott west of Wing. Another slight left turn east of Aston Abbotts takes the track over Rowsham crossing the A418 where the flight will start to descend perpendicular to the extended runway centreline over the Aylesbury Golf Range.
It would intercept final approach in the vicinity of Puttenham and Buckland then on to Marsworth then Pitstone Hill, where it would be about 3,000ft.
The final approach path to runway 08 always overflies part of the Chilterns AONB, from Pitstone Hill to Kensworth Common, in a very narrow path.
Note that, in the vicinity of Wing and the expected left turn at Aston Abbots, some vectoring may be required to achieve efficient spacing, hence some variation is likely. Tactical action may also be necessary elsewhere along the route, however we expect most flights to follow this narrower flightpath.
Should this flightpath be flown accurately by all flights with minimal vectoring, about 54,000 people could be overflown below 7,000ft.</td></tr>
<tr><td>Communities</td><td>Air quality</td><td>Qualitative</td><td>See also Government guidance ANG2017.</td></tr>
<tr><td colspan="4">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 is no change from today.</td></tr>
<tr><td>Communities</td><td>Historic environment</td><td>Qualitative</td><td>Overflight of registered historic parks and gardens below 4,000ft</td></tr>
<tr><td colspan="4">Luton Hoo would be overflown below 4,000ft by these arrivals to Runway 08 Easterly.</td></tr>
<tr><td>Wider society</td><td>Greenhouse gas impact</td><td>Quantified estimate</td><td></td></tr>
<tr><td colspan="4">Note the introductory paragraph on page 6 describing the weighted average, single upper flight methodology.
Under this methodology we estimate:
An arriving A320 via upper option 1.4 and lower option 2.7 (runway 08) would expect to emit an additional 480kg of CO_2 equivalent.</td></tr>
<tr><td>Wider society</td><td>Capacity/ resilience</td><td>Qualitative</td><td></td></tr>
<tr><td colspan="4">All arrivals to Luton would be separated from Stansted arrivals in the upper region.
This removes the dependency between the airports, reducing the complexity of the region and increasing its capacity and resilience.
Holding is likely to be significantly reduced.
A defined PBN arrival route at Luton may need some tactical vectoring in order to maximise runway capacity. However, this would still reduce the likelihood of needing to apply flow regulation measures.</td></tr>
</table>

Continued…

Group	Impact	Level of Analysis	Evidence – see the row below each heading
General Aviation	Access	Qualitative	
This option requires additional CAS volumes at higher levels and a smaller volume at a lower altitude. Our developed proposal in the upper region is for one volume with a base of FL75 and another with a base of FL125. The smaller diamond shaped volume in the lower region would need a base of 4,500ft, and a top of 5,500ft beneath the LTMA lying above at 5,500ft Class A. As noted in Step 2A (ii), aircraft would be unlikely to fly in this volume because it would need to exist to provide lateral containment against this PBN route. If a safety case could be made for containment of 2nm, then the region would measure c.3.2nm^2 over Stoke Hammond. If a safety case could be made for less than 2nm, the region could be smaller. This CAS volume may change the behaviour of some GA aircraft which might currently use the current Class G area. It may impact some departures from Cranfield Airport during its opening hours, in particular those which head southwest from runway 21. The bases of these volumes are as high as possible for the needs of the predicted arrival operation, to minimise impacts on GA. The upper bases may impact some higher flying GA, such as gliders. Glider logs supplied by BGA indicate few glider flights would actually be impacted by these bases, but the possibility remains. Generally in the UK, powered GA tends to fly lower than FL75 thus is less likely to be impacted by the lowest base of FL75. The proposed airspace classification is not yet set, but we do not expect to request Class A which precludes VFR flight. All other classes allow for VFR access subject to appropriate ATC clearance. Qualitatively this would be an increased restriction on GA compared with the baseline do-nothing upper options 1.1, 2.1 and 2.2.			
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Qualitative	
Qualitatively the increased effective capacity would have a positive economic impact on commercial air traffic compared with the baseline do-nothing options 1.1-2.1/2.2.			
General Aviation/ commercial airlines	Fuel Burn	Quantified estimate, monetised estimate	
Note the introductory paragraph on page 6 describing the weighted average, single upper flight methodology. Under this methodology we estimate: An arriving A320 via upper option 1.4 and lower option 2.7 (runway 08) would expect to burn an additional 149kg of fuel, costing about £72.			
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, and 28 controllers & 5 assistants at Luton Airport. 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.			

2.8 PBN route S-bend type to Runway 26 (westerly) from Upper Option 1.4

This option assumes all arrivals use this PBN route. Some vectoring would be required to fine tune the arrival spacing but the main concentration of arrivals would closely follow this flightpath when runway 26 is in use.

Group	Impact	Level of Analysis	Evidence – see the row below each heading
Communities	Noise impact on health and quality of life	Qualitative, quantify people overflown below 7,000ft	This includes impacts on tranquillity. There are no expected impacts on biodiversity (see page 5). See Document 2A (i) Design Options for illustrations of arrivals from Upper Option 1.4 with Lower Option 2.8 (runway 26 westerly)
<u>Upper Option 1.4 Luton arrivals separated at upper levels, new delay absorption area to the north of Luton</u> Luton traffic is separated into flows using new volumes of controlled airspace, towards a new delay absorption area in the vicinity of Grafham Water, descending to about 8,000ft. Stansted arrivals would not change. Government guidance does not prioritise minimising the impacts of noise of aircraft at and above 7,000ft. <u>Lower Option 2.8 PBN route S-bend type to Runway 26 westerly</u> Runway 26 is used about 70% of the time. The controllers would take most of the Luton arrivals at 8,000ft and direct them to follow the PBN route south of Grafham Water to the east of St Neots, remaining to the east of the A1 main road and roughly parallel with it until passing east of Potton. The flight would automatically turn right past the southern edge of Biggleswade and descend through 6,000ft to 5,000ft before reversing the turn back to the left again, starting that left turn west of the A1 main road in the gap between Langford and Stanford towards Henlow. It would remain at 5,000ft for the next c.16km, taking a path between Arlesey and Henlow Camp, then continuing the left turn until heading east. On this eastward track it would cross the A1(M) between Radwell and Baldock, continuing east across the A505 near the biogeneration plant. Here the track starts a right turn and leaves 5,000ft in the descent, perpendicular to the extended runway centreline between Wallington and Roe Green. Continuing south over Cottered and Ardeley, it would intercept final approach in the vicinity of Walkern where it would be about 3,000ft. The final approach path to runway 26 always overflies Stevenage in a very narrow path, and this would continue. Note that, in the vicinity of Baldock and the expected right turn at the biogeneration plant, some vectoring may be required to achieve efficient spacing – some variation is likely. Tactical action may also be necessary elsewhere along the route, however we expect most flights to follow this narrower flightpath. Should this flightpath be flown accurately by all flights with minimal vectoring, about 72,000 people could be overflown below 7,000ft.			
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 is no change from today.			
Communities	Historic environment	Qualitative	Overflight of registered historic parks and gardens below 4,000ft
Julians Garden and The Garden House Cottered, would both be overflown below 4,000ft by this option (no change to today).			
Wider society	Greenhouse gas impact	Quantified estimate	
Note the introductory paragraph on page 6 describing the weighted average, single upper flight methodology. Under this methodology we estimate: An arriving A320 via upper option 1.4 and lower option 2.8 (runway 26) would expect to emit an additional 640kg of CO_2 equivalent.			
Wider society	Capacity/ resilience	Qualitative	
All arrivals to Luton would be separated from Stansted arrivals in the upper region. This removes the dependency between the airports, reducing the complexity of the region and increasing its capacity and resilience. Holding is likely to be significantly reduced. A defined PBN arrival route at Luton may need some tactical vectoring in order to maximise runway capacity. However, this would still reduce the likelihood of needing to apply flow regulation measures.			

Continued…

Group	Impact	Level of Analysis	Evidence – see the row below each heading
General Aviation	Access	Qualitative	
This option requires additional CAS volumes. Our developed proposal is for one volume with a base of FL75 and another with a base of FL125. The bases of these volumes are as high as possible for the needs of the predicted Luton arrival operation, to minimise impacts on GA. The bases may impact some higher flying GA, such as gliders. Glider logs supplied by BGA indicate few glider flights would actually be impacted by these bases but the possibility remains. Generally in the UK, powered GA tends to fly lower than FL75 thus is less likely to be impacted by the lowest base of FL75. The proposed airspace classification is not yet set, but we do not expect to request Class A which precludes VFR flight. All other classes allow for VFR access subject to appropriate ATC clearance. Qualitatively this would be an increased restriction on GA compared with the baseline do-nothing upper option 1.1.			
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Qualitative	
Qualitatively the increased effective capacity would have a positive economic impact on commercial air traffic compared with the baseline do-nothing options 1.1-2.1/2.2.			
General Aviation/ commercial airlines	Fuel Burn	Quantified estimate, monetised estimate	
Note the introductory paragraph on page 6 describing the weighted average, single upper flight methodology. Under this methodology we estimate: An arriving A320 via upper option 1.4 and lower option 2.8 (runway 26) would expect to burn an additional 201kg of fuel, costing about £97.			
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, and 28 controllers & 5 assistants at Luton Airport. 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.			

2.9 PBN route direct type to Runway 26 (westerly) from Upper Option 1.4

This option assumes all arrivals use this PBN route. Some vectoring would be required to fine tune the arrival spacing but the main concentration of arrivals would closely follow this flightpath when runway 26 is in use.

Group	Impact	Level of Analysis	Evidence – see the row below each heading
Communities	Noise impact on health and quality of life	Qualitative, quantify people overflown below 7,000ft	This includes impacts on tranquillity. There are no expected impacts on biodiversity (see page 5). See Document 2A (i) Design Options for illustrations of arrivals from Upper Option 1.4 with Lower Option 2.7 (runway 08 easterly)
Upper Option 1.4 Luton arrivals separated at upper levels, new delay absorption area to the north of Luton Luton traffic is separated into flows using new volumes of controlled airspace, towards a new delay absorption area in the vicinity of Grafham Water, descending to about 8,000ft. Stansted arrivals would not change. Government guidance does not prioritise minimising the impacts of noise of aircraft at and above 7,000ft. Lower Option 2.8 PBN route S-bend type to Runway 26 westerly Runway 26 is used about 70% of the time. The controllers would take most of the Luton arrivals at 8,000ft and direct them to follow the PBN route south of Grafham Water to the east of St Neots, remaining to the east of the A1 main road and roughly parallel with it until Abbotsley. The flight would automatically turn slighly right past Abbotsley to the west of Gamlingay and Potton, then turn left at about 6,000ft passing Sutton towards Dunton in the descent to 5,000ft west of Guilden Morden. It would remain at 5,000ft for the next c.9km, taking a path west of Steeple Morden crossing the A505 east of Odsey to Kelshall. Here the track makes a slight right turn and leaves 5,000ft in the descent, perpendicular to the extended runway centreline east of Sandon, continuing south Throcking where it would turn right to intercept final approach between Ardeley and Wood End and then Walkern where it would be about 3,000ft. The final approach path to runway 26 always overflies Stevenage in a very narrow path, and this would continue. Note that, in the vicinity of Dunton, Odsey and Sandon some vectoring may be required to achieve efficient spacing – some variation is likely. Tactical action may also be necessary elsewhere along the route, however we expect most flights to follow this narrower flightpath. Should this flightpath be flown accurately by all flights with minimal vectoring, about 32,000 people could be overflown below 7,000ft.			
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 is no change from today.			
Communities	Historic environment	Qualitative	Overflight of registered historic parks and gardens below 4,000ft
Julians Garden and The Garden House Cottered, would both be past about 2km away below 4,000ft by this option, but would not be overflown.			
Wider society	Greenhouse gas impact	Quantified estimate	
Note the introductory paragraph on page 6 describing the weighted average, single upper flight methodology. Under this methodology we estimate: An arriving A320 via upper option 1.4 and lower option 2.9 (runway 26) would expect to emit an additional 550kg of CO_2 equivalent.			
Wider society	Capacity/ resilience	Qualitative	
All arrivals to Luton would be separated from Stansted arrivals in the upper region. This removes the dependency between the airports, reducing the complexity of the region and increasing its capacity and resilience. Holding is likely to be significantly reduced. A defined PBN arrival route at Luton may need some tactical vectoring in order to maximise runway capacity. However, this would still reduce the likelihood of needing to apply flow regulation measures.			

Continued…

Group	Impact	Level of Analysis	Evidence – see the row below each heading
General Aviation	Access	Qualitative	
This option requires additional CAS volumes. Our developed proposal is for one volume with a base of FL75 and another with a base of FL125. The bases of these volumes are as high as possible for the needs of the predicted Luton arrival operation, to minimise impacts on GA. The bases may impact some higher flying GA, such as gliders. Glider logs supplied by BGA indicate few glider flights would actually be impacted by these bases but the possibility remains. Generally in the UK, powered GA tends to fly lower than FL75 thus is less likely to be impacted by the lowest base of FL75. The proposed airspace classification is not yet set, but we do not expect to request Class A which precludes VFR flight. All other classes allow for VFR access subject to appropriate ATC clearance. Qualitatively this would be an increased restriction on GA compared with the baseline do-nothing upper option 1.1.			
General Aviation/ commercial airlines	Economic impact from increased effective capacity	Qualitative	
Qualitatively the increased effective capacity would have a positive economic impact on commercial air traffic compared with the baseline do-nothing options 1.1-2.1/2.2.			
General Aviation/ commercial airlines	Fuel Burn	Quantified estimate, monetised estimate	
Note the introductory paragraph on page 6 describing the weighted average, single upper flight methodology. Under this methodology we estimate: An arriving A320 via upper option 1.4 and lower option 2.9 (runway 26) would expect to burn an additional 172kg of fuel, costing about £82.			
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, and 28 controllers & 5 assistants at Luton Airport. 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.			

3. Safety Assessments

This section provides a brief, qualitative overview of the impact of each option on aviation safety.

Process Note: Following Step 2A (ii) Design Principle Evaluation, only one Upper option, 1.4, was progressed. Its progression was not on the basis that it was the only potential option on the grounds of safety. For the avoidance of doubt, this was not "the only safe option" within the meaning of CAP1616 page 166 of 2nd edition, paragraph E51. Option 1.2 Point Merge also met the first design principle on safety, however Option 1.2 did not meet the third design principle, which was defined in the success criteria on page 4 of Step 2A (ii) as a reason to reject the option.

0. Do-nothing baseline options 1.1, 2.1, 2.2

The region is a complex system of Luton 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).

2.3 and 2.4 Controller vectoring to runway 08 and 26 respectively, from upper option 1.4

Upper option 1.4 separates out the Luton arrivals from the Stansted arrivals, 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 delay absorption area, dedicated to Luton 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 lead to a lower likelihood of approaching the limit of controller workload, meaning fewer temporary limits would be applied, reducing those consequential complexity problems. Therefore, this option is considered sustainable and safe.

2.5, 2.7, 2.8 and 2.9 PBN routes to final approach, from upper option 1.4

Upper option 1.4 would separate out the Luton arrivals as described in the previous paragraph for 2.3 and 2.4.

Flights would arrive at the dedicated delay absorption area 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 until the aircraft can be placed back on the route, 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 airspace is less busy, 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, 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 written, as will a study of each route against other routes and flows (including departures).

4. Conclusions and next steps

The Statement of Need for this proposal can be summarised:

Current situation – Luton and Stansted traffic use the same arrival routes and holding capacity which causes increased complexity as traffic levels increase. (Growth is still anticipated at each airport).

NATS has conducted an internal safety survey on the TC Essex Sector and has identified some latent risk which has been shared with the CAA.

NATS is exploring options to address the safety issues and work with co-sponsor, London Luton Airport, to improve capacity within the TC Essex sector.

Desired outcome – To improve complexity, workload and delays in relation to arrival traffic at Luton and, as a consequence, Stansted.

The safety imperative identified with the NATS internal report makes adherence to the minimum timeline achievable under CAP1616 process highly desirable.

We developed design principles in accordance with Step 1B of the airspace change process CAP1616.
We used them to inform our nascent feasibility studies at upper levels and lower levels leading to design concepts. We took these concepts to our representative stakeholder groups, explaining why we are describing them separately, in addition to seeking feedback to inform their development.

These options have been developed thus far with the significant assistance, input and feedback from representatives of the General Aviation community, UK Ministry of Defence and United States Air Force (Europe) staff, executives from several airlines, and representatives of the local communities around London Luton Airport.

We used their feedback, did additional design work, and refined the concepts into design options with formal descriptions under Step 2A (i). We used the design principles from Stage 1 to evaluate the design options and discarded those least fitting the principles, under Step 2A (ii).

We thank all these stakeholders and look forward to continuing the development of this proposal.

From this initial options appraisal Step 2B, we conclude that the lower options 2.3, 2.4, 2.5, 2.7, 2.8 and 2.9 are all suitable for further development in conjunction with upper option 1.4, and can be progressed to the next stage.

Furthermore, as discussed in Step 2A (i) Design Options document section 2 page 22, each of the lower options is a viable option individually. However, it is possible, indeed preferable, that some or all of these six lower options could be combined into a system of options to convey Luton arrivals from the upper option 1.4 to the runway.

An example could be the use of controller vectoring to minimise constraints on airport capacity (design principle 4) during busy periods, where vectoring is currently the most effective method of continuously setting an accurate arrival sequence. During periods where a constant arrival sequence is less important, one or more of the PBN routes could be used (design principle 10), minimising tactical intervention by controllers (design principle 14) – we find this to be our preferred concept, but we have not yet developed the combinations to see which are viable together.

Another example, the combinations could be based on set times of day, it may be possible to consider the creation of a schedule for different PBN routes to provide predictable respite when the arrival traffic is less busy (bearing in mind that the runway in use at the time depends predominantly on the wind direction and speed).

At this stage our preferred option is to combine option 1.4 with 2.5, 2.7, 2.8 and 2.9. This would provide a dedicated arrival structure for Luton and introduce combinations of PBN routes to each runway. We consider PBN routes preferable to align this change to the CAA Airspace Modernisation Strategy and to facilitate pro-active management of traffic dispersion to each runway.

The next step is the Stage 2 Gateway Assessment planned for 29th November 2019. Subject to CAA approval, our proposal would move on to Stage 3 Consult.

We will then explore technically viable combinations of options, and refine our analysis in light of those combinations.

The initial evidence has been gathered and is summarised in this document (see the Technical Appendix for more details). For the next stage where a Full Options Appraisal is needed, we will update our design combinations, use them to quantify the likely noise impacts in greater detail where possible, refining the methodology to do so using the Government's WebTAG tools and guidance. We will refine our initial fuel burn calculation methodology into one taking greater account of expected holding reduction and improved height profiles, again using appropriate WebTAG tools and guidance.

We will write consultation material and formally consult with you.

End of document