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

2 A (i) Design Options

Roles

Action	Role	Date
Produced	Airspace Change Specialist NATS Airspace and Future Operations	08/11/2019
Produced	Airspace and Noise Performance Manager London Luton Airport	08/11/2019
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1.0	Nov 2019	First published to CAA Portal
1.1	Nov 2019	Minor clarifications to Section 6 Annex following CAA feedback.

Contents

Introduction – about this document, scope, background

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 2A (i) Design Options. Its purpose is to provide, and describe, a comprehensive list of options. It is designed to be read in conjunction with document Step 2A (ii) Design Principles Evaluation.

We re-engaged our representative stakeholder groups (mostly the same stakeholders who participated in Stage 1 with some extra, see Section 6 Annex: Summary of Stakeholder Engagement Evidence on page 58 for details). We recapped the airspace change process and design principles, and explained the fundamental concept of this proposal. We explained that other (non-airspace-change) solutions[1] to the issue have already been considered, and either implemented if possible, or discarded if not, prior to the inception of this airspace change proposal.

We explained the constraints, and what was feasible within those constraints. We targeted each stakeholder group for feedback relevant to their interests, which informed the construction of this document. Not every option was presented to every stakeholder because each stakeholder has different interests, with some options coming out of the engagement itself. We thank the stakeholders for this engagement.

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 and this document is part of Step 2A.

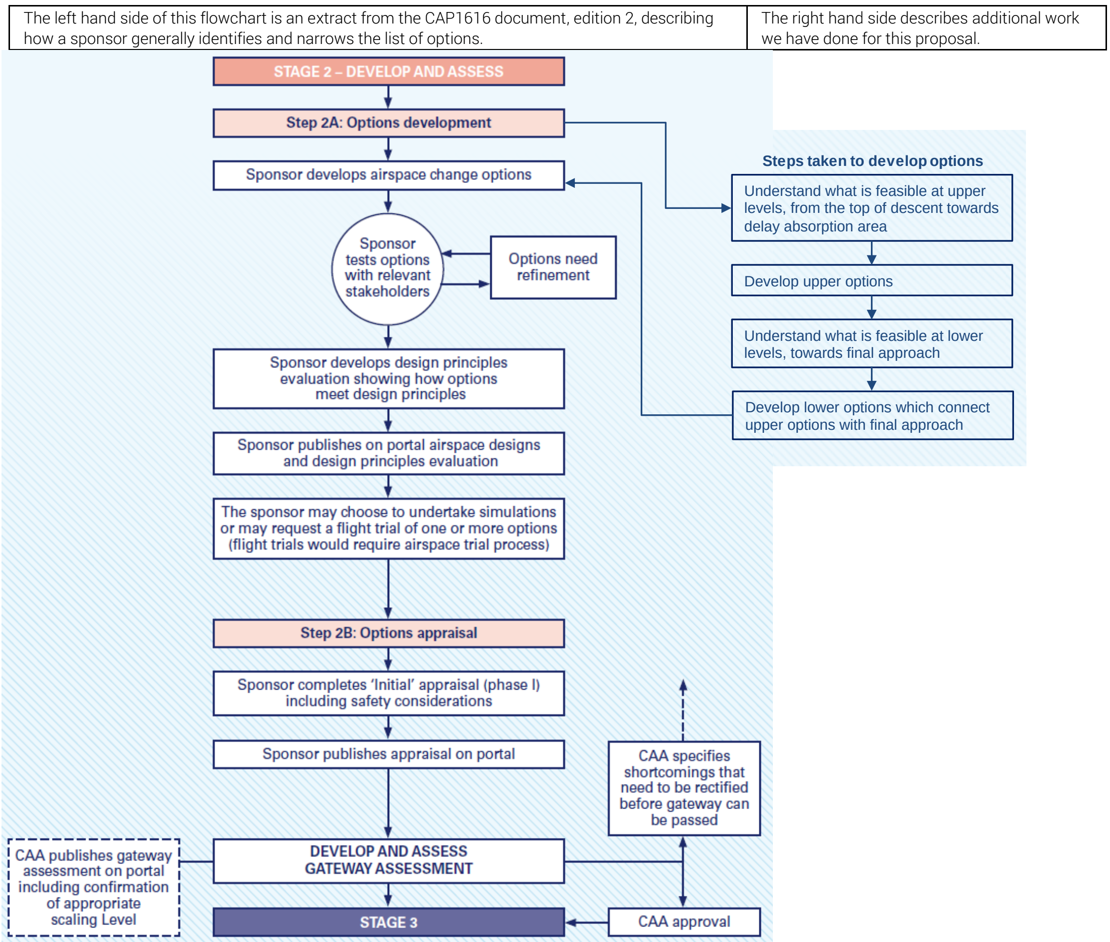

Figure 1 Airspace Change Process Stage 2

[1] CAP1616 Edn 2 page 157 para E14. Examples include improvements to staffing and use of flow control to regulate demand & complexity in the airspace sector. Also we considered waiting for the major airspace infrastructure change known as FASI-S (see page 5 for details of that separate project).

About Luton and Stansted Airports, and this proposal

Currently, Luton and Stansted Airports (two of the five busiest airports in the UK in terms of air traffic movements) share exactly the same arrival flows from the en-route cruise phase to the holds. This is a unique situation – other airports sometimes share arrival routes, but one always has a much bigger proportion of movements (for example, Heathrow and RAF Northolt, or London City and Biggin Hill).

Like most airports, Luton has a single runway which can be used in two directions – easterly or westerly.

The scope of this proposal specifically addresses Luton arrival flows, and their interaction with Stansted arrival flows in the existing London Terminal Manoeuvring Area (LTMA). The LTMA consists of a complex system of air traffic service (ATS) routes (for all traffic) plus Standard Departure/Arrival Routes (known as SIDs/STARs), existing holding facilities and airspace volumes for all London Airports.

How to read this document – two major sections, a minor third section:

This document describes the broad concept options for Luton Airport arrivals, from the end of the en-route cruise phase of flight, known as "Top of Descent" (TOD), to final approach Luton's runway.

The total number of options from en-route to final approach is significant, so in order to manage their development we have split them into two major sections. We expect most stakeholders to have an interest in these two sections. A minor third section discusses contingency procedures.

Section 1: Upper design options

Options for the routes from TOD, to arriving at the Delay Absorption area (referred to as 'holds' regardless of the existence of a formal holding pattern). This is at higher altitudes, from c.8,000ft and above.
Summarising Government guidance, consideration of the reduction of CO_2 emissions takes priority over the minimising of aviation noise at these higher levels[2]. All upper options will be numbered 1.1, 1.2, 1.3…

Section 2: Lower design options

Options for the routes leaving the Delay Absorption area, to final approach at the runway. This is at lower altitudes, from c.8,000ft and below.
Summarising Government guidance, 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[2]. All lower options will be numbered 2.1, 2.2, 2.3…

Section 3: Contingency Procedures (technical, rarely used)

Contingency routes are used only under unusual circumstances, for example if radar or communications fail and the pilot must take action without guidance from the controller. This section is targeted at aviation technical specialists and unavoidably uses technical language.

Limited scope for multiple options or radical designs

The airspace change process (CAP1616) acknowledges[3] that, sometimes, there will only be limited scope for multiple design options, with few realistic options available, due to the physical constraints of adjacent airspace or flight procedures (both of which apply to the LTMA).

CAP1616 also suggests the consideration of so-called "radical" options[4] – these would test the general feasibility of potential solutions. Examples are potential designs requiring major air traffic technology changes, the use of less-common navigation technologies, and/or impacting other LTMA flows.

We engaged stakeholder groups and tested our preliminary design concepts with each group, tailoring our presentations and meetings to their interests. We told these groups that we would divide the concepts into Upper and Lower to keep them simple yet comprehensive. We also explained our constraints as part of the

[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.
[3] CAP1616 Edn 2 page 39 para 123
[4] CAP1616 Edn2 page 157 para E16

engagement process, and that these concepts were considered useful in defining the scope and feasibility of the proposal. A list of engagement activities is summarised in Section 5 on page 57.

Some radical options are included in this document, demonstrating that we have considered a wide variety of concepts, exploring and illustrating how they might work, with associated constraints.
These constraints are explained more, in the upper and lower sections of this document.

Why must this change happen now?

Where complex traffic flows cross each other, altitude restrictions may be used to separate them by 1,000ft vertically. Also, air traffic controllers tell pilots to fly in certain directions to avoid conflictions – this is called "tactical vectoring", and is a large part of a controller's day to day work. It involves a significant workload on the controller because they are managing many other aircraft at the same time, ensuring they are all kept safely separated. All the aircraft in this region are being tactically vectored, all the time.

The region is especially complex, and the amount of air traffic has grown faster than expected, increasing the workload of our controllers. Safety is always our first priority. We have identified that, unless we do something now, the intensity of this workload complexity may become unsustainable for our controllers in the next two years (about the length of time to progress an airspace change of this scale). During periods where workload is predicted to become too intense, safety dictates that we apply temporary limits to the numbers of flights entering the controller's sector before the number exceeds safe limits. This causes delay to the travelling public (at both Luton and Stansted), and is a short-term temporary solution to the latent problem. The longer the temporary limits are applied, the more flights get moved later and later in the day, causing different complexity problems for our controllers, the airports and airlines - and causes flights to be delayed into the night time noise period[5]. This was explained to our representative stakeholder groups during engagement sessions.

Why not make bigger, further-reaching changes to the whole area?

There is a longer-term piece of work, initiated by the CAA and the UK Government, known as the Airspace Modernisation Strategy[6] (AMS) (superseding the Future Airspace Strategy (FAS)). Part of the AMS aims to make large-scale improvements in the South of the UK, still currently referred to as the Future Airspace Strategy Implementation – South (FASI-S). This is a much larger project involving many of the airports in the south, changing their traffic flows in a coordinated way, including the LTMA. This will take longer than the two years explained above. We expect the work done in this proposal to be compatible with that of the future project, and refinements may be explored during its lifetime. This was explained to our representative stakeholder groups during engagement sessions.

What are the main LTMA constraints, limiting the number of feasible options?

The fundamental design concept is to reduce the complexity of the currently-entwined Luton and Stansted Airport arrival flows at higher altitudes, between TOD and the current Delay Absorption areas – this concept, to separate the arrival flows, was explained to all stakeholder groups.
Amendments to the flows for other airports within the LTMA are outside of the scope of this ACP and therefore the design options must complement the existing airspace design.

A new route network which would split the Luton and Stansted arrival flows, while remaining *entirely* within the existing system, would require changes to most of the established flows illustrated above. For example, Luton is situated in the northern sector of the LTMA – a new flow to the south would impact London Heathrow and City airport operations. The same is true to the east, with Stansted airport operations – this proposal's primary purpose is to reduce the complex interactions of entwined Luton and Stansted arrival flows. A new flow within this area would necessarily impact on Stansted arrivals and departures as well as Luton departures. Also, it would not be feasible to consider moving the Stansted arrival flow because the relative geography of the two airports precludes it.

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[5] Regulating the amount of traffic within a sectors is a human-centric process. An airspace design which significantly reduces the need for flow regulation also reduces the number of processes needed to manage the airspace, thus improving safety.
[6] Search online for "Airspace Modernisation Strategy" or go to this link www.caa.co.uk/News/New-Airspace-Modernisation-Strategy-launched-to-overhaul-UK-airspace/

To the west and northwest, the airspace comprises the "spine" of the UK airspace network with flows climbing and descending into and out of the LTMA. Outside the LTMA there are also military and General Aviation to consider, other airspace users, and airspace restrictions such as danger areas to be avoided.

These constraints also show that changing the main Luton arrival flows at upper levels would change the flows at lower levels – the two are inextricably linked. And at the lower levels nearer the airport, other technical constraints influence what is feasible. These are described in more detail in Section 2 Lower design options.

The constraints were explained to our representative stakeholder groups during engagement sessions.
The diagrams on the next pages illustrate the current flows and constraints.

What was the Statement of Need for this proposal?

The Statement of Need is the first step a Sponsor must take, to initiate and airspace change proposal with the CAA. The design concepts in this document strive to address the Statement. Ours is summarised below. The full document is published on the CAA's Airspace Change Portal (link to portal).

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.

What are the design principles for this proposal?

The design principles were set following engagement with representative stakeholder groups as part of CAP1616 Stage 1. The table of design principles and their relative priorities is shown in Section 5 Annex: Design Principles on page 57.

Altimetry – altitudes, heights and flight levels

In aviation, aircraft can use different vertical references when flying. "Altitude" specifically means the distance of an aircraft above mean sea level using a local or regional pressure setting, "height" specifically means the distance above a particular piece of land, and "Flight Level" (FL) is a standard reference for aircraft at higher levels, in hundreds of feet, so an aircraft at FL90 is 90 x 100 = 9,000ft above the standard reference.

Worth noting is that aircraft at a level altitude will be at a different height over low flat land than over hilly terrain. For example, an aircraft level at an altitude of 6,000ft over Royston (which is about 200ft above mean sea level) would be at a height of 5,800ft at that moment, but the same aircraft at the same altitude of 6,000ft over Heathrow Airport (83ft above mean sea level) would be at a height of 5,917ft. It would be difficult for a controller to issue a height to fly at, because the pilot would need to constantly adjust to the terrain.

Controllers need to use reference settings which are common for the aircraft under their control and those adjacent, hence the use of altitudes and flight levels.
Aircraft at altitudes, for example one at 5,000ft and another at 6,000ft, use a common datum and are therefore always separated by 1,000ft from each other vertically regardless of the terrain.

In this document we generally refer to altitudes, occasionally to flight levels FLs. They are not necessarily the same, but they are close enough so the differences can be ignored during these illustrations. From a technical point of view, the differences have been considered in the development of these options, especially where different controlling agencies may be using different references.

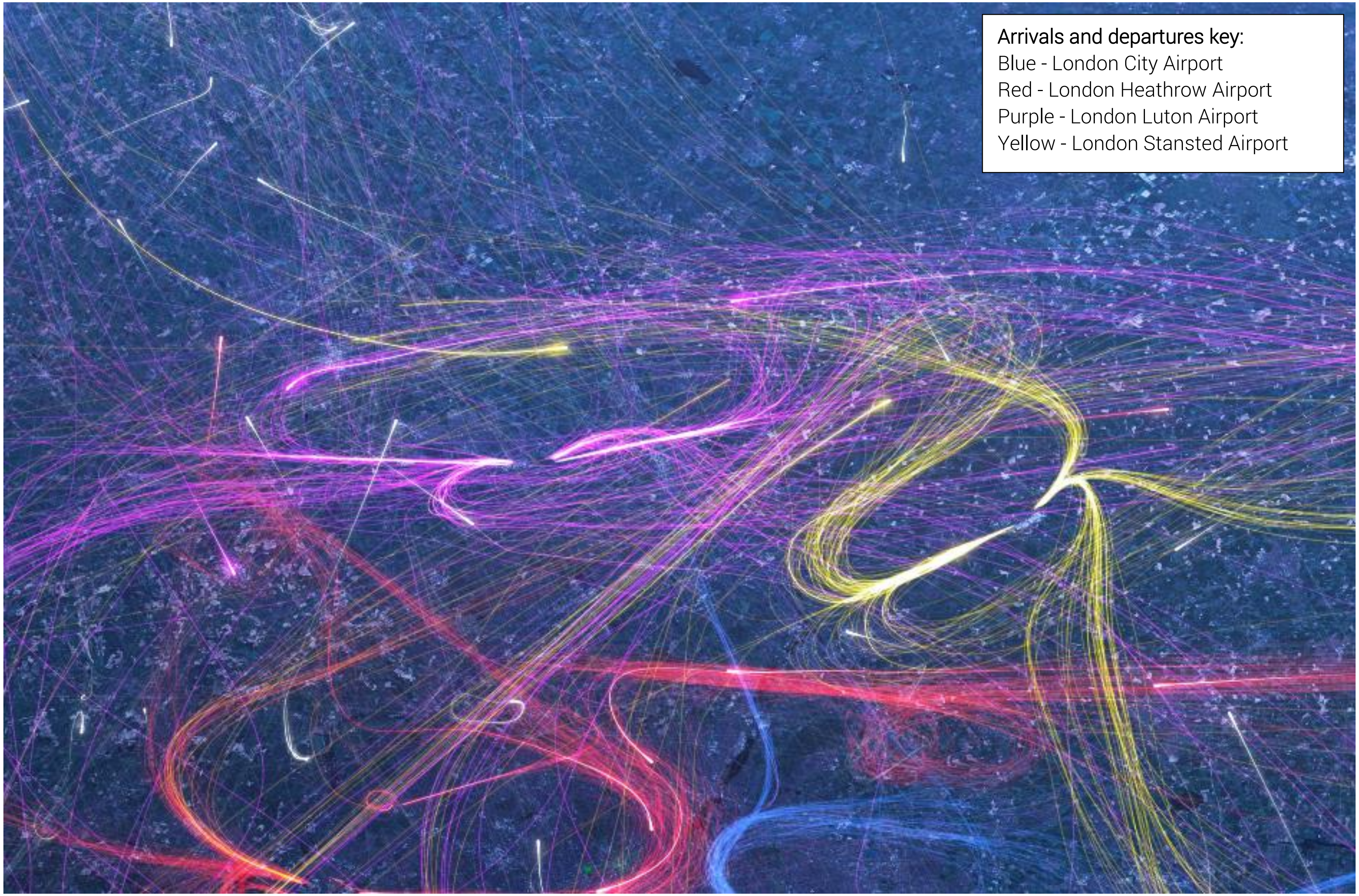


Figure 2 Current air traffic flows in the northern LTMA

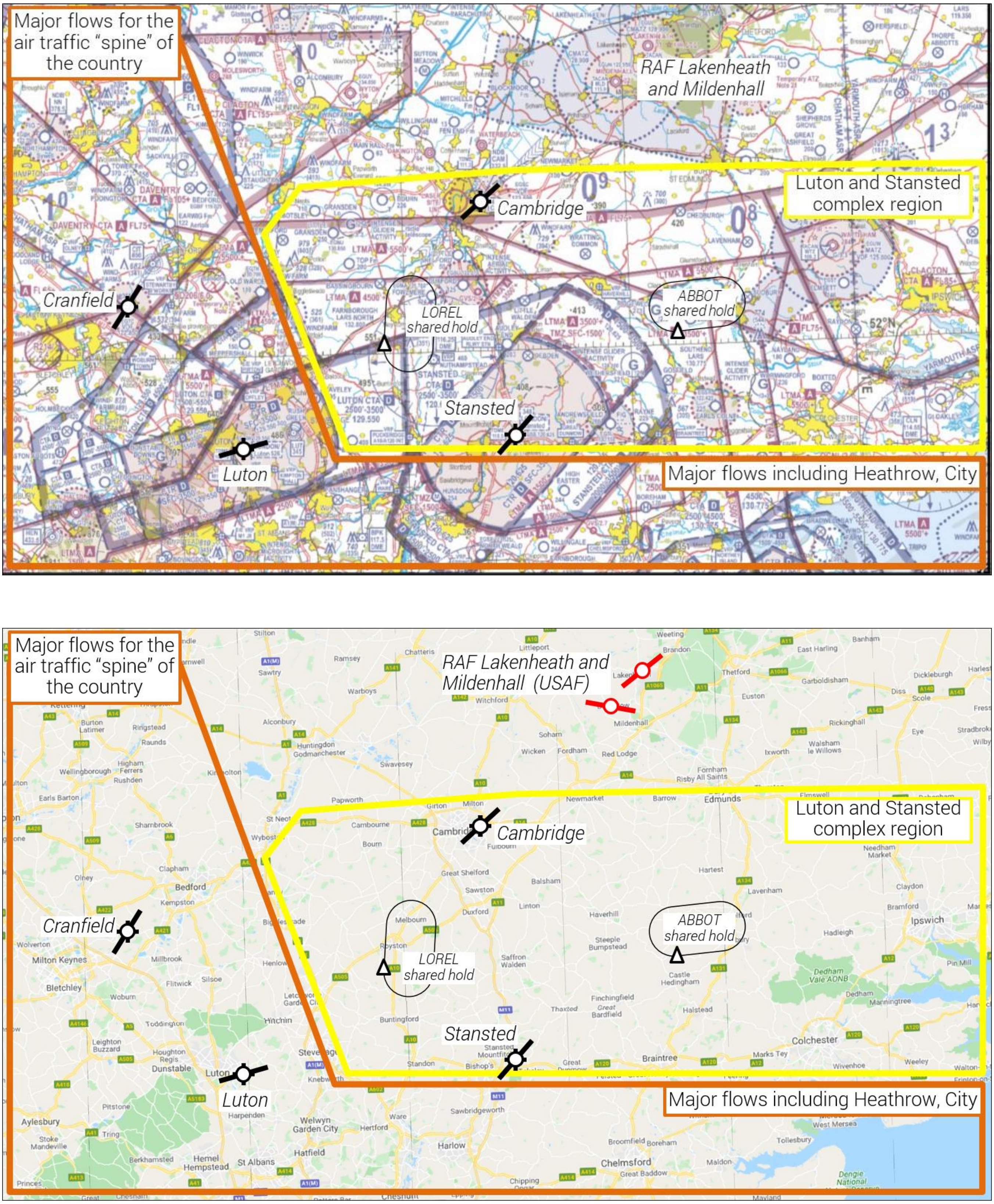
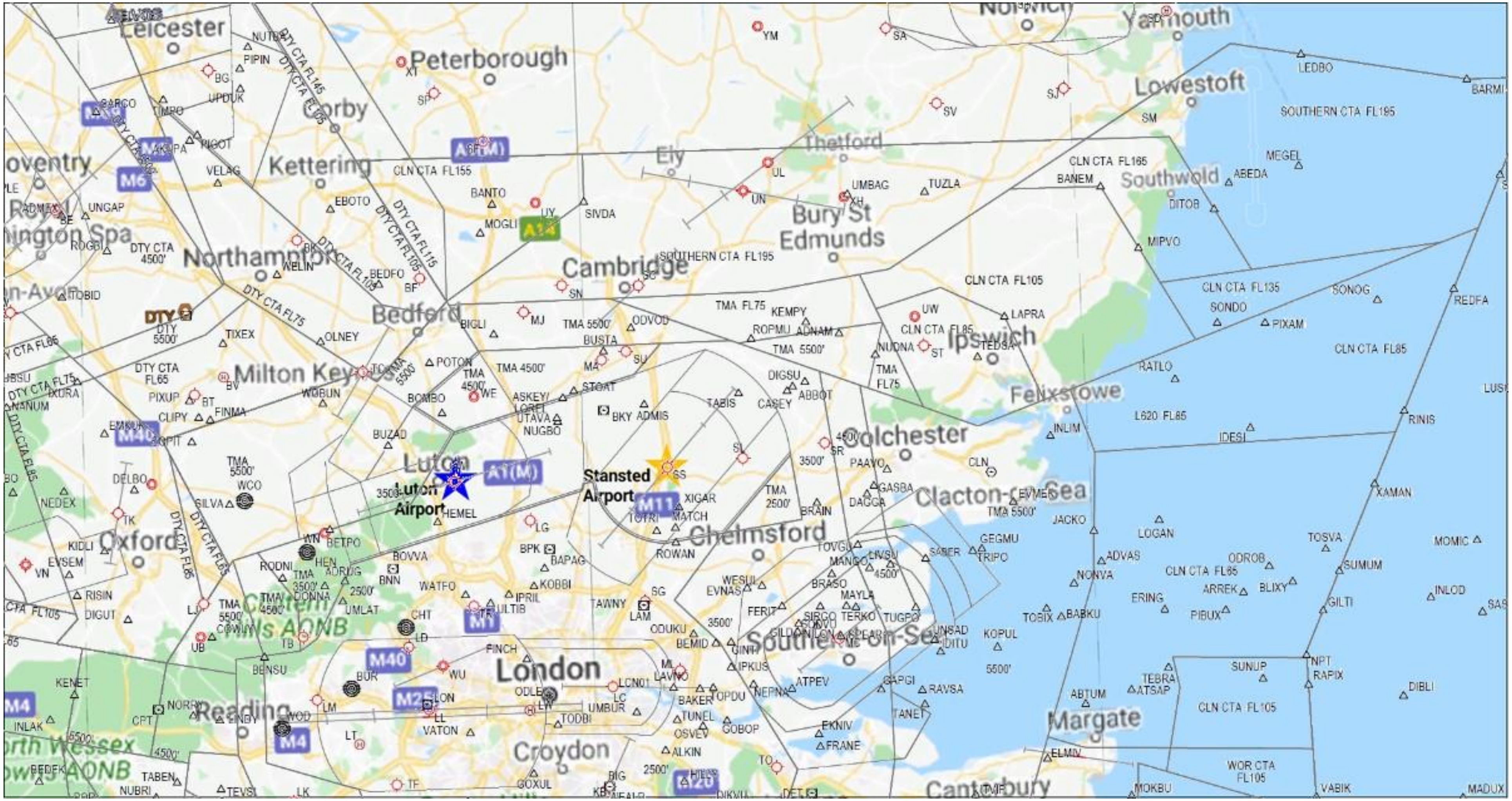


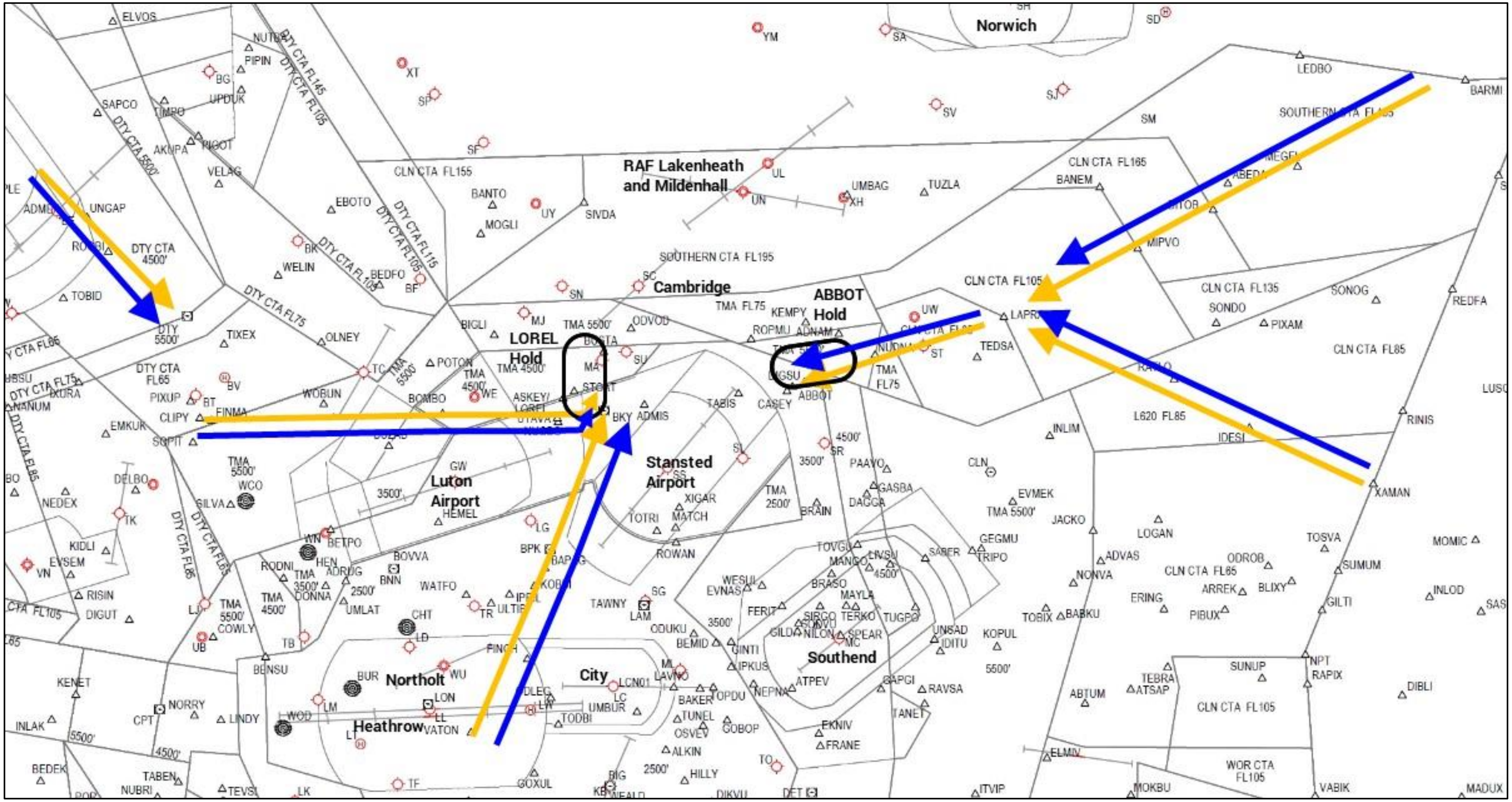
Figure 3 Constraints, illustrated using an aviation chart, and a map with towns, cities and villages

1. Upper design options



The upper design options are primarily of interest to aviation specialists due to the height involved. However we recognise that it is important for everyone to be able to understand where the flows might go, even at higher levels. This page aligns a Google map with the aviation-based charts which follow, so that you can interpret the relative geography as well as the aviation information – it is a reference for the reader. For scale, the runway centreline markers are set at 5 nautical mile intervals.

1.1 Do nothing – the upper baseline



The yellow arrows show the upper Stansted arrival flows.
The blue arrows show the upper Luton arrival flows.

This simple picture is the cause of significant complexity at lower levels. The yellow and blue arrows are shown separately, but illustrate the fact that arrivals into both airports are combined into a single joint mixed flow.

These joint flows arrive at the black racetrack-shaped delay absorption areas ("holds"), known as LOREL to the west and ABBOT to the east. The westbound departure routes from Stansted (not shown here) also interact with these arrival flows, adding to the complexity of the current design.

Aircraft arrive into the holds from three main directions; west, south and east. The position and combined capacity of the existing LOREL and ABBOT holds is required to service arrivals into Stansted alone. The capacity of the region, and these two holds, is not sufficient to cope with the demand for both airports in today's operation.

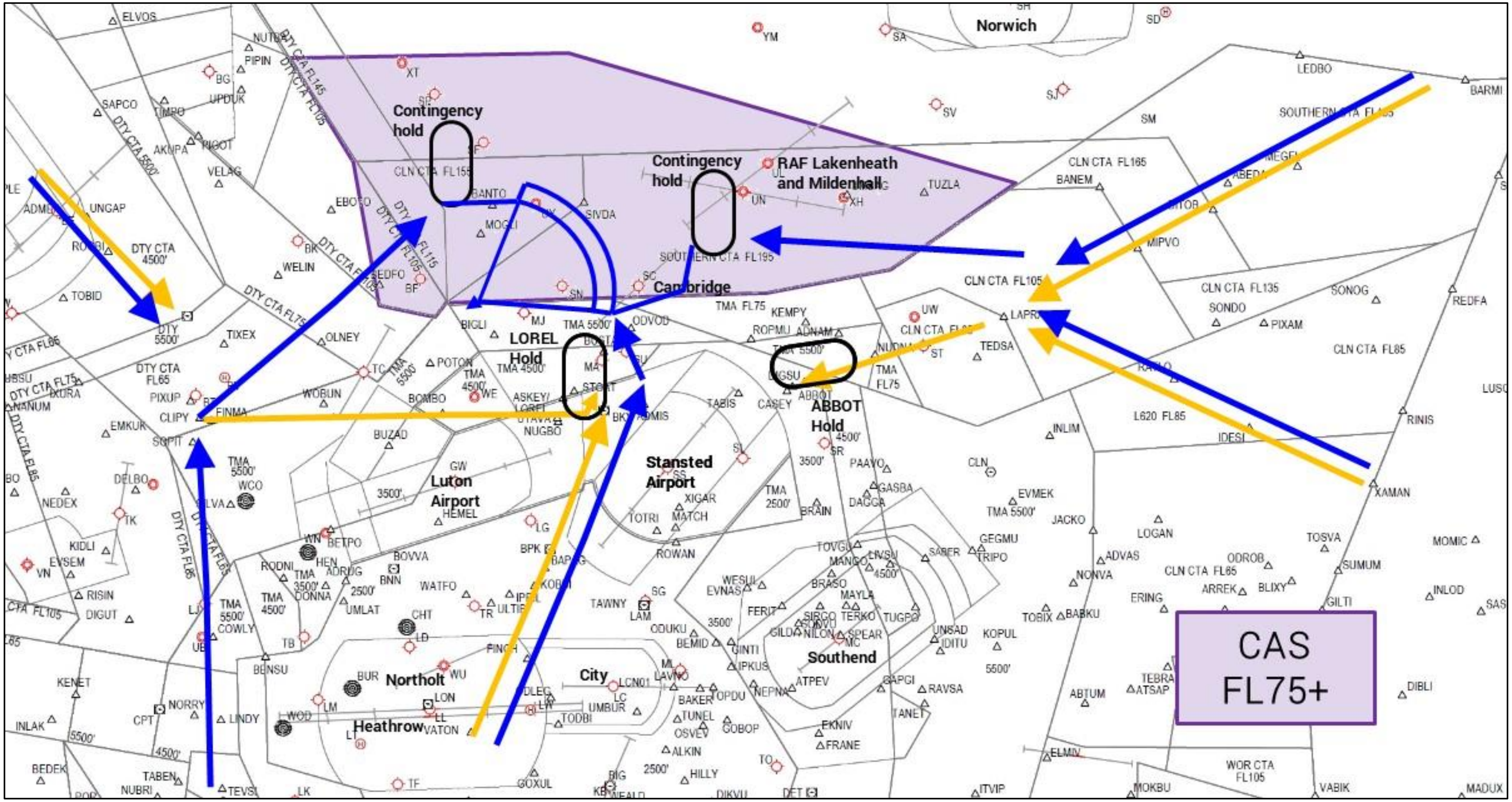
It is a regular occurrence that, when there is a holding delay for one airport, aircraft inbound to the other airport are penalised either by holding unnecessarily or given extended and complex vectoring at lower altitudes to circumnavigate the holding area.

Separating these arrival flows, which have been entwined since the cruise phase of flight, requires intense and complex air traffic control interactions within congested airspace, mostly at lower altitudes from 8-7,000ft and below (see Section 2 from page 22 onwards).

As stated earlier, during periods where workload is predicted to become too intense, safety dictates that we apply temporary limits to the numbers of flights entering the controller's sector before the number exceeds safe limits. This causes delay to the travelling public (at both Luton and Stansted Airports), and is a short term temporary solution to the latent problem. The longer the temporary limits are applied, the more flights get moved later in the day, causing different complexity problems for our controllers, the airports and airlines - and causes flights to be delayed into the night time noise period.

This option would not require any new controlled airspace (CAS) or routes. This option can only be combined with the do-nothing lower baseline options 2.1 and 2.2 because it does not split the Luton arrivals from the Stansted arrivals.

1.2 Separate flows, point merge delay absorption concept option (airspace location & dimensions are illustrative)



The yellow arrows show the upper Stansted arrival flows, unchanged from today.
The blue arrows show the upper Luton arrival flows, and a semi-linear holding pattern in the form of two arcs about a merge-point to the west.

This design option is conceptually similar to that used by London City Airport.

The concept is designed to minimise racetrack-shaped holding. Nevertheless, as per the London City Airport point merge system, a racetrack-shaped pattern is needed at the beginning of each of the two blue arcs, for contingency purposes should there be a need for extended periods of delay such as Luton's runway closing unexpectedly.

The general position of this point merge concept was determined by the complexity and capacity of the surrounding airspace (Stansted arrivals and departures, Heathrow arrivals and departures and London City departures).

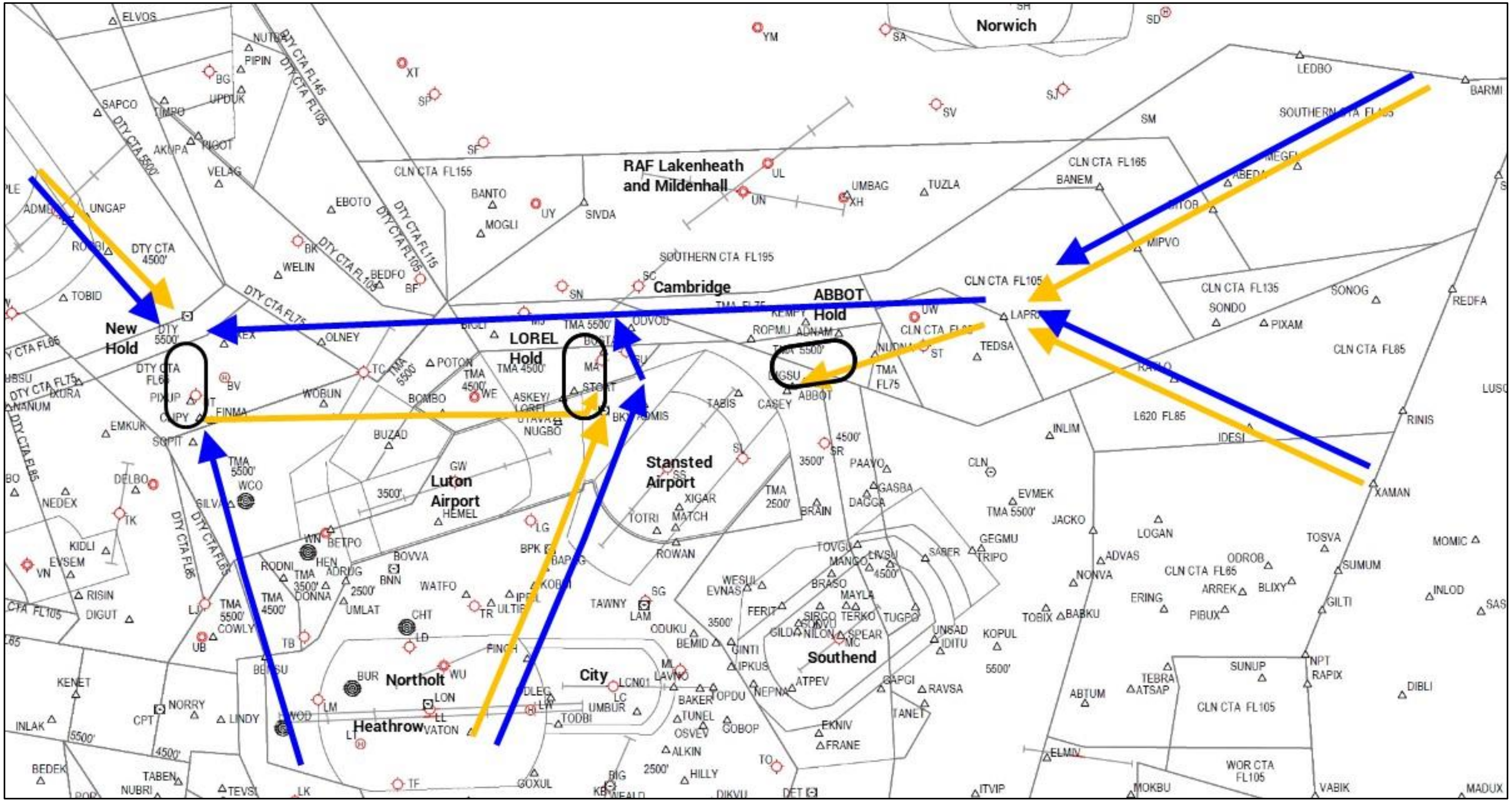
This option uses Performance Based Navigation (PBN) principles, enabling aircraft to fly published routes very accurately. An example of PBN is the use of satellite navigation rather than using ground-based radio beacons.

This option would require a volume of additional CAS to the northeast of Luton to contain the point merge design, the classification[7] of which would be determined later in the development process, illustrated as a single volume with a base of FL75.
This would facilitate the separation of Luton arrivals from Stansted arrivals. The illustrated CAS base was determined by the need for aircraft to be at a suitable level for descent into the airport at each end of the arcs.

We engaged some of our aviation stakeholders on this, noting that our controllers believed it would be a larger scale of development. Nevertheless we included it in this list because it is an option using an alternate method of delay absorption rather than the typical racetrack pattern (racetracks illustrated in the design are for contingency purposes only).

[7] Airspace volumes are classified by letters A (most restrictive, highest standards of pilot qualification, aircraft equipage and adherence to air traffic control instructions) to G (least restrictive, generally no requirement to talk to any air traffic controller). Most of the UK's airspace is classified G, D, C and A in ascending order, with some volumes of class E.

1.3 Semi-separate flows, delay absorption to the west of Luton Airport within existing LTMA



The yellow arrows show the upper Stansted arrival flows, unchanged from today.
The blue arrows show the upper Luton arrival flows, aiming to a new delay absorption area to the west of Luton, within the existing LTMA (position/orientation illustrative).

This concept would favour Luton traffic arriving from the west of the airport, and would also require changes to the existing route network within the LTMA.

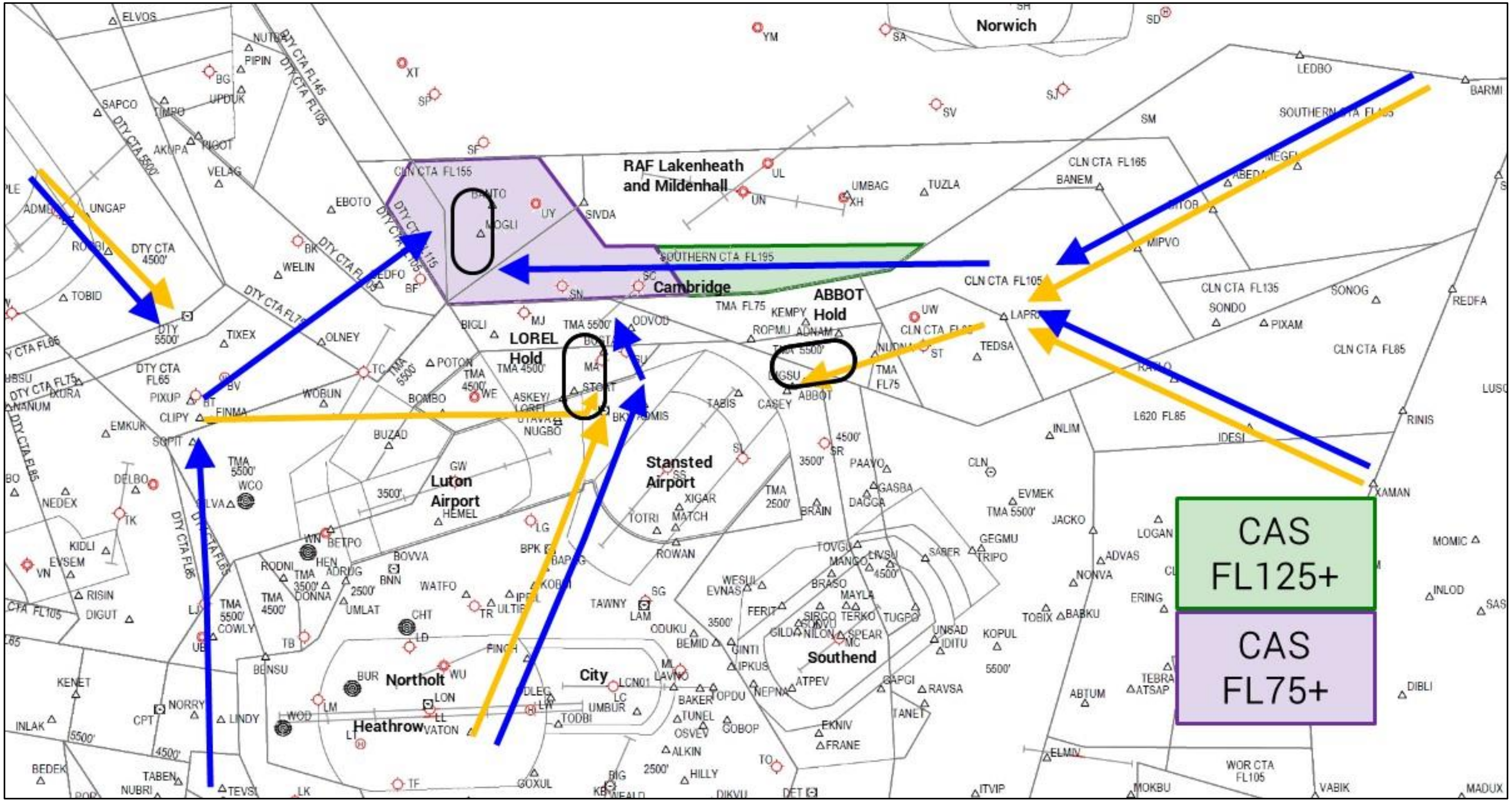
The delay absorption area would be positioned in a congested volume of airspace due to the route interactions of Heathrow, Birmingham, East Midlands, Gatwick and London City airports. It would connect to Luton airport with new routes crossing the current inbound/outbound flows serving Heathrow, Gatwick, Birmingham, Stansted, London City and Luton. The smallest, simplest type of delay absorption area that might be suitable, is a racetrack-shaped pattern. The orientation shown is illustrative only.

This option uses Performance Based Navigation (PBN) principles, enabling aircraft to fly published routes very accurately.

We consider this to be a radical option because of the complex interactions and the changes required to existing flows.

We engaged some of our aviation stakeholders on this, noting that our controllers believed it was unlikely to be viable. Nevertheless we included it in this list because it is an option requiring no new controlled airspace (CAS).

1.4 Separate flows, delay absorption area to the north of Luton Airport (airspace location & dimensions are illustrative)



The yellow arrows show the upper Stansted arrival flows, unchanged from today.
The blue arrows show the upper Luton arrival flows, aiming to a new delay absorption area to the north of Luton, outside the existing LTMA.

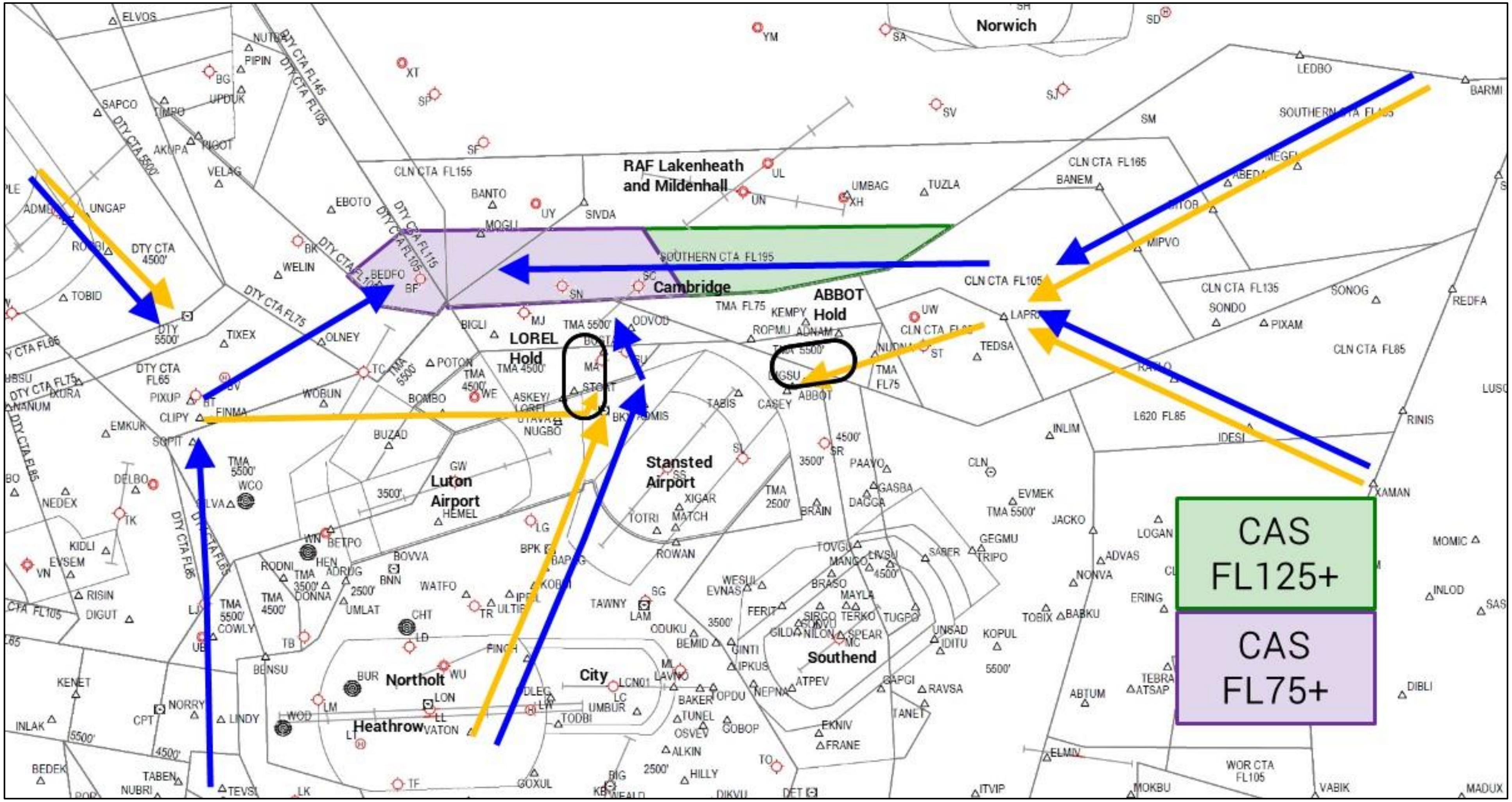
The general position of the delay absorption area was determined to deconflict Luton traffic from the existing LTMA arrival/departure flows. This area would connect the arrival routes to Luton from the north, west, south and east, slightly favouring arrivals from the west. The smallest, simplest type of delay absorption area that might be suitable, is a racetrack-shaped pattern. The orientation shown is illustrative only.

This option uses Performance Based Navigation (PBN) principles, enabling aircraft to fly published routes very accurately.

This concept option would require additional CAS to the north of the existing LTMA, the specific dimensions and classification of which would be determined later in the development process, illustrated as two volumes (one with a base FL125, the other FL75).
This would be to facilitate the separation of Luton arrivals from Stansted arrivals.
The illustrated CAS bases were determined by the need for aircraft to be at a suitable level for descent closer to the airport, but as high as possible further away from the airport close to the USAF air base to minimise the impacts on their operation. The location of any division between CAS volumes is illustrative at this stage, as are the specific dimensions.

This design concept started with a much larger CAS volume to the east, with a lower base. It has been developed thus far via direct engagement activities with the United States Air Force in Europe (USAFE) based at RAF Lakenheath and RAF Mildenhall, facilitated by the UK Ministry of Defence.

1.5 Separate flows, no delay absorption area – technology driven delay absorption en route (airspace location & dimensions are illustrative)



The yellow arrows show the upper Stansted arrival flows, unchanged from today.
The blue arrows show the upper Luton arrival flows, outside the existing LTMA, with no delay absorption area at all.

This concept option relies on a technological tool (Arrival Management System) to determine and absorb delay en route.

It would provide information to controllers in both Europe and the UK to manipulate the speed of individual aircraft, arranging the arrival order sequence long before aircraft are in the vicinity of Luton Airport. It would require the cooperation of other air navigation service providers in Europe, several hundred miles away. The technology to enable this cooperation – secure transmission of Luton arrival data to the required resilient infrastructure standards – is not yet available at Luton airport.

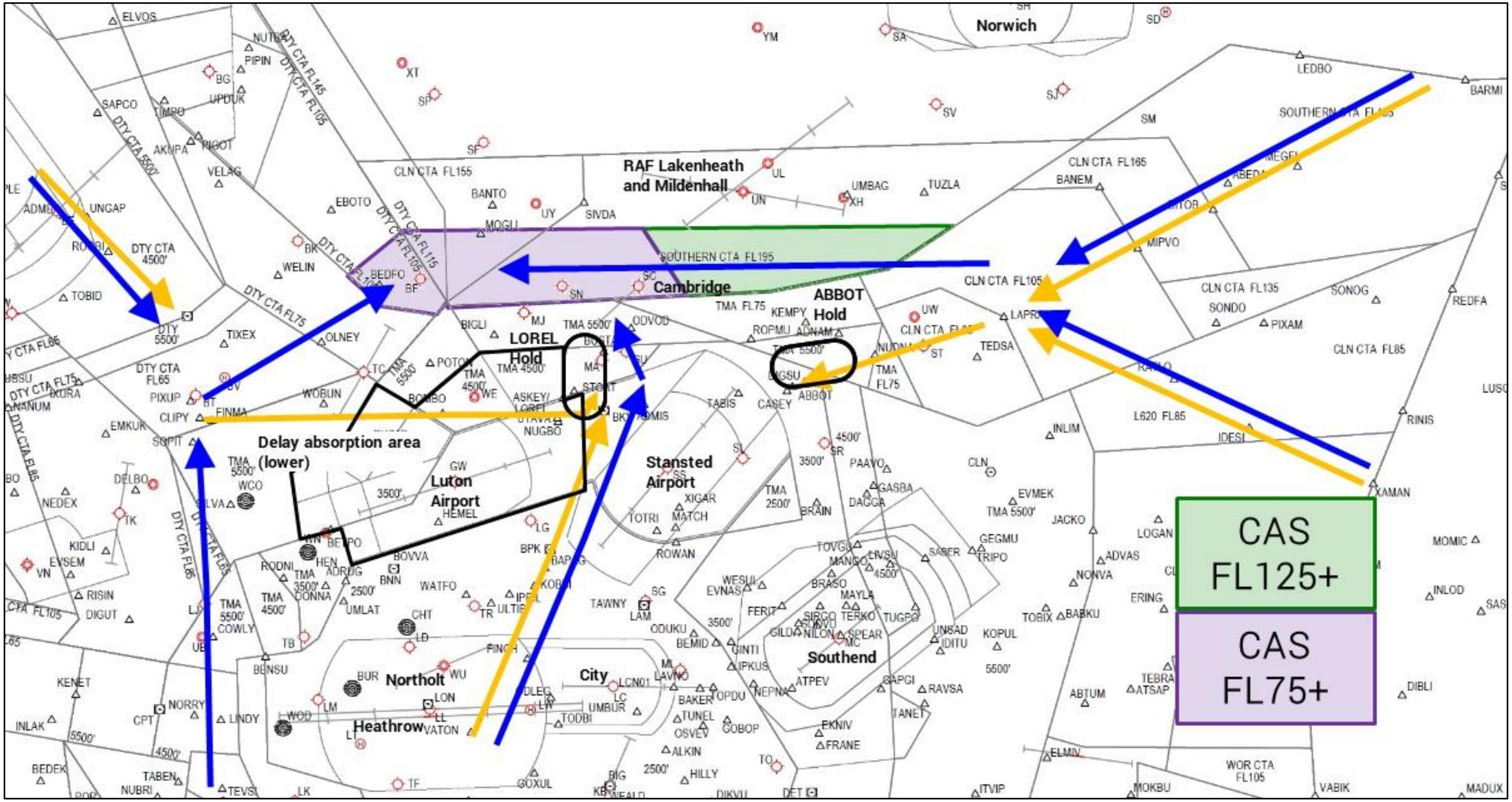
This option uses Performance Based Navigation (PBN) principles, enabling aircraft to fly published routes very accurately.

This concept option would require additional CAS to the north of the existing TMA, the classification of which would be determined later in the development process, illustrated as two volumes (one with a base FL125, the other FL75).
This would be to facilitate the separation of Luton arrivals from Stansted arrivals.
The illustrated CAS bases were determined by the need for aircraft to be at a suitable level for descent closer to the airport, but as high as possible further away from the airport close to the USAF air base. The location of any division between CAS volumes is illustrative at this stage.

We consider this to be a radical option because of the technology required to implement it.

This concept was based on a suggestion by the GA community, to explore non-holding solutions, see Section 6 Annexe.

1.6 Delay absorption via tactical vectoring at low level (airspace location & dimensions are illustrative)



The yellow arrows show the upper Stansted arrival flows, unchanged from today.
The blue arrows show the upper Luton arrival flows, outside the existing LTMA, with no delay absorption area at higher levels.

This concept option does not rely on arrival management technology, though it appears similar in concept to the previous option 1.5.

Delay would be absorbed by ATC's use of tactical vectoring within Luton Airport's "Radar Manoeuvring Area" (RMA) – this is the small volume of controlled airspace entirely dedicated to Luton traffic, not shared with other airports. The black shape shown in this diagram is based on the current Luton RMA, but that may need to change. Tactical vectoring to arrange the sequence would take place at much lower levels than the other options.

This option uses Performance Based Navigation (PBN) principles, enabling aircraft to fly published routes very accurately.

This concept option would require additional CAS to the north of the existing TMA, to facilitate the separation of Luton arrivals from Stansted arrivals. It may also require additional CAS in the vicinity of Luton at lower levels.

The illustrated CAS bases were determined by the need for aircraft to be at a suitable level for descent closer to the airport, but as high as possible further away from the airport close to the USAF air base. The location of any division between CAS volumes is illustrative at this stage.

We consider this to be a radical option because it would be a uniquely complex system of delay absorption with no clear contingency procedure possible.

This concept was also based on a suggestion by the GA community, to explore non-holding solutions, see Section 6 Annexe.

2. Lower design options

The lower design options must take account of the direction of the landing runway at Luton Airport. Typically, runway 08 (easterly) is used c.30% of the time, with runway 26 (westerly) operating c.70% of the time. This is a long-term average and is consistent with the region's other airports. The proportion may differ for significant periods in the short term, runways can stay the same direction for more than a week, or they can change direction more than once per day primarily depending on the wind direction at the time. However, the UK's prevailing wind is from the west and the 30-70 proportion remains appropriate for these illustrations.

The coloured areas in the following diagrams illustrate today's arrival flows, and also the design concepts being considered at lower levels.

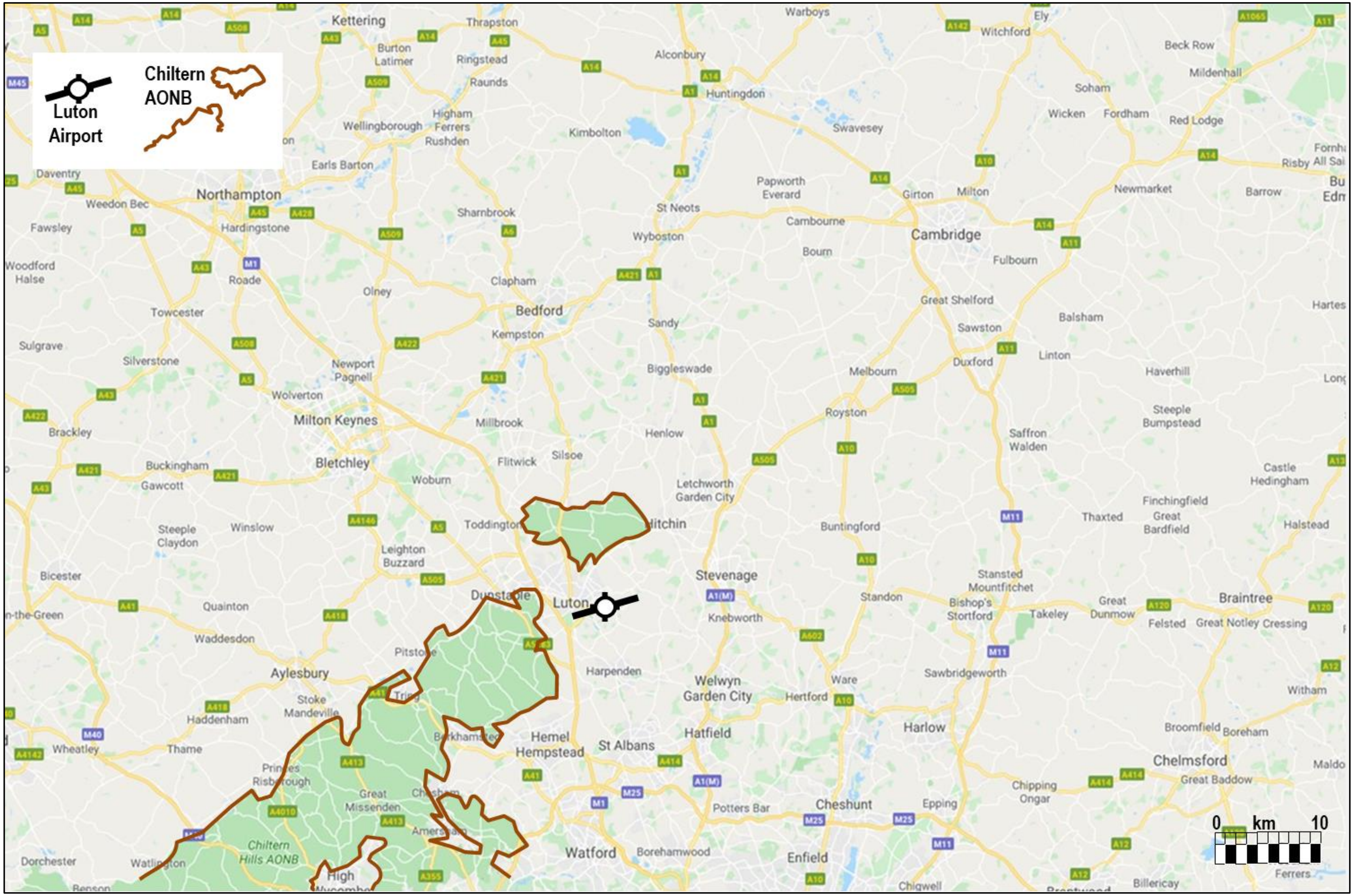
They show approximately how wide/narrow the flow, and approximately how high, as they descend towards final approach. These illustrations are not yet definitive – once the individual design concepts in this Stage 2 have been accepted or rejected, those which progress will be consulted upon in more detail under Stage 3 of the airspace change process. This means that the specific position, size, boundary and colour of each shape are all subject to adjustments, but the overall illustration is a reasonable explanation of the concept under consideration.

An important thing to remember is that each of the lower options are described as self-contained individual concepts. It is possible some lower options could be combined in different ways, possibly at different time periods for the purposes of respite. It would not be proportional to try to describe every permutation here because not all options may progress to the next stage. This would be completed during the formal consultation period, where we may describe combinations that are technically viable. The consultation is the best forum for you to provide your opinion on combinations of options. Note that options 2.1 and 2.2 can only be combined with the do-nothing upper baseline option 1.1 because they presume Luton arrivals and Stansted arrivals have not been split in the upper region.

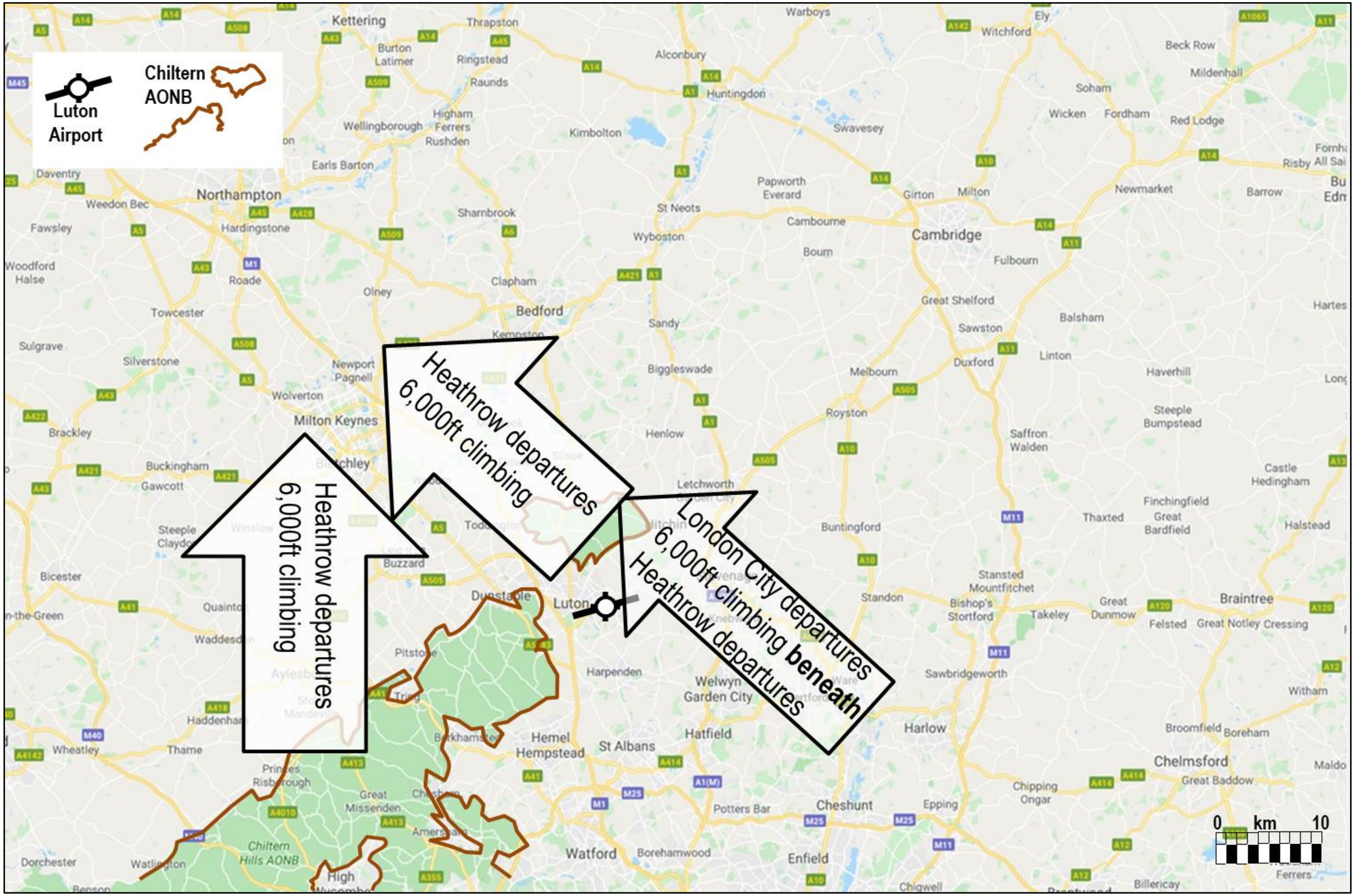
The coloured areas in all these design option concepts show where the change would be significant, but there would also be areas where the traffic arrives in a similar manner to today. These are highlighted in grey with a double dashed outline, and are intended to convey where no significant change is anticipated. This does not mean all flights in the grey area would be exactly the same as today – the general Luton arrival flows and altitudes would likely be similar to today. Where there is no coloured shape at all, this does not indicate a lack of overflight. Rather, it indicates that we do not expect changes to any other air traffic. As a reminder, this proposal is solely about changes to Luton Airport arrivals. We do not anticipate changes to Luton departures, nor any other type of air traffic to or from any other airport under this proposal.

For geographic orientation, we will now introduce four types of reference chart. Each chart is aligned on the page with later charts, which illustrate our design option concepts.

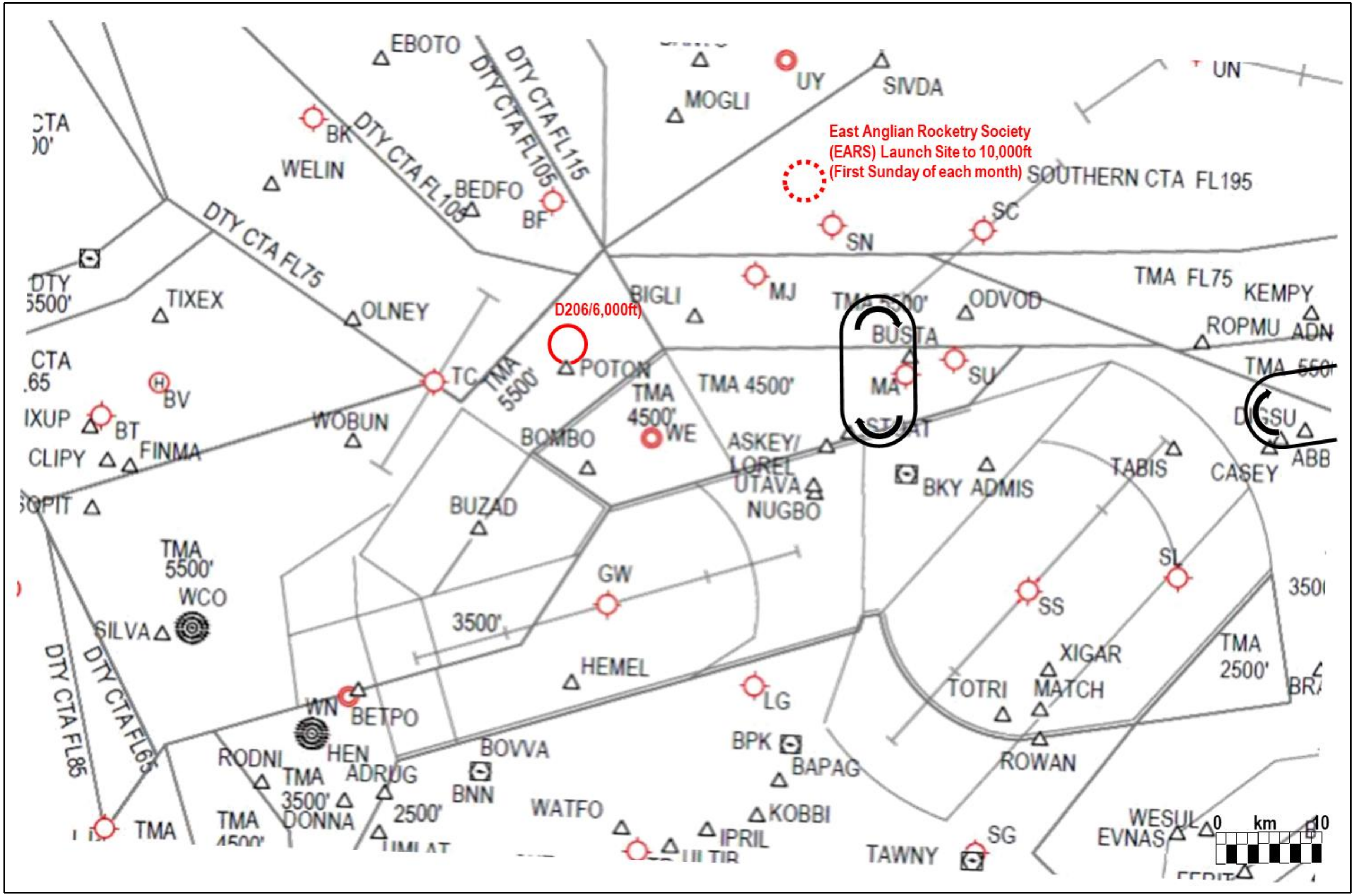
A Google map of the region, aligned with all the other charts in this section.



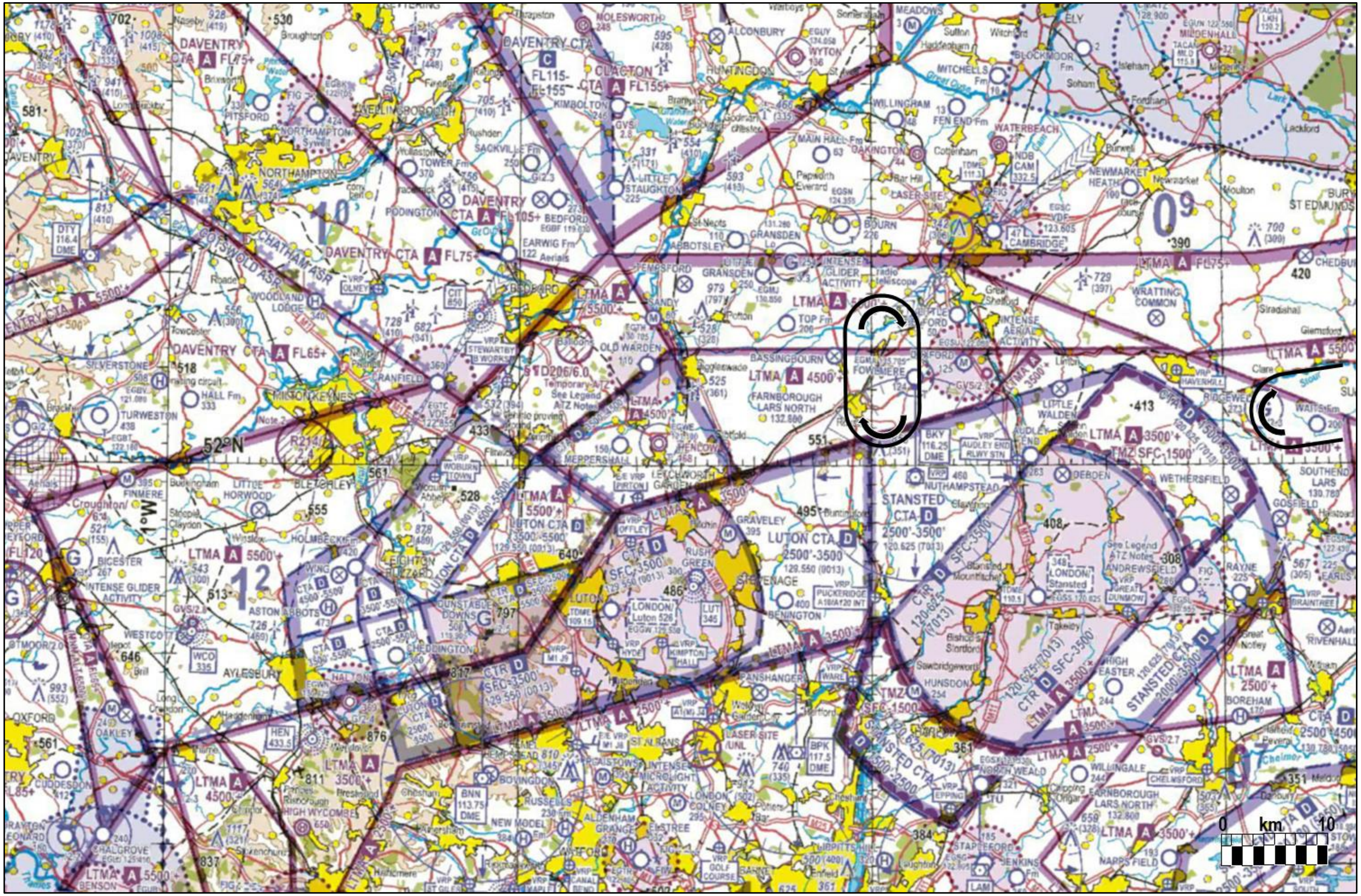
The same Google map, overlaid with three of the most relevant LTMA flow constraints – Heathrow and London City departures.



Next, a chart showing a schematic of useful aviation information in the same region, again aligned with the other charts in this section.



Finally, an extract from a chart often used by those with a pilot's licence. This is known as a 1:500,000 VFR chart, and is aligned with the other charts in this section.



Constraints relevant to the lower design concept options

Runway 08 arrivals and the town of Leighton Buzzard

Under a previous airspace change implemented in May 2006, the CAA placed a condition on Luton arrivals which is that *arriving traffic for runway 08 should not be routinely radar vectored over the town of Leighton Buzzard, unless tactically unavoidable*[8]. We infer that the intent of this CAA condition is to minimise overflight of the town (whether via a published route, or vectoring), unless tactically unavoidable. We would consider all options counter to this CAA condition as radical options.

Standards of navigation system fitted to Luton aircraft

Briefly, all aircraft operating at Luton use one of two standards of navigation, both of which are part of the umbrella term "Performance Based Navigation" (PBN).
At Luton, the two primary PBN equipage standards in use are known as RNAV1 and RNP1. The former is highly accurate, the latter just as accurate but provides on-board alerting to the pilot if the aircraft deviates from the performance standard. One of the additional functions, which not all RNP1 aircraft have, is the ability to fly turns defined by a fixed radius – this extra capability allows for different airspace design criteria to be used.
Almost all aircraft at Luton (circa 95%) are currently capable of RNAV1, and by the time this proposal is planned to be introduced (2021), this will be true for every Luton arrival. A majority, but not all (circa 70%), are capable of RNP1 in addition to RNAV1, and many of those RNP1 aircraft also have the "fixed radius" ability (known as RF turns).

We designed some routes which are RNAV1 (the most common equipage), and other routes which are RNP1+RF (less common and with different airspace design criteria). There is still a sizeable proportion (c.30%) of Luton arrivals which cannot use RNP+RF, and that would not necessarily reduce by the time this proposal is planned to be introduced. We would need to supplement any design which is specifically for RNP+RF aircraft, with a similar RNAV1 design or with controller vectoring. This document illustrates the anticipated spread and altitude of flights using different PBN Routes which are likely to be technically viable.
We would consider options where we need to use more than one design navigation standard at the same time as radical, because it would introduce a new element of complexity, and different design specifications would result in different track lengths, causing difficulty in spacing the arrivals.

Existing LTMA flows and airspace design

The same constraints apply as described earlier, in the Upper section on pages 5 and 6.
We would consider all options conflicting with these constraints as radical options.

[8] CAA Directorate of Airspace Policy, Post Implementation Review letter dated 31 Jan 2008, ref 8AP/066/02/06/02 page 3 para 2.2.3 amongst others.

Illustration of numbers of flights

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. If there was a single arrival route, it could see similar numbers of overflights at present traffic levels.

Illustration of current and potential noise impacts

Most Luton aircraft fall into the "125-180 seat single-aisle twin jet" family, similar types with similar noise, i.e. Airbus A320 and Boeing 737 versions.

This table illustrates typical noise in decibels (Lmax dBa) an observer on the ground might expect to experience, from arriving aircraft:

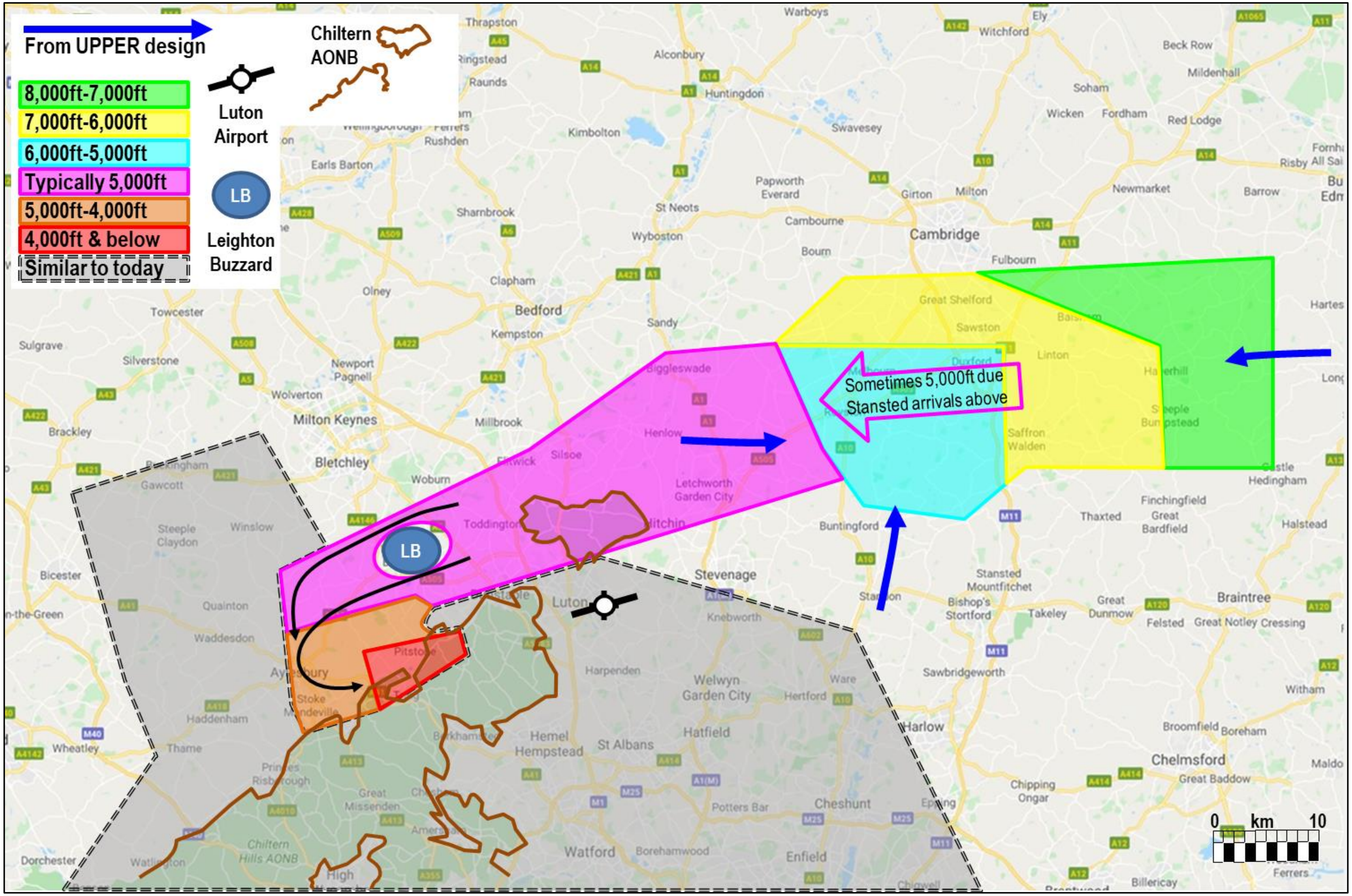
Arrival noise Lmax dBa by aircraft grouping (measurements stop at 55dBa as not reliable below that level)								
Height (ft)	Turboprop	50 seat regional jet	70-90 seat regional jet	125-180 seat single-aisle 2-eng jet	250 seat twin-aisle 2-eng jet	300-350 seat twin-aisle jet	400 seat 4-eng jet	500 seat 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 of comparison sounds:

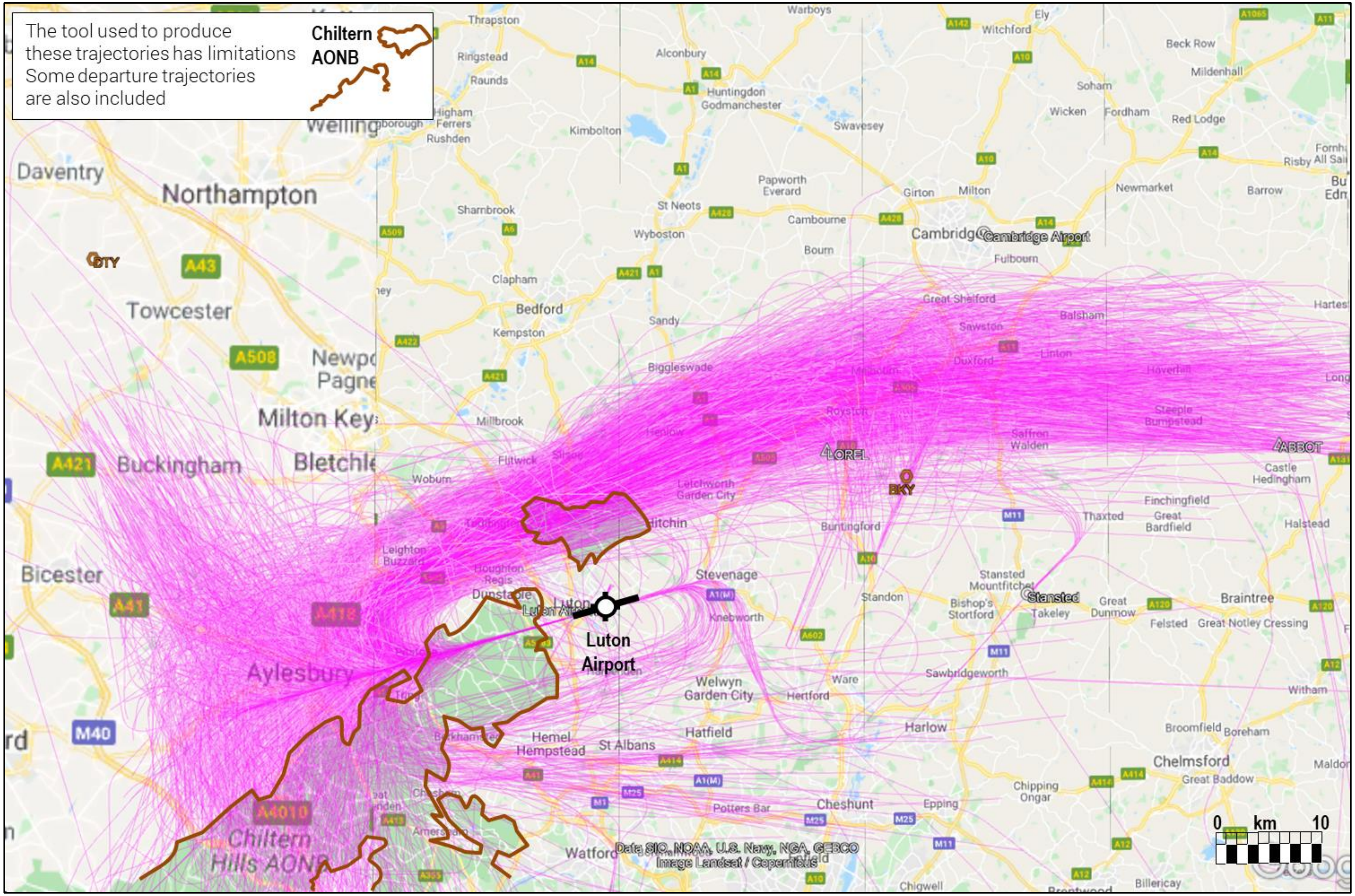
Typical sound	Approximate noise level Lmax dBa
Pneumatic Drill 7 metres away	95
Heavy diesel lorry at 40kmh, 7 metres away	85
Medium aircraft descending at 1000ft	70
Busy general office	60
Quiet office	50
Quiet bedroom, library	35
Threshold of audible sound	0

The following pages illustrate today's Luton arrival air traffic situation at lower altitudes (from 8-7,000ft and below), and airspace design concepts under consideration. Each option is numbered 2.1, 2.2, 2.3 and so on.

2.1 Do nothing – the lower baseline for Runway 08 (easterly) arrivals



The same diagram, this time showing the actual trajectories of all Luton arrivals to runway 08 below 8,000ft (June 2018)



These pictures are simplified for chart clarity, to only show Luton arrivals, as that is the scope of this proposal.

This complex flow shows the Luton arrivals as they descend from today's upper flows described in paragraph 1.1 on page 10.
Arrivals to Stansted Airport are not shown here.

The first diagram shows the typical altitudes of Luton arrivals as they descend towards the runway from the Upper region, via the blue arrows, and their typical spread. In the green, yellow and blue areas, traffic from both the ABBOT hold (to the east, near the green area) and the LOREL hold (near Royston, the blue area) is separated from the Stansted arrivals as much as possible, then combined into a flow of Luton-only arrivals, level at 5,000ft heading east in the pink corridor. Sometimes, as illustrated by the pink arrow in the yellow and blue areas, Luton arrivals are descended to 5,000ft earlier than usual.

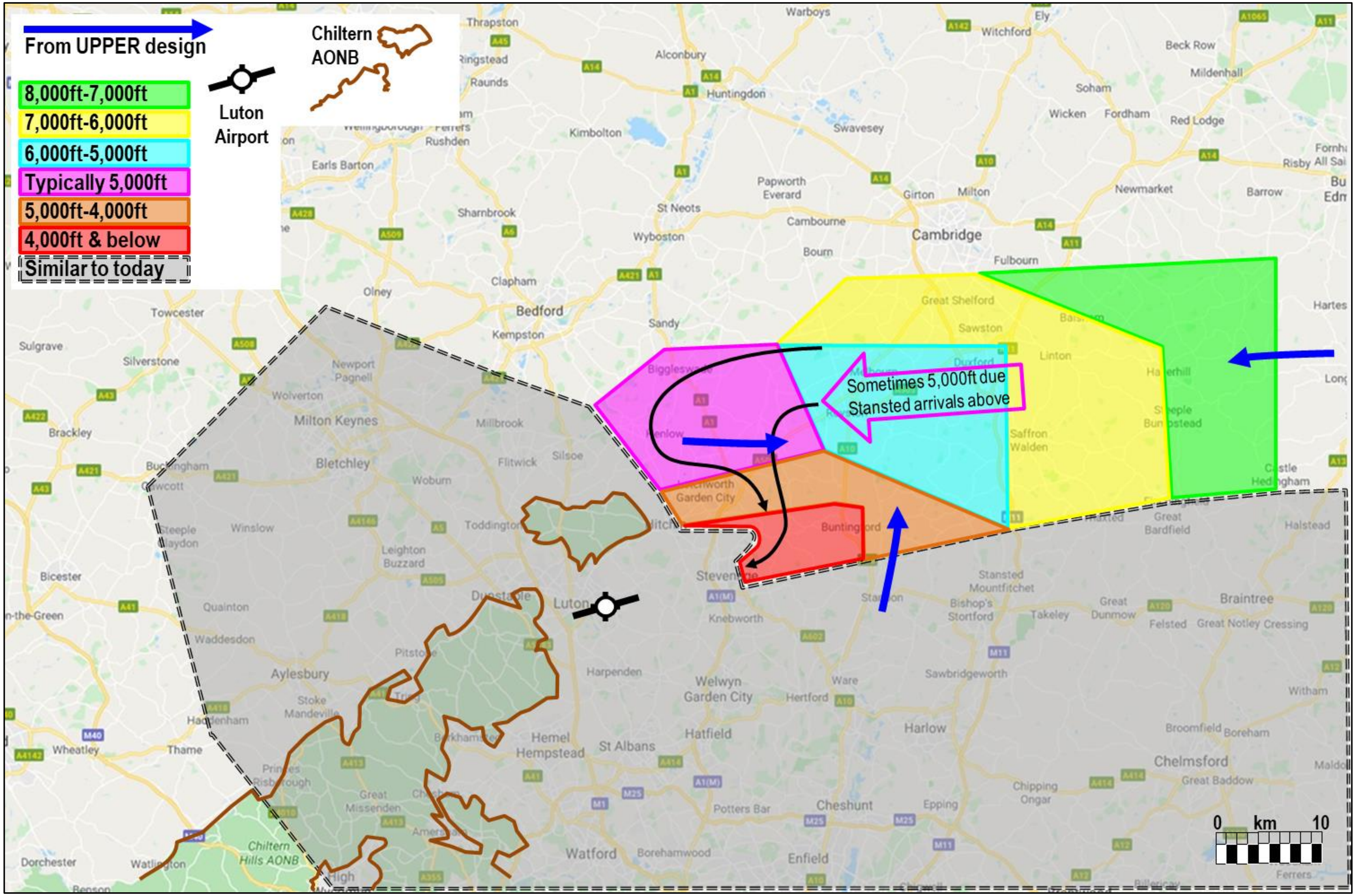
As the arrivals get closer to Leighton Buzzard, controllers do their best to direct Luton arrivals around the town unless it is tactically unavoidable due to the specific traffic situation at the time. Generally, controllers put the aircraft to the south of the town, but sometimes they go north as can be seen in the second diagram.

The controller then turns the aircraft left, timing each aircraft's turn very precisely, to achieve the most efficient space between each arrival. The last turn, intercepting final approach, is also precisely given in order to fine-tune the gap between aircraft. This is usually exactly 6 nautical miles (nm), which is enough space for an aircraft to land, leave the runway, a departing aircraft to line up and take off, with the next arrival safely still on final approach but efficiently close ready for the next land-line up-departure cycle. If there are more arrivals than departures, controllers will tighten the spacing to nearer 4nm. If there is a need to get more departures airborne, the controller might need to increase the spacing, or that spacing might naturally increase if there is any lull in the arrival flow from the upper region.

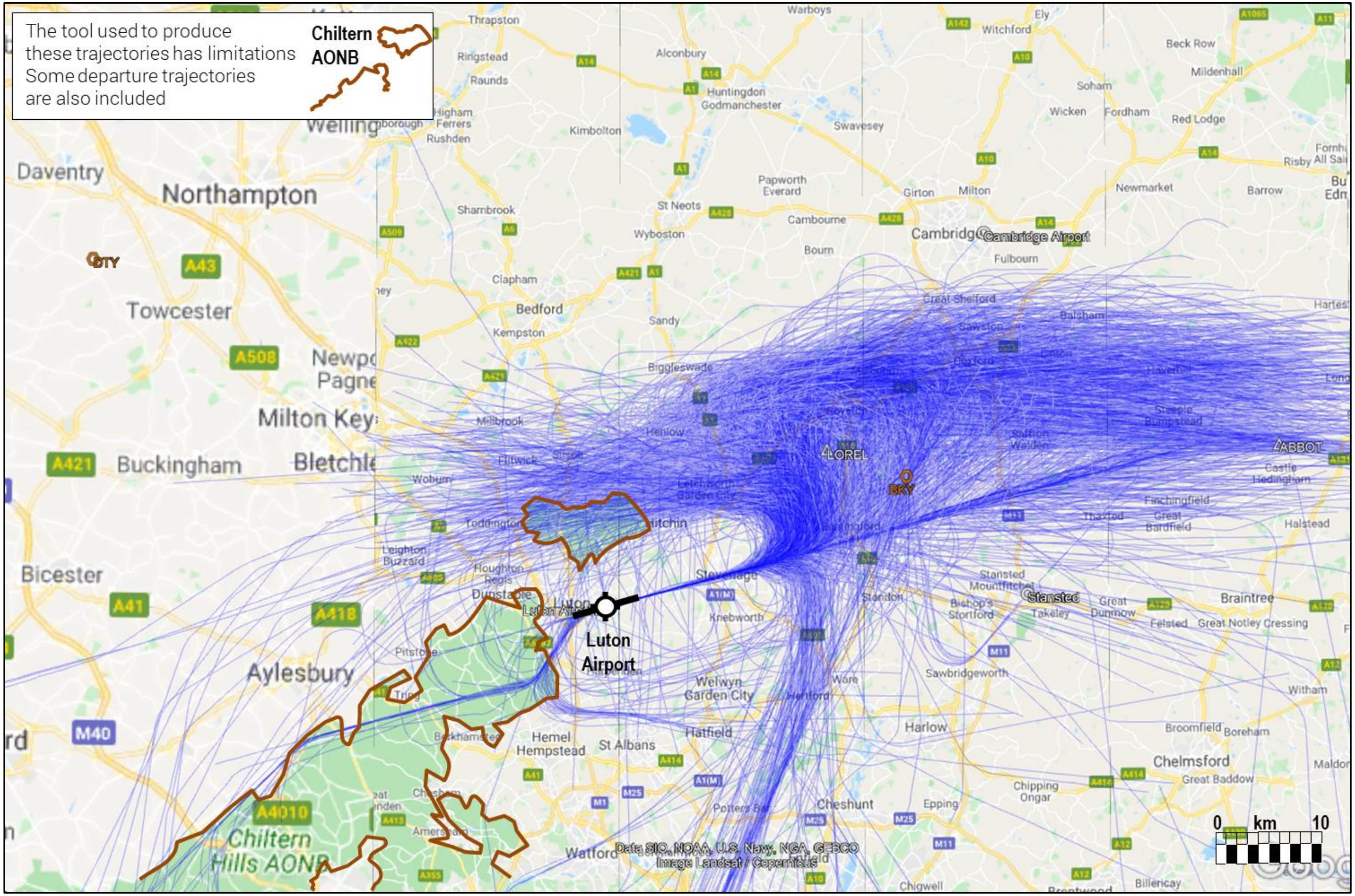
This disentwining is a complex, intensive workload for the controller because they are also managing departures and monitoring the overall region's air traffic flows. As stated earlier, during periods where workload is predicted to become too intense, safety dictates that we apply temporary limits to the numbers of flights entering the controller's sector before the number exceeds safe limits. This causes delay to the travelling public (using both Luton and Stansted), and is a short-term temporary solution to the latent problem. The longer the temporary limits are applied, the more flights get moved later and later in the day, causing different our controllers, the airports and airlines - and causes flights to be delayed into the night time noise period.

This option would not require any new controlled airspace (CAS) or routes. This option can only be combined with the do-nothing upper baseline option 1.1 because they presume Luton arrivals and Stansted arrivals have not been split in the upper region.

2.2 Do nothing – the lower baseline for Runway 26 (westerly) arrivals



The same diagram, this time showing the actual trajectories of all Luton arrivals to runway 26 below 8,000ft (June 2018)



This complex flow shows the Luton arrivals as they descend from today's upper flows described in paragraph 1.1 on page 10. Arrivals to Stansted Airport are not shown here.

The first diagram shows the typical altitudes of Luton arrivals as they descend towards the runway from the Upper region, via the blue arrows, and their typical spread. In the green, yellow and blue areas, traffic from both the ABBOT hold (to the east, near the green area) and the LOREL hold (near Royston, the blue area) is separated from the Stansted arrivals as much as possible, then combined into a flow of Luton-only arrivals, level at 5,000ft in the pink box. Sometimes, as illustrated by the pink arrow in the yellow and blue areas, Luton arrivals are descended to 5,000ft earlier than usual.

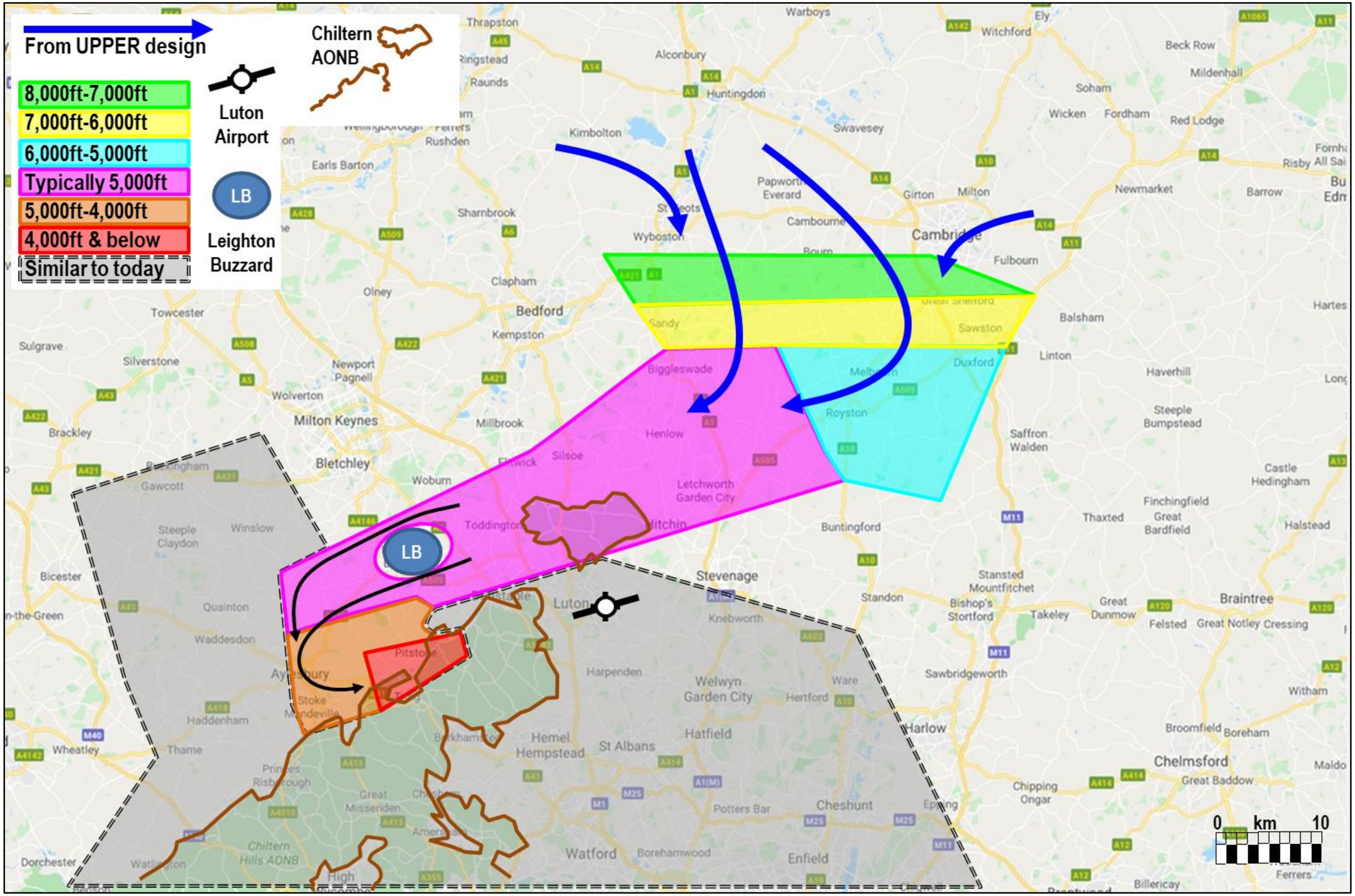
This pink box is a particularly complex region because this small area is where the arrival sequence is set, and there is not much space. To slightly delay an aircraft, it is sent west and then turned left, partly back on itself like an S, so the controller can start setting up each aircraft's gap to the following flight.

When the sequence is set, the controller turns the aircraft right, timing each aircraft's turn very precisely, to achieve the most efficient space between each arrival. The last turn, intercepting final approach, is also precisely given in order to fine-tune the gap between aircraft. As per the runway 08 arrivals, this is usually exactly 6 nautical miles (nm), which is enough space for an aircraft to land, leave the runway, a departing aircraft to line up and take off, with the next arrival safely still on final approach but efficiently close ready for the next land-line up-departure cycle. If there are more arrivals than departures, controllers will tighten the spacing to nearer 4nm. If there is a need to get more departures airborne, the controller might need to increase the spacing, or that spacing might naturally increase if there is any lull in the arrival flow from the upper region.

This disentwining is a complex, intensive workload for the controller because they are also managing departures and monitoring the overall region's air traffic flows. As stated earlier, during periods where workload is predicted to become too intense, safety dictates that we apply temporary limits to the numbers of flights entering the controller's sector before the number exceeds safe limits. This causes delay to the travelling public (using both Luton and Stansted), and is a short term temporary solution to the latent problem. The longer the temporary limits are applied, the more flights get moved later and later in the day, causing different our controllers, the airports and airlines - and causes flights to be delayed into the night time noise period.

This option would not require any new controlled airspace (CAS) or routes. This option can only be combined with the do-nothing upper baseline option 1.1 because they presume Luton arrivals and Stansted arrivals have not been split in the upper region.

2.3 Controller vectoring to Runway 08 (easterly) arrivals



The Luton arrivals are separated from the Stansted arrivals by one of the Upper design concepts. This concept retains manual vectoring by the air traffic controller from that point onwards.

The blue arrows illustrate the potential directions from which air traffic at higher levels (7-8,000ft and above) would arrive.

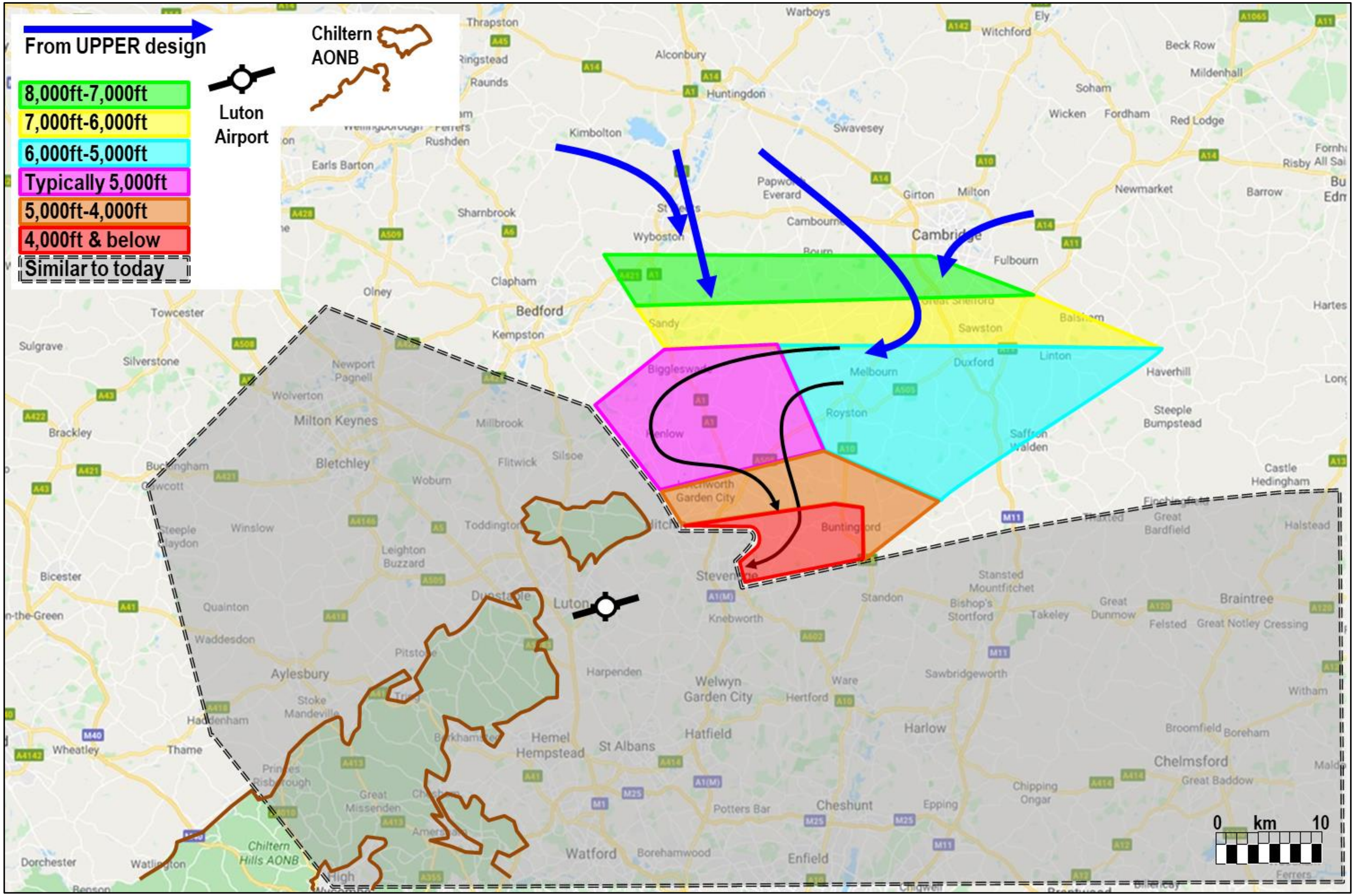
They may fly south towards Letchworth then turn right into the pink corridor for arrival sequencing, or they may need to be vectored east then a right turn west depending on the traffic situation.

As per today's flows, the controller will turn and descend aircraft to precisely arrange an efficient arrival flow, flying around Leighton Buzzard either side as they do today. It would remain a relatively manual task for the controller.

This option requires one of the upper options, to separate the Luton arrivals from the Stansted arrivals, however it is less likely to work when combined with Upper option 1.3 due to that option's western delay absorption location. It does not require additional controlled airspace or routes at lower altitudes.

Intentionally Blank

2.4 Controller vectoring to Runway 26 (westerly) arrivals



The Luton arrivals are separated from the Stansted arrivals by one of the Upper design concepts. This concept retains manual vectoring by the air traffic controller from that point onwards.

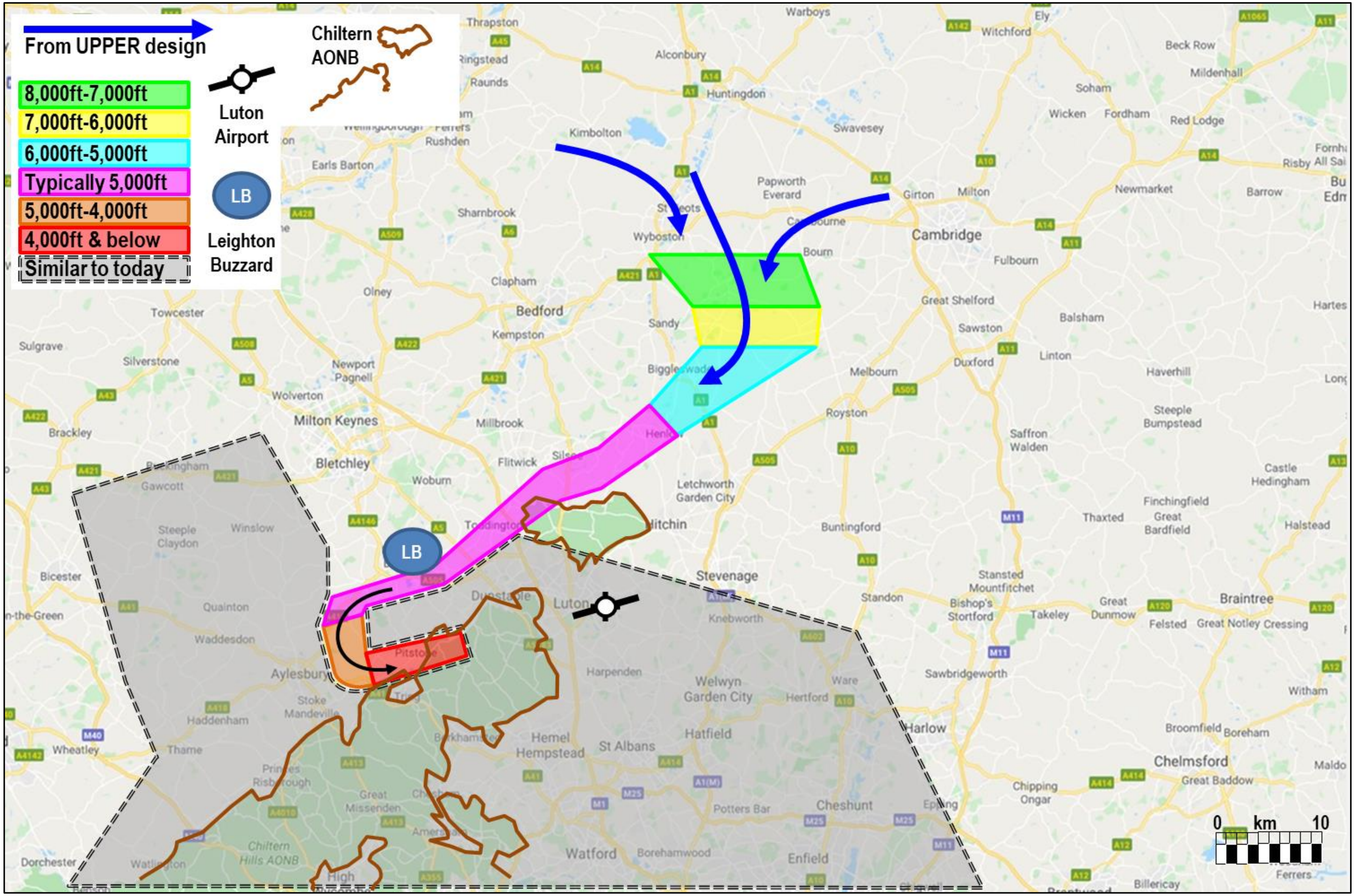
The blue arrows illustrate the potential directions from which air traffic at higher levels (7-8,000ft and above) would arrive.

They may fly south towards Biggleswade, or they may need to be vectored east towards Royston and Melbourn before being given a turn west like an S shape, depending on the traffic situation.

As per today's flows, the controller will turn and descend aircraft to precisely arrange an efficient arrival flow. It would remain a relatively manual task for the controller.

This option requires one of the upper options, to separate the Luton arrivals from the Stansted arrivals, however it is less likely to work when combined with Upper option 1.3 due to that option's western delay absorption location. It does not require additional controlled airspace or routes at lower altitudes.

2.5 PBN Route (RNAV1 standard) south of Leighton Buzzard to Runway 08 (easterly) arrivals



The Luton arrivals are separated from the Stansted arrivals by one of the Upper design concepts. This concept reduces the manual vectoring by the air traffic controller, though some is likely to be needed in order to perfect the spacing.

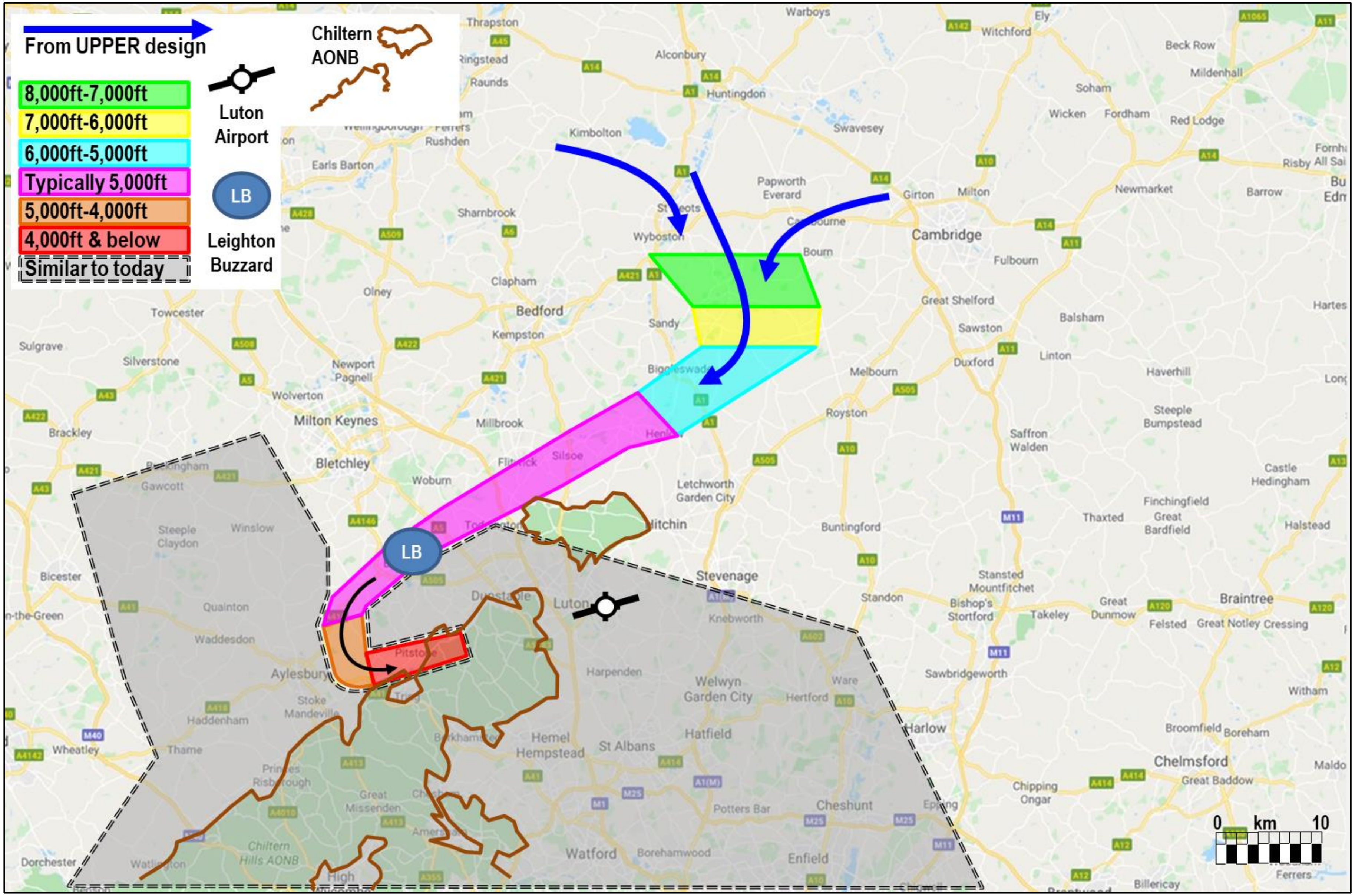
The blue arrows illustrate the potential directions from which air traffic at higher levels (7-8,000ft and above) would arrive.

The controller would consider the arrival sequence at the Upper levels, and would set it up as they instruct the aircraft to descend to follow a pre-programmed RNAV1 route. The aircraft would automatically and consistently follow this path, which would be programmed to fly to the south of Leighton Buzzard, descending automatically according to the programme.

This route would naturally concentrate flights along the towns and villages beneath the programmed route, avoiding most of the northern part of the Chilterns AONB but potentially regularly overflying one small area of the AONB to its northwest.

This option requires one of the upper options, to separate the Luton arrivals from the Stansted arrivals, however it is less likely to work when combined with Upper option 1.3 due to that option's western delay absorption location. It does not require additional controlled airspace at lower altitudes, but does require an RNAV1 route which would be predictable.

2.6 PBN Route (RNAV1 standard) over Leighton Buzzard to Runway 08 (easterly) arrivals



The Luton arrivals are separated from the Stansted arrivals by one of the Upper design concepts. This concept reduces the manual vectoring by the air traffic controller, though some is likely to be needed in order to perfect the spacing.

The blue arrows illustrate the potential directions from which air traffic at higher levels (7-8,000ft and above) would arrive.

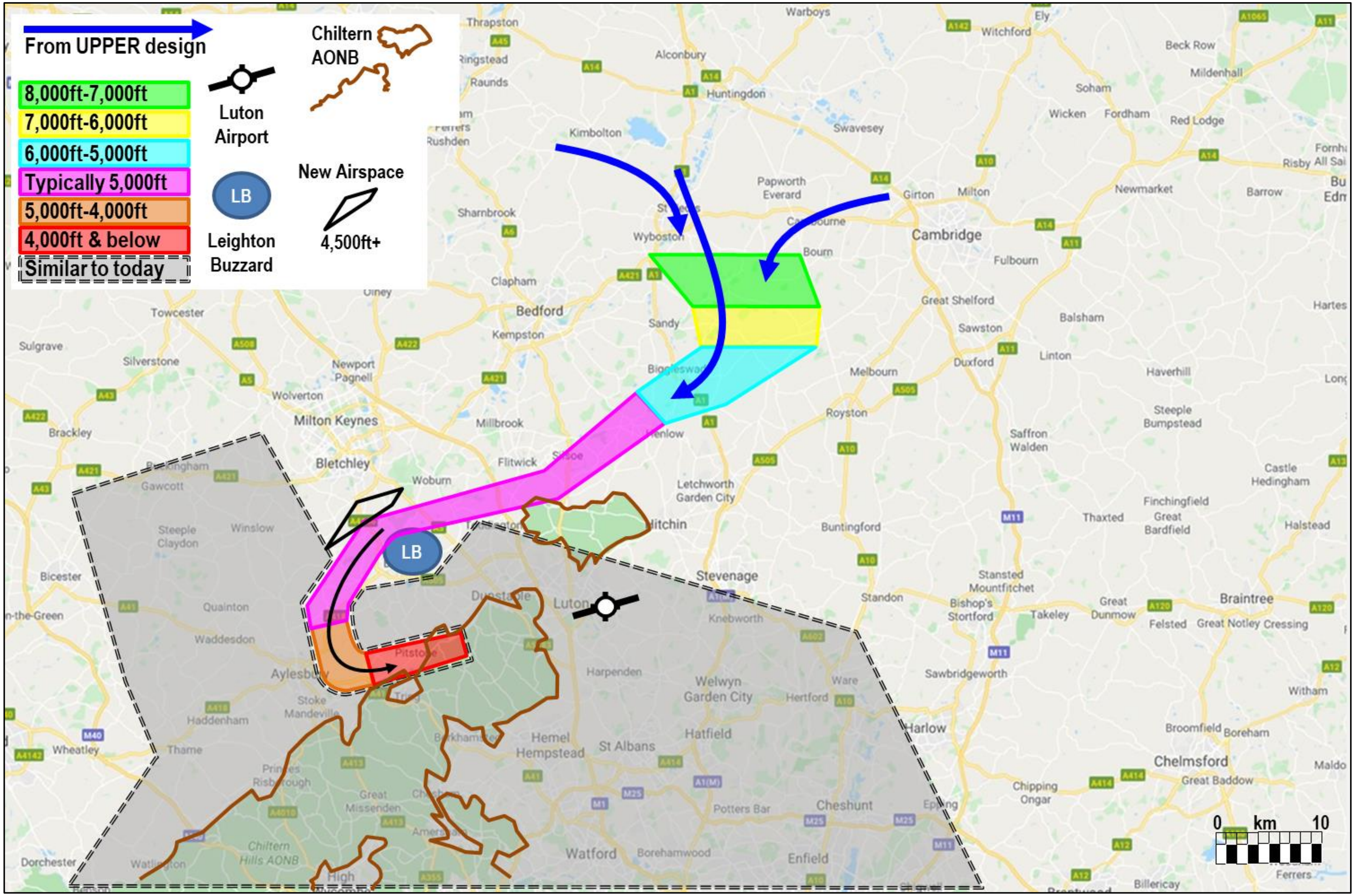
The controller would consider the arrival sequence at the Upper levels, and would set it up as they instruct the aircraft to descend to follow a pre-programmed RNAV1 route. The aircraft would automatically and consistently follow this path, which would be programmed to fly along a route overhead Leighton Buzzard, descending automatically according to the programme.

This route would naturally concentrate flights along the towns and villages beneath the programmed route, generally avoiding the northern part of the Chilterns AONB.

This option requires one of the upper options, to separate the Luton arrivals from the Stansted arrivals, however it is less likely to work when combined with Upper option 1.3 due to that option's western delay absorption location. It does not require additional controlled airspace at lower altitudes, but does require an RNAV1 route which would be predictable.

We consider this to be a radical option because it is contrary to the CAA's condition (see page 27 for details).

2.7 PBN Route (RNAV1 standard) north Leighton Buzzard to Runway 08 (easterly) arrivals



The Luton arrivals are separated from the Stansted arrivals by one of the Upper design concepts. This concept reduces the manual vectoring by the air traffic controller, though some is likely to be needed in order to perfect the spacing.

The blue arrows illustrate the potential directions from which air traffic at higher levels (7-8,000ft and above) would arrive.

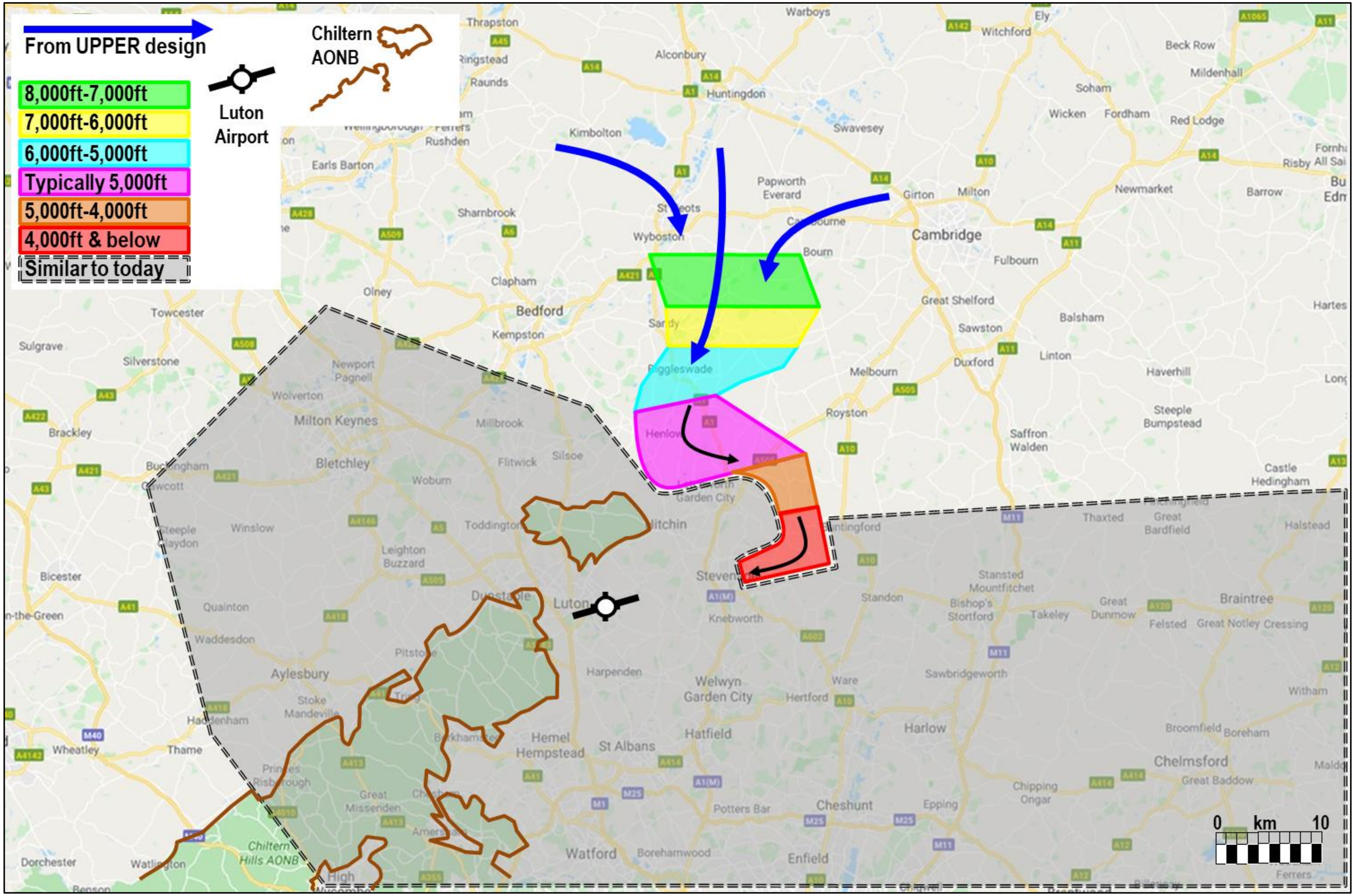
The controller would consider the arrival sequence at the Upper levels, and would set it up as they instruct the aircraft to descend to follow a pre-programmed RNAV1 route. The aircraft would automatically and consistently follow this path, which would be programmed to fly along a route to the north of Leighton Buzzard, descending automatically according to the programme.

This route would naturally concentrate flights along the towns and villages beneath the programmed route, generally avoiding the northern part of the Chilterns AONB.

This option requires one of the upper options, to separate the Luton arrivals from the Stansted arrivals, however it is less likely to work when combined with Upper option 1.3 due to that option's western delay absorption location.
This option requires an RNAV1 route which would be predictable.
It also requires a small additional volume of controlled airspace, starting not below 4,500ft. Aircraft would be unlikely to fly in this small volume, hence its lack of colour in this chart. The reason it is needed is to create what's called "lateral containment" for a route, in accordance with UK airspace policy[9].
The centreline of any new route must not run right up to the edge of controlled airspace (CAS) for safety against unknown aircraft outside CAS.
The other new route options in this Lower section remain acceptably within existing CAS, but this particular route runs close to an airspace "corner". For this route to be viable, we must add a small volume to partially in-fill that corner.
For those with a technical interest, typically the route should not run closer than 3nm from the edge of CAS, but smaller distances can be proposed as long as an appropriate safety case is agreed with the CAA. NATS has made the case to use less than 3nm several times before. We would expect to do the same here, making this shape as small as possible. For illustration purposes, the diamond shape in the chart above is based on 2nm containment.

[9] For full details see the CAA's Controlled Airspace Containment Policy (Jan 2014), link

2.8 PBN Route (RNAV1 standard) – S-bend type – to runway 26 (westerly) arrivals



The Luton arrivals are separated from the Stansted arrivals by one of the Upper design concepts. This concept reduces the manual vectoring by the air traffic controller, though some is likely to be needed in order to perfect the spacing.

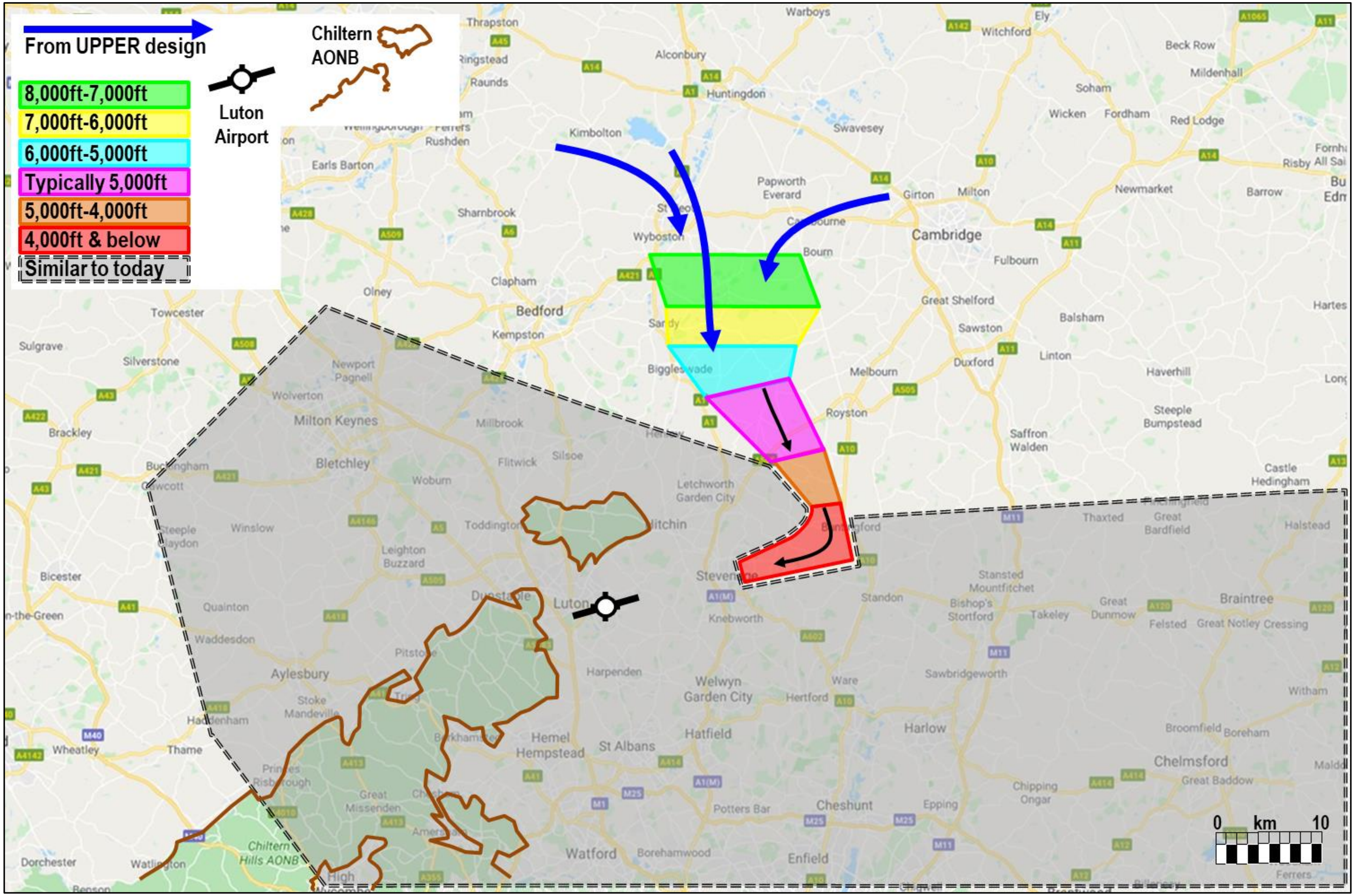
The blue arrows illustrate the potential directions from which air traffic at higher levels (7-8,000ft and above) would arrive.

The controller would consider the arrival sequence at the Upper levels, and would set it up as they instruct the aircraft to descend to follow a pre-programmed RNAV1 route. The aircraft would automatically and consistently follow this path, which would be programmed to fly along a route with a slight S shape towards final approach at 10 nautical miles (nm), descending automatically according to the programme.

This route would naturally concentrate flights along the towns and villages beneath the programmed route. These arrivals to runway 26 would avoid overflying the Chilterns AONB.

This option requires one of the upper options, to separate the Luton arrivals from the Stansted arrivals, however it is less likely to work when combined with Upper option 1.3 due to that option's western delay absorption location. It does not require additional controlled airspace at lower altitudes, but does require an RNAV1 route which would be predictable.

2.9 PBN Route (RNAV1 standard) – direct type – to runway 26 (westerly) arrivals



The Luton arrivals are separated from the Stansted arrivals by one of the Upper design concepts. This concept reduces the manual vectoring by the air traffic controller, though some is likely to be needed in order to perfect the spacing.

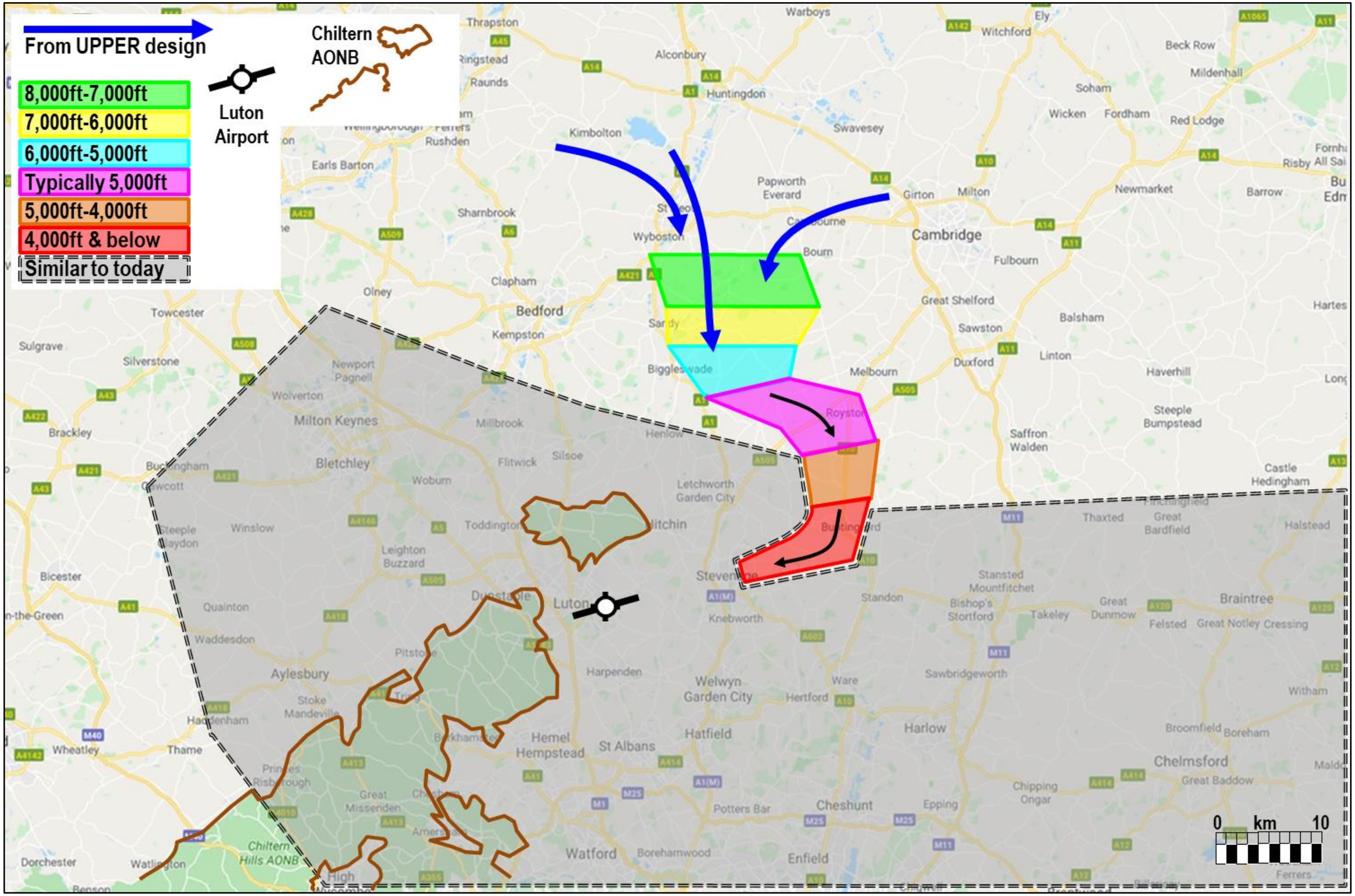
The blue arrows illustrate the potential directions from which air traffic at higher levels (7-8,000ft and above) would arrive.

The controller would consider the arrival sequence at the Upper levels, and would set it up as they instruct the aircraft to descend to follow a pre-programmed RNAV1 route. The aircraft would automatically and consistently follow this path, which would be programmed to fly along a route almost directly to, and perpendicular to, the extended centreline of the runway, descending automatically according to the programme.

This route would naturally concentrate flights along the towns and villages beneath the programmed route. These arrivals to runway 26 would avoid overflying the Chilterns AONB.

This option requires one of the upper options, to separate the Luton arrivals from the Stansted arrivals, however it is less likely to work when combined with Upper option 1.3 due to that option's western delay absorption location. It does not require additional controlled airspace at lower altitudes, but does require an RNAV1 route which would be predictable.

2.10 PBN Route (RNAV1 standard) – wider type – to runway 26 (westerly) arrivals



The Luton arrivals are separated from the Stansted arrivals by one of the Upper design concepts. This concept reduces the manual vectoring by the air traffic controller, though some is likely to be needed in order to perfect the spacing.

The blue arrows illustrate the potential directions from which air traffic at higher levels (7-8,000ft and above) would arrive.

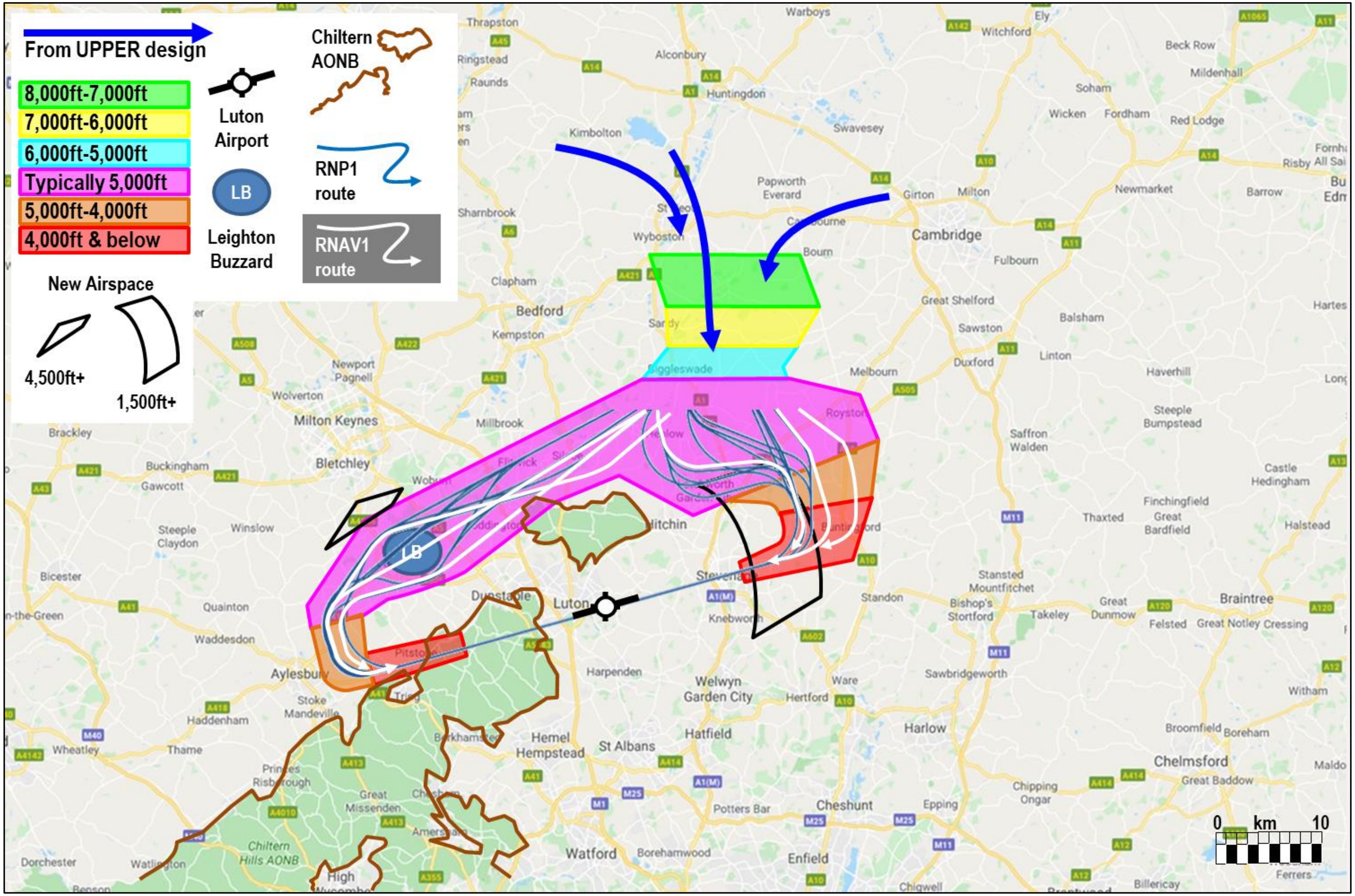
The controller would consider the arrival sequence at the Upper levels, and would set it up as they instruct the aircraft to descend to follow a pre-programmed RNAV1 route. The aircraft would automatically and consistently follow this path, which would be programmed to fly along a route with a wider S shape, descending automatically according to the programme. This wider S shape would take the aircraft further east, very close to, or entering, airspace reserved exclusively for Stansted Airport.

This route would naturally concentrate flights along the towns and villages beneath the programmed route. These arrivals to runway 26 would avoid overflying the Chilterns AONB.

This option requires one of the upper options, to separate the Luton arrivals from the Stansted arrivals, however it is less likely to work when combined with Upper option 1.3 due to that option's western delay absorption location. It does not require additional controlled airspace at lower altitudes, but does require an RNAV1 route which would be predictable.

We consider a route close to (or entering) Stansted airspace to be a radical option because it is likely to get close to Stansted traffic or cause Stansted flows to move as a consequence.

2.11 Supplementing RNP+RF designs with RNAV1 designs



We want to provide assurance and evidence that we have considered not only where the routes might go, but also how the available navigation technology influenced our design decisions.

This design concept is different from the others because it is more concerned with the *types* of route at lower altitudes, rather than the specific path those routes take.

The white routes are technically viable and based on the PBN navigation standard called RNAV1, the most common standard in use across the greatest proportion of Luton aircraft. These are the basis for the coloured shapes in the earlier options 2.5 to 2.10.

The mid-blue routes are based on the standard called RNP+RF, allowing for routes to be designed differently by specifying the precise radius of each turn – but *only* usable by aircraft with this equipage. Earlier we explained that c.30% of Luton aircraft are not capable of flying a route designed using RNP+RF.

The Luton arrivals are separated from the Stansted arrivals by one of the Upper design concepts. This concept reduces the manual vectoring by the air traffic controller, though some is likely to be needed in order to perfect the spacing.

All of the routes illustrated here would naturally concentrate flights along the towns and villages beneath the particular programmed route.

This option requires one of the upper options, to separate the Luton arrivals from the Stansted arrivals, however it is less likely to work when combined with Upper option 1.3 due to that option's western delay absorption location.
In this diagram, some of the routes to runway 08 would require a small fillet of controlled airspace (CAS, see option 2.7 on page 44 for technical details on route containment.) However, in this diagram for runway 26, some of the routes require a larger, lower volume of CAS for similar reasons.

We consider all routes designed using RNP+RF to be radical options because we would need to also implement supplementary routes using RNAV1 criteria. Both designs would join the same Upper option to the runway. This duality accommodates the c.30% of Luton's non-RNP+RF aircraft, but introduces a new element of complexity.

3. Contingency Procedures (technical, rarely used)

These procedures enable aircraft to safely reposition to the final approach under certain circumstances if they are unable to land from their initial approach. A missed approach, also known as a go-around, is what happens when a pilot cannot complete the final part of the landing, increases engine power, and climbs away from the runway instead. Once the aircraft is established in a stable climb away from the runway, the controller issues heading and altitude instructions in order to fit the aircraft back into the approach sequence, or to put the aircraft into a safe area to resolve any potential issues. This is a safe and routine part of operations for all pilots and controllers. There are many reasons for a pilot, or a controller, to initiate a missed approach. These can be split broadly in to two categories; one where the reason for the missed approach does not preclude the pilot from immediately making another approach, and one where the cause needs to be addressed before making another approach. There were c.400 missed approaches at Luton recorded in 2018, the vast majority of which resulted in the aircraft being immediately positioned for another approach.

If radar and/or radio has failed, the pilot must be able to navigate from the missed approach itself to a position where it is safe to hold and then to make another approach, all without the guidance of a controller.

Flight procedures are published for these possibilities, at all airports. Luton is no exception – we have a suite of contingency procedures to accommodate such situations, though they are very rare events because the radio and radar technology is extremely reliable with redundant backups (no failures causing the use of these contingency procedures were recorded in the past 10 years).

This section is here because we are changing the way arrivals work at Luton Airport. We will need to update the contingency procedures to match, and also the procedures to be used should the radar or radio fail so a pilot can find the runway and land safely. These procedures will detail how a pilot could fly, without assistance from a controller, from the upper section via the lower section to making an approach at the runway if radar is not available, and also from any missed approach to a safe contingency holding pattern.

The current contingency procedures are designed to be used and interpreted by professional aviation technical specialist familiar with the subject, are unavoidably technical in nature, and use aviation language & abbreviations. Anyone may provide feedback on any aspect of any airspace change proposal.

Until we have concluded Stage 2 of the airspace change process, we won't be sure enough of where the arrivals are likely to fly. This means we can't start to redesign the contingency procedures because it would not be proportional to attempt to do so. After Stage 2 concludes we will have a better understanding of what's possible, so we plan to include technically viable contingency procedures later in this proposal. Consultation is the next Stage of this process.

Technical section using aviation terms and abbreviations
Should PBN transitions be implemented, they would replace the existing Initial Approach Procedures (IAPs) for radio failure purposes. They would link to redesigned ILS/DME, LOC/DME and RNP APCH procedures, the latter of which was submitted in 2016 and is pending IFP approval at the CAA.

The ILS/DME and LOC/DME procedures require a re-design so that they no longer begin at the LUT NDB and the Initial Fixes (IFs) will be added to the procedures. If possible, the Final Approach Fixes (FAFs) for the ILS/DME, LOC/DME and RNP APCH procedures will be coincident.

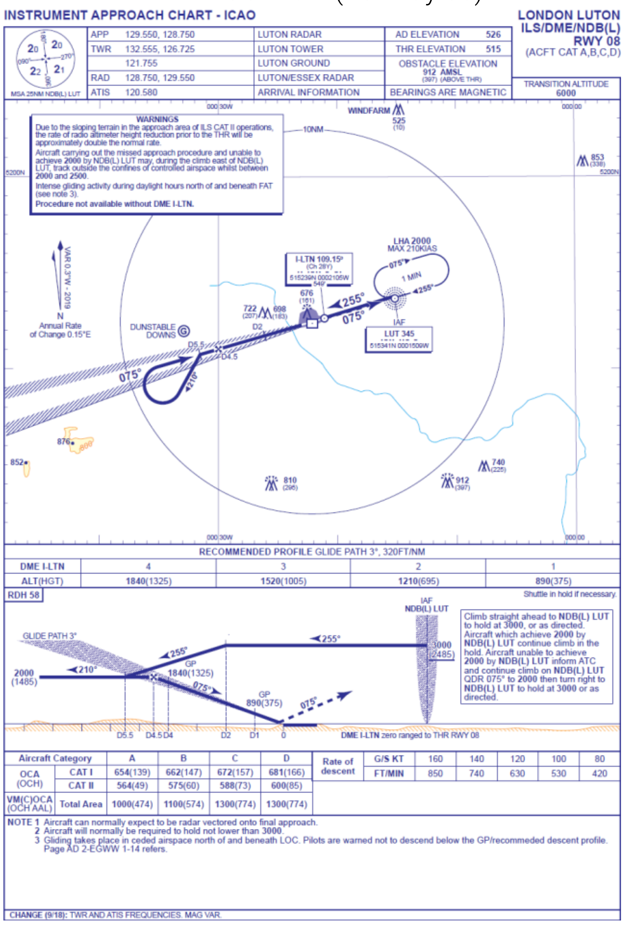
All published missed approach procedures at Luton Airport terminate at the LUT NDB(L) contingency hold, and therefore consideration needs to be given to how the Missed Approaches will be handled with a new airspace design.

Radio communications failure procedures, detailed in the AIP EGGW AD 2.22 FLIGHT PROCEDURES, instruct pilots to follow the Missed Approach procedure to LUT NDB (L) and then adopt the basic radio failure procedure

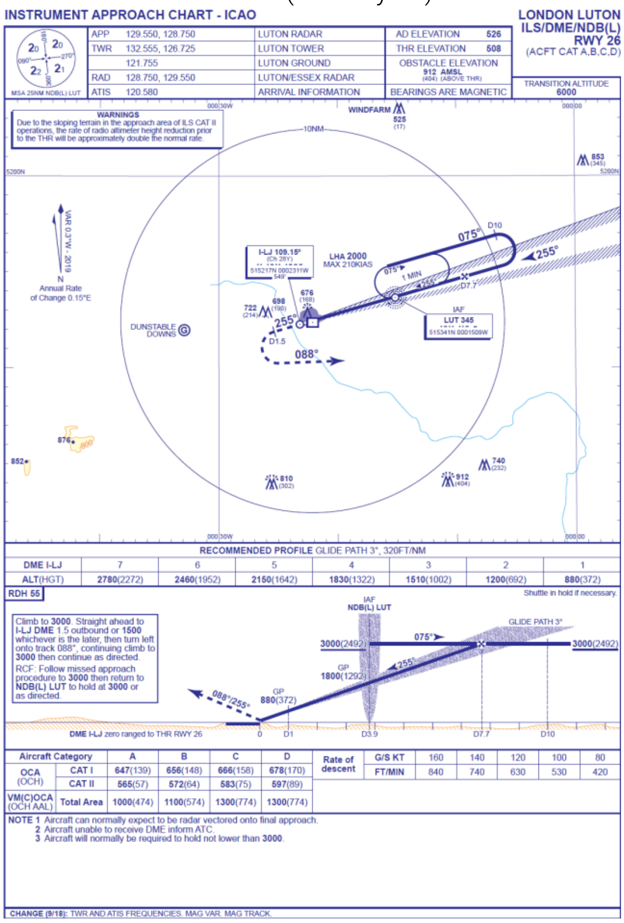
detailed in ENR 1.1.3. The basic radio failure procedure is to maintain for a period of seven minutes, the current speed and last assigned level or minimum safe altitude, if this is higher. Following the period of seven minutes, adjust the speed and level in accordance with the current flight plan and continue the flight to the appropriate designated landing aid serving the destination aerodrome.
In order to comply with these radio communications failure procedures, a contingency hold following the missed approach and IAPs connecting that hold back to the approach are required. The location of the contingency hold following a missed approach is the primary constraining factor. When there is reasonable assurance of its location, the IAPs can be designed.

Example instrument approach charts to be updated:

EGGW-8-1 (Runway 08)



EGGW-8-4 (Runway 26)



For a full list of reference charts which would need changing, see the UK AIP Aerodrome section for EGGW London Luton Airport, IAP charts AD2.EGGW.7.15 to 7.18 and Initial Approach Charts AD2.EGGW.8.1 to 8.7.

4. Conclusion and Next Steps

We engaged with appropriate stakeholder groups, resulting in comprehensive discussions on the possibilities for the region.

This document illustrates the main individual design concept options for Luton Airport arrivals, at upper and lower altitudes. It explains them factually, and if an option is considered by us to be radical, we say so.

They have been created bearing in mind the Statement of Need and the Design Principles from Stage 1 of the airspace change process CAP1616.

These options will be formally evaluated against the Design Principles under Stage 2 Step 2A ii.

Those least fitting the Design Principles may be discarded, those best fitting will progress, reducing this longlist to a shortlist for appraisal under Stage 2 Step 2B.

It is possible some lower options could be combined in different ways, but it would be disproportionate to try to describe all the combinations at this stage. After Stage 2 concludes, we will know which of the lower options have progressed to Stage 3 Consultation. We will then understand which options might complement each other under certain conditions, and we will consult you on what we think might work. You can then tell us your opinion.

Rarely used contingency procedures will also need to be updated, but we can't start to redesign them until after Stage 2 is completed.

5. Annex: Design Principles

Priority	Ref	Design Principle
1	1	Safety is the highest priority Optimise the complexity of the TC Essex sector within the scope of this project
2	2	Environmental – Must meet the 3 aims of the NPSE, Air Navigation Guidance 2017 and all appropriate Government aviation policies, and updates thereof
	3	Technical – Minimise impacts on MoD USAFE Lakenheath operations to a level acceptable to MoD
3	4	Operational – Should not constrain the airport's capacity, providing the environmental objectives/ requirements have been met
	5	Technical – Minimise dependency of LLA's arrivals on those of Stansted Airport.
	6	Operational – Increase the predictability of LLA's arrivals
	7	Environmental – Should enable continuous descent from at least 7,000ft & facilitate continuous descent above that
4	8	Environmental – Minimise the requirement to change future low altitude arrival flows within the next ten years
	9	Technical – There must be agreement between stakeholder ANSPs that the design concept being progressed suits all operations. MoD (other than USAFE Lakenheath) MoD (USAFE Lakenheath) Stansted Airport Cambridge Airport Cranfield Airport
	10	Environmental – Should provide an equitable distribution of traffic where possible, through e.g. use of multiple routes, new route structures, options/mechanisms for respite
5	11	Economic – Reduce fuel burn
	12	Economic – Minimise potential increases in fuel burn
6	13	Environmental – Should avoid overflying the same communities with multiple routes, & take into account routes of other airports, below 7,000ft
7	14	Operational – Should minimise tactical intervention by ATC below 7,000ft
8	15	Technical – Minimise negative impact on other airspace users by keeping CAS requirements to a minimum, investigating potential release of existing CAS, keeping new airspace boundaries simple where possible, and FUA if possible

The design principle development document is published on the CAA airspace change portal here.

6. Annex: Summary of Stakeholder Engagement Evidence

This section summarises the engagement activities we conducted, and the broad design decisions / considerations we made with the feedback we received. Copies of the engagement material will be sent unredacted to the CAA so they can make sure our engagement was effective – if you were involved in these discussions it is possible the CAA might contact you.

We met with representative stakeholder groups to discuss our design concepts, tailoring each presentation to their interests. Most of these stakeholders are the same as those we engaged with in Stage 1, however for Stage 2 we had some additional participating stakeholders (noted in the table below).
The engagement activities typically followed this format – this is the "we asked…" element of the typical cycle "we asked, they said, we did":

- Introductions and scene setting, background to AD6
- Airspace change CAP1616 process and the role of stakeholders, design principles
- Today's situation in the region.
- Progress to date and illustrations of concepts for consideration
- Impacts on, and mitigations for, the interests of this stakeholder – two-way discussion
- Summarise discussions
- Process notes, conclusions and close
- Minutes and a copy of the presentation sent out afterwards, sometimes extra email feedback acquired

Where possible, we met face to face, by visiting their offices or by hosting them at one of our sites. This table summarises these activities and the feedback, by stakeholder group. We show the date of the primary engagement activity only (subsequent calls/emails etc not listed in this summary), and the primary discussion points.
An example presentation is included on the CAA portal, so you can see how we explained this proposal's development to our participating stakeholder groups.

Due to the activities themselves generating back and forth communications, overlapping with other stakeholder engagement activities, we present them by group rather than chronologically.

Participating Stakeholders	Primary Engagement Date (2019)	Discussions/Decisions
Aircraft operators including business jets, specifically EZY, WZZ, TUI, RYR, Gama, Signature The same individual represented both Gama Aviation and Signature Aviation under Stage 1 and attended this meeting in the same joint capacity. Zenith Aviation (Stage 1 stakeholder) could not attend.	01 July meeting Face to face at Luton airport (except RYR online by phone). Two-way discussion in the room, feedback acquired.	They said: Predictability of the sector is important. Planning for such flights can be inefficient and inconsistent due to that unpredictability. Predictability of operation is more important than track length, for flight planning efficiency. PBN transitions at lower levels preferred. CDAs preferred. RNP+RF equipage c.70% We did: PBN transitions included in the design options (RNAV1 and RNP+RF). Separation of flows would increase predictability, some tracks may be longer. Vectoring would still be a consideration, far more predictable if the flows have been separated at upper levels. CDAs considered unlikely due to other LTMA flows in the region, but efforts made to maximise the possibility.
Cardington Danger Area EGD206 Weather Research Station (classed as military, run by the UK Meteorological Office) This was their first opportunity to actively participate in this project as we were unable to contact them for Stage 1 engagement.	24 June Meeting face to face at Cardington station. Two-way discussion in the room, feedback acquired.	They said: Operations include lower-speed unmanned aerial systems beyond visual line of sight, and balloons operating to the extremities of the area (a column 1nm radius, 6,000ft altitude). Highly dependent on the weather of the day, impossible to plan long-term for activities which only use certain altitudes. However in principle it may be possible to consider flexible use airspace (FUA) depending on D206 having primacy, for example if known that our operation would not exceed 4,000ft for a period. We did: EGD206 would retain primacy should FUA be considered a useful item for exploration. A formal letter of agreement would be required.

Continued…

British Parachute Association BPA (also on behalf of GoSkydive, intending to set up a parachute dropping centre at Little Staughton near Bedford). This stakeholder was engaged under Stage 1.	27 June Meeting face to face at NATS Swanwick Centre Two-way discussion in the room, feedback acquired, additional feedback via email later.	They said: If a new volume of CAS was implemented above the planned drop zone then there would be impacts on their operations at higher levels (up to FL130, FL150), compared with the impacts under current situation. BPA understood the technicalities of the situation including the likelihood of access restrictions should this proposal result in a route and CAS in the vicinity of Little Staughton. We did: Suggested setting the base of any CAS in the vicinity as high as possible, with FL75 used as an example based on typical descent profiles. Discussed with the BPA potential mitigations based on interrupting or rearranging Luton arrival flows, presuming CAS in the region is needed. Discussed how long an acceptable paradrop could be delayed in the air pending a gap in arrivals. A formal letter of agreement would be required. They said, afterwards, that GoSkydive intend to proceed for the time being, fully aware of the likely access restrictions if the process resulted in a route/CAS in the vicinity.
East Anglian Rocketry Society (EARS) Previous attempts at engagement went unnoticed due to spam filtering, phone calls and alternate contact methods were used, and this was a successful engagement under Stage 2.	05 August Online/phone meeting Two-way discussion online, feedback acquired, additional feedback via email later.	They said: We have a specific site at Elsworth near Papworth in Cambs, and we set our launch NOTAMs to 10,000ft which would be in the middle of where a route/CAS could be located. We plan launch on the first Sunday of each month, with some being cancelled for weather or fire risk of dry crops. We also typically use all of the first May bank holiday for longer periods of launches. Most launches do not get that high, but some would be impacted unless a mitigation was agreed. Launches known to not exceed a certain altitude would not be impacted by the implementation of a route/CAS in the vicinity. We did: Suggested setting the base of any CAS in their vicinity as high as possible, with FL75 used as an example based on typical descent profiles. No mitigation needed for launches known to never exceed appropriate altitudes beneath any CAS, with EARS to determine safety buffers. Mitigation such as pre-submitting dates of higher launches to NATS control centre, with a method of arranging a launch window based on the air traffic situation on the day. A formal letter of agreement LoA would be required. They said, later, an LoA would be explored in due course, setting up something similar to that suggested during the meeting. We replied that the consultation would be a good way to get the process started.
Cambridge Marshall Airport This stakeholder was engaged under Stage 1.	24 June Meeting face to face at Cambridge Airport Two-way discussion in the room, feedback acquired	They said: Arrivals not affected by AD6. Some departures which join the airways system via BKY would be better moved to join via EBOTO, this was already under separate consideration and would hopefully align with or precede AD6. We did: Took additional steps to understand the BKY vs EBOTO departure situation and how AD6 fits.
London Stansted Airport Ltd STAL This stakeholder was engaged under Stage 1.	19 August Meeting face to face at Stansted Two-way discussion in the room, feedback acquired.	They said: Complexity reduction for Luton arrivals would also reduce complexity for Stansted arrivals. The base altitude of two small volumes of CAS SE of the CTR could be raised. This was provisionally agreed previously, and is now confirmed. No anticipated changes to typical Stansted arrival tracks, but is an improved CDA to runway 04 possible using these same tracks? We did: Thanked STAL for confirmation that any CAS design we develop could include the raising of these bases. Reiterated that we do not anticipate changes to other LTMA flows due to this proposal, apart from the complexity reduction benefitting both airports. Other unchanging flows in the vicinity are likely to preclude improved CDAs for Stansted 04 arrivals at this time.

Continued…

Participating Stakeholders	Date(s) in 2019	Discussions/Decisions
Cranfield Airport This stakeholder was engaged under Stage 1.	24 June Meeting face to face at Cranfield 19 September Online and phone meeting Two-way discussion in the room or on the phone, feedback acquired additional feedback via email later.	They said: Higher-level Cranfield traffic may change slightly, but no negative impact. Understood that, if certain route options were progressed, lower level CAS would be needed in the vicinity for containment purposes. If lower level CAS was introduced, runway 03 arrivals are unlikely to be affected due to descent profile and draft base proposed at 4,500ft. Runway 21 departures are more likely to be impacted due to straight-ahead climb-out. WCO-bound departures would need to be considered. CAS in this vicinity could change GA flight behaviours in the vicinity of Cranfield. We did: Suggested setting the base of any CAS in the vicinity as high as possible, with 4,500ft used as an example based on typical descent profiles. If the associated route was deemed viable and progresses, consider minimising the volume by decreasing its dimensions as much as possible, reducing containment safely via a safety case. Later, we considered if FUA may be possible subject to consultation.
General Aviation Community A4A, GAA, BGA, London Gliding Club at Dunstable, Cambridge Gliding Club at Gransden Lodge These stakeholders were engaged under Stage 1.	03 July Meeting face to face at NATS Whiteley 28 August Meeting face to face at Luton Airport Two-way discussion in the room, feedback acquired, additional feedback via email later.	They said: Airspace in the upper region is less likely to impact GA operations if its lowest base is FL75+ Airspace below this would be more likely to impact GA and would be unwelcome. Use the FASVIG VFR Significant Areas material to consider what is important in the region for GA. Return of lower-altitude CAS would be a positive step The safety case causing the desired timeline should be shared with GA via non-disclosure agreement, and justification for the proposal is not clear. Other methods than racetrack holding should be considered, e.g. advanced traffic flow systems to reduce/negate holding, and changes to other flows in the region to improve the wider system. Raise the CAS base over EGD206 to 6,000ft or higher. Use glider log data to illustrate where and how high gliders fly in the vicinity. Consider local improvements to London Gliding Club areas such as “Area 1” and the Chiltern Ridge Soaring Area. Failed to follow CAP1616 process. We did: Suggested setting the base of any CAS in the wider vicinity as high as possible, with FL75 used as an example based on typical descent profiles. Some CAS at lower altitude may be needed to contain a viable route, if it progresses. Acquired glider log data and provided illustrations of their flight, widened to a longer period on request. Two volumes of CAS, agreed with Stansted, can have their bases raised, these are in one of the regions FASVIG has described as important to GA. Clarify that in-depth safety data is shared only with the CAA as regulator, which has used its judgement to allow the progress of this proposal ahead of FASI-S. Clarified (to all stakeholders) that other methods than racetrack holding are being considered such as arrival management etc. The CAS base over EGD206 is used by existing non-Luton flows thus is outside the scope of this proposal. Some of the London Gliding Club interests are more locally relevant to LoA discussions. Clarified that we are confident the proposal adheres to CAP1616 process and the CAA will make that determination, and that lines of communication continue on all matters relating to this proposal and aviation safety in general.

Continued…

Participating Stakeholders	Date(s) in 2019	Discussions/Decisions
Local community Independent Noise Consultant for LLACC Hertfordshire Association of Town and Parish Councils York Aviation representing LLAL Herts County Council Aylesbury Vale District Council Luton Borough Council LADACAN East Herts Council LLATVCC Central Bedfordshire Representative Chiltern Conservation Board Buckinghamshire and Milton Keynes Association of Town and Parish Councils Bedfordshire Association of Town and Parish Councils Representatives of the local communities were engaged under Stage 1, some of the individual attendees or representatives could not attend this Stage 2 session. However we subsequently provided the information to all appropriate representatives and offered additional sessions to those who could not attend, that offer was not taken up.	28 August Face to face meeting at a conference room near Luton Airport Two-way discussion in the room, some feedback acquired, additional feedback via email later.	They said: Two weeks is not enough time, please give us a month to provide feedback More detail on exact routes and locations Add a scale to the charts, and include more detailed information on possible numbers of flights and noise impacts. Reduce complexity of charts. Alignment with FASI-S (more than one change in the region). Concerns over concentration via PBN routes – request a schedule of respite if this is used. Preferences for more than one route in rotation for the same reason. Retention of vectoring as this causes some dispersal. Consideration of CDAs. Re-prioritise AONBs to improve tranquillity Additional questions compiled separately We did: Added a week to the initial two-week feedback period, to allow community groups more time to respond via email. We had a major design workshop the day after this three week period expired and so we needed comments before then. Explained that detail would come later, this is a first development discussion. Scale added to charts. Additional information on numbers of flights and potential noise impacts. We understood that respite or vectoring may be more equitable than a single route. We explained via this document that some lower routes could be used in combination with other lower routes, but too many combinations to describe as none have yet been discounted. From a design decision point of view, the individual options that progress to the next stage could be assessed as being technically viable for combining, which would be appropriately discussed in the consultation forum. Part of the Chilterns AONB lies under the runway 08 final approach track and cannot be avoided, but some of the option concepts may reduce overflight of other parts of the AONB. This proposal is separate from FASI-S, clarification that its scope is Luton arrivals only.
Ministry of Defence Defence Airspace & Air Traffic Management DAATM United States Air Force in Europe USAFE	21 June Online / phone meeting 16 July Face to face visit to RAF Lakenheath 03 September Face to face visit to NATS Swanwick control centre (feedback acquired in the room and more via email/ phone calls). Later, emails/ calls re lower CAS volumes	They said, we did (combined due to evolution of design): USAFE will acquire F35s which require regular practice of emergency engine failure procedures called PFOs, from 10nm final at 10,000ft in VFR during daylight, with procedures to Lakenheath Runway 06 of primary interest. Initial design sketches roughly considered these impacts, but refinement was needed. Visits and further discussions improved mutual understanding of each other's operations. If CAS was needed, it could be split into volumes above the 10,000ft PFO initiation, and volumes below. The basic principle of at least two volumes, one to contain any delay absorption area FL75+, the other FL125+ above the PFO, was considered viable. Various considerations on where and how that split might work, should the concept progress to the next stage. Other considerations re RAF Mildenhall paradropping also, with the F35 PFOs remaining the primary interest. Smaller CAS volume base 4,500ft for route containment is unlikely to cause MoD issues.

7. Annex: Glossary

Altitude	The distance measured in feet, above mean sea level. Due to variations in terrain, air traffic control measures altitude as above mean sea level rather than above the ground. If you are interested in the height of aircraft above a particular location to assess potential noise impact, then local elevation should be taken into account when considering aircraft heights; for example an aircraft at 6,000ft above mean sea level would be 5,500ft above ground level if the ground elevation is 500ft.
AMSL	Above Mean Sea Level
AONB	Area of Outstanding Natural Beauty
ATC	Air traffic control
ATC intervention	This is when ATC instruct aircraft off their planned route, for example, in order to provide a short cut, they may be instructed to fly directly to a point rather than following the path of the published route
CAA	Civil Aviation Authority, the UK Regulator for aviation matters
CAP1616	Civil Aviation Publication 1616, the airspace change process regulated by the CAA
Capacity	A term used to describe how many aircraft can be accommodated within an airspace area without compromising safety or generating excessive delay
CAS	See Controlled Airspace
Centreline	The nominal track for a published route (see Route)
CO_2	Carbon dioxide
Concentration	Refers to a density of aircraft flight paths over a given location; generally refers to high density where tracks are not spread out; this is the opposite of Dispersal
Continuous descent	A climb or descent that is constant, without long periods of level flight
Controlled airspace (CAS)	Generic term for the airspace in which an air traffic control service is provided as standard; note that there are different sub classifications of airspace that define the particular air traffic services available in defined classes of controlled airspace. Abbreviated to CAS
Conventional navigation	The historic navigation standard where aircraft fly with reference to ground based radio navigation aids
Conventional routes	Routes defined to the conventional navigation standard
Delay Absorption Area	See Holds
Dispersal	Refers to the density of aircraft flight paths over a given location; generally refers to lower density – tracks that are spread out; this is the opposite of Concentration
Easterly operation	When a runway is operating such that aircraft are taking off and landing in an easterly direction
Final approach path	The final part of a flight path that is directly lined up with the runway;
Flexible Use Airspace FUA	Airspace which can be designated as neither “civilian” nor “military” but which can operate in either guise, allocated according to need, or switched entirely on/off according to a schedule.
Flight-path	The track flown by aircraft when following a route, or when being directed by air traffic control (see also Vector)
ft, feet	The standard measure for vertical distances used in air traffic control
GA	See General Aviation

General Aviation (GA)	All civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire. The most common type of GA activity is recreational flying by private light aircraft and gliders, but it can range from paragliders and parachutists to microlights and private corporate jet flights.
Holds/Holding Stacks	An airspace structure where aircraft circle in a racetrack-shaped pattern above one another at 1,000ft intervals when queuing to land.
Lower airspace	Airspace in the general vicinity of the airport containing arrival and departure routes below 7-8,000ft. Airports have the primary accountability for the design of this airspace, as its design and operation is largely dictated by local noise requirements, airport capacity and efficiency
NATS	The UK's licenced air traffic service provider for the en route airspace that connects our airports with each other, and with the airspace of neighbouring states. Also the air navigation service provider at Luton Airport, under commercial contract for the aerodrome control provision and via the London Licence for the approach control function.
Nautical Mile	Aviation measures distances in nautical miles. One nautical mile (nm) is 1,852 metres. One road mile ('statute mile') is 1,609 metres, making a nautical mile about 15% longer than a statute mile.
Network airspace	En route airspace above 7,000ft in which NATS has accountability for safe and efficient air traffic services for aircraft travelling between the UK airports and the airspace of neighbouring states
nm	See Nautical Mile
PBN	See Performance Based Navigation
Performance Based Navigation (PBN)	Referred to as PBN; a generic term for modern standards for aircraft navigation capabilities including satellite navigation (as opposed to 'conventional' navigation standards).
Radar, radar blip, radar target, radar return	Generic terms covering how ATC 'sees' the air traffic in the vicinity. One type of radar (Primary) sends out radio pulses that are reflected back to the receiver (the 'return'), defining the target's position accurately and displaying a marker on the controller's screen ('blip' or 'target'). The other type (Secondary, often attached to the Primary and rotating at the same speed) sends out a request for information and receives coded numbers by return (see Transponder). These numbers are decoded and displayed on top of the Primary return, showing an accurate target with callsign identity and altitude.
RNAV	Short for aRea NAVigation. This is a generic term for a particular specification of Performance Based Navigation
RNAV1	See RNAV. The suffix '1' denotes a requirement that aircraft can navigate to with 1nm of the centreline of the route 95% or more of the time. In practice the accuracy is much greater than this.
RNP1+RF	Required Navigation Performance 1. An advanced navigation specification under the PBN umbrella. The suffix '1' denotes a requirement that aircraft can navigate to with 1nm of the centreline 95% or more of the time, with additional self-monitoring criteria. In practice the accuracy is much greater than this. The RF means Radius to Fix, where airspace designers can set extremely specific curved paths to a greater accuracy than RNAV1.
Route	Published routes that aircraft plan to follow. These have a nominal centreline that give an indication of where aircraft on the route would be expected to fly; however, aircraft will fly routes and route segments with varying degrees of accuracy based on a range of operational factors such as the weather, ATC intervention, and technical factors such as the PBN specification. RNAV1 routes and RNP1 routes are flown accurately.

Route system or route structure	The network of routes linking airports to one another and to the airspace of neighbouring states.
Separation	Aircraft under Air Traffic Control are kept apart by standard separation distances, as agreed by international safety standards. Participating aircraft are kept apart by at least 3nm or 5nm lateral separation (depending on the air traffic control operation), or 1,000ft vertical separation.
Sequence	The order of arrivals in a queue of airborne aircraft waiting to land
SID	See Standard Instrument Departure
Standard Arrival Route (STAR)	The published routes for arriving traffic. In today's system these bring aircraft from the route network to the holds (some distance from the airport at high levels), from where they follow ATC instructions (see Vector) rather than a published route. Under PBN it is possible to connect the STAR to the runway via a Transition.
Standard Instrument Departure	Usually abbreviated to SID; this is a route for departures to follow straight after take-off
STAR	See Standard Arrival Route
Statute mile	A standard mile as used in normal day to day situations (e.g. road signs) but not for air traffic where nautical miles are used
Stepped descent	A descent that is interrupted by periods of level flight required to keep the aircraft separated from another route in the airspace below
Systemisation	The process of reducing the need for human intervention in the air traffic control system, primarily by utilising improved navigation capabilities to develop a network of routes that are safely separated from one another so that aircraft are guaranteed to be kept apart without the need for air traffic control to intervene so often
Tactical methods	Air traffic control methods that involve controllers directing aircraft for specific reasons at that particular moment (see Vector)
Terminal airspace	An aviation term to describe a designated area of controlled airspace surrounding a major airport or cluster of airports where there is a high volume of traffic; a large part of the airspace above London and the South East is defined as terminal airspace (or Terminal Manoeuvring Area – TMA). This is the airspace that contains all the arrival and departure routes for Heathrow, Gatwick, Stansted, Luton and London City from around 2,000ft-3,000ft up to approximately 20,000ft.
Tonne, t	Metric Tonne (1,000kg)
Top of Descent (TOD)	The aircraft ends its cruise phase and starts its descent from the en-route environment towards the runway
Transition	The part of a PBN arrival route, defined to either RNAV1 or RNP1 standard, between the last part of the hold and the final approach path to the runway. Typically followed accurately in three dimensions by an aircraft's flight management system.
Transponder	An electronic device on board aircraft which sends out coded information which is picked up by radar and other systems. Most importantly the aircraft altitude, and identity code, by which the aircraft can be identified on the radar screen.
Uncontrolled Airspace	Generic term for the airspace in which no air traffic control service is provided as standard.
Unknown traffic	Aircraft not participating in ATC services. They may show on radar with altitude information (if they are operating with a Transponder) or in the worst case they will only show as a blip on the radar screen (a radar primary return) with no other information. If ATC sees a primary return on radar, they have to assume that it could be at the same altitude as any flight they are controlling, and hence the flight has to be tactically vectored to safely avoid it.

Vector, Vectoring, Vectored	An air traffic control method that involves directing aircraft off the established route structure or off their own navigation – ATC instruct the pilot to fly on a compass heading and at a specific altitude. In a busy tactical environment, these can change quickly. This is done for safety and for efficiency.
Westerly operation	When a runway is operating such that aircraft are taking off and landing in a westerly direction

End of document