Proposed changes to

London Luton Airport Arrivals

CAP1616 Stage 4

Step 4B Airspace Change Proposal

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NATS-LLA Public

Roles

Action	Role	Date
Produced	Airspace Change Specialist NATS Airspace and Future Operations	25/06/2021
Reviewed Approved	Airspace and Noise Performance Manager London Luton Airport	25/06/2021
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References

Ref No	Description	Hyperlinks
1	SAIP AD6 CAA web page – progress through CAP1616	Link to CAA portal Link to consultation site
2	Stage 1 Statement of Need	Link to document
3	Stage 1 Assessment Meeting Minutes	Link to document
4	Stage 1 Design Principles	Link to document
5	Stage 2 Design Options	Link to document
6	Stage 2 Design Principle Evaluation	Link to document
7	Stage 2 Initial Options Appraisal and Safety Assessment	Link to document
8	Stage 3 Consultation Document	Link to document
9	Stage 3 Full Options Appraisal	Link to document
10	Stage 3 Consultation Strategy	Link to document
10A	Stage 3 Step 3D Consultation Feedback Report and Technical Compliance Supplement	Link to report Link to CAA portal
10B	Stage 4 Step 4A(ii) The Final Airspace Design (technical map for use on computers, unsuitable for smartphones and tablets, open using the free Adobe Reader DC app to make use of switchable layers)	Link to map
10C	Stage 4 Step 4A(iii) Final Options Appraisal	Link to document
10D	Stage 4 Step 4A(i) Consultation Response Document	Link to document
11	Airspace change: Guidance on the regulatory process for changing the notified airspace design and planned and permanent redistribution of air traffic, and on providing airspace information CAP1616	Link to document (Edition 4, March 2021)
12	Environmental requirements technical annex CAP1616A	Link to document
13	Definition of Overflight CAP1498	Link to document
14	Airspace Modernisation Strategy AMS CAP1711	Link to document
15	UK Government Department for Transport's 2017 Guidance to the CAA on its environmental objectives when carrying out its air navigation functions, and to the CAA and wider industry on airspace and noise management (abbreviated to ANG2017)	Link to document
Sup 01 to Sup 16	List of supplemental documents supplied separately, most are not suitable for publication (red number indicates CAA eyes only)	See last page

1. Contents

2. Introduction

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

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

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

2.4 Where complex air traffic flows cross each other within UK airspace, restrictions are used to separate aircraft by 1,000ft vertically and/or by a minimum lateral distance of either 3 or 5 nautical miles (nm) depending on the rules applicable to the particular airspace. This places a significant workload on the controller because they issue heading and altitude instructions to many aircraft simultaneously, ensuring they are all kept safely separated.

2.5 The LLA and Stansted region is especially complex due to the number of crossing traffic flows, and the amount of air traffic has grown faster than expected over the last few years, increasing the workload of air traffic controllers. Safety is always the first priority. We have identified that, unless something is done now, the intensity of the air traffic control workload may become unsustainable for controllers. This would lead to more holding, in order to manage the workload safely, and therefore delay. While the amount of air traffic has been reduced as a result of the coronavirus pandemic, the need to change the design of this airspace remains. We must ensure it is fit for purpose when traffic recovers to pre-pandemic levels and we must allow for safe potential future growth at either airport.

2.6 During periods when the workload of air traffic controllers is predicted to become too intense, safety dictates that temporary limits (known as flow restrictions) are applied to the numbers of aircraft that a controller can manage before safe limits are exceeded. This causes delay to the travelling public (at both LLA and Stansted) and is a short-term temporary solution to the underlying latent problem. Over a day, temporary limits increase the amount of delay and may cause flights to be delayed into the night-time noise period[1] which is detrimental to local communities. These delays can also result in increases in fuel burn and associated CO_2 emissions. The sponsors acknowledge the likely temporary impacts of the Covid-19 coronavirus on aviation but are clear that this air traffic complexity issue must be resolved. Doing nothing would increase the potential for a reduction in safety as a result of increased arrival delay. It is assumed that air traffic will return to pre-pandemic levels and the analysis forecasts remain valid, albeit delayed by a year[2]. During that recovery period, temporary limits to the numbers of aircraft may not be required as often as previously, minimising the impacts on the travelling public until this change is delivered.

2.7 This proposal will separate LLA arrival flows from Stansted arrival flows, further out and higher up than the current airspace structures can allow. This will reduce the airspace complexity in the region, decrease the controllers' workload, reduce the likelihood of delay, and increase safety by design.

[1] Regulating the amount of traffic within a sector 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.

[2] For more information on forecasts, assumptions, and the impact on aviation of the coronavirus pandemic see Ref 9 Section 6.

3. Executive Summary

3.1 Air traffic control in the London region is complex, especially for aircraft arriving at LLA and London Stansted Airport because they are geographically close to each other. The current airspace design has been fundamentally unchanged in decades, since before the low-fare carrier expansion at both airports and their associated subsequent growth. It forces LLA and Stansted, which are two of the five busiest airports in the UK, to share the same arrival flows, in a relatively small region north of London (if combined, the figures for LLA and Stansted would make it the second busiest in the UK).

3.2 The more complex the airspace, the greater the need for the airborne holding of arrivals when it gets busy, delaying and disrupting the travelling public.

3.3 Controllers take each aircraft from the shared flows towards the destination airport, descending them safely to their respective runways. This can be an intense task and is unique in the UK; arrival flows to most busy airports are separated, by airspace design, higher and further away.

3.4 LLA's and Stansted's arrival flows are shared until aircraft descend through c.8,000ft (around 25 miles from the airport), which is comparatively close and leaves little room for controllers to operate. Any arrival delay or disruption at one airport causes unnecessary arrival delay to the other, because the flows are so closely shared.

3.5 During periods where the workload of our air traffic controllers is predicted to become too intense, safety dictates that we apply temporary limits (known as flow restrictions) to the numbers of aircraft that a controller can manage, before safe limits are exceeded. This causes delay to the travelling public (at both LLA and Stansted), and is a short-term, temporary solution to the underlying problem.

3.6 We have identified that, unless we do something now, the intensity of air traffic control workload may become unsustainable for air traffic controllers in the longer term. This would make arrival delays and airborne holding more common, creating increased environmental impacts - including the aviation fuel burnt and greenhouse gases, such as CO_2.

3.7 The amount of air traffic has been impacted by the 2020 coronavirus pandemic, but the need to change the design of this airspace remains. We must ensure it is fit for purpose when traffic recovers to pre-pandemic levels, and we must allow for future growth.

3.8 We propose to reduce this complexity by moving LLA's arrival flightpaths, leaving Stansted's arrival flows unchanged. This would reduce air traffic controller workload because the arrival flows to each airport would be separated further out and higher up, assuring a safe and efficient operation for the future. We are not proposing any change to the way aircraft depart from LLA, nor would there be changes to the way Stansted arrivals and departures fly under this proposal.

How we progressed through the CAA's airspace change process CAP1616:

3.9 At Stage 1 we developed 15 Design Principles via engagement with representative stakeholder groups.

3.10 At Stage 2 we developed 5 Upper Design Options and 9 Lower Design Options, via further engagement with the same representative stakeholder groups.

3.10.1 We evaluated each Design Option and rejected those that did not best meet the Design Principles.

3.10.2 Of those that were accepted, we conducted an Initial Options Appraisal (Ref 7) and stated that some or all Design Options could be combined into systems of options for the next stage.

3.11 At Stage 3 we developed a documentation set for consultation that was approved by the CAA. We held a 15-week consultation on two combined systems of options, which we named Option 1 Vectoring, and Option 2 PBN Routes with Vectoring.

3.11.1 Option 1 Vectoring sought to establish a new airborne hold, or stack, for LLA arrivals, with associated airspace and air routes, above approximately 8,000ft. From that new hold, the method air traffic controllers use to bring arrivals from 8,000ft to the runway would be similar to today – providing each aircraft with heading, descent and speed instructions, manually managing each flight (known as vectoring). This reduces complexity and minimises the change from today's flightpaths at lower altitudes.

3.11.2 Option 2 PBN Routes with Vectoring also sought to establish a new airborne hold, or stack, for LLA arrivals, with associated airspace and air routes, at 8,000ft and above. From that new hold, air traffic controllers would still use the vectoring method described in the first option, to descend aircraft to the runway. However, there would also be a number of predetermined arrival flightpaths which pilots could be instructed to fly, their aircraft could fly them automatically and without intervention by controllers. These predetermined arrival flightpaths would reduce air traffic complexity even more than the first option, making this our preferred option.

3.11.3 We provided comprehensive material including a virtual exhibition hall, hosted ten video conferences for the general public to watch a presentation then interact and ask questions of the host and expert panel. All ten were recorded and are available for repeat viewing in the virtual exhibition hall.

3.11.4 We held private video conferences with other stakeholders such as MPs, a variety of General Aviation representative groups, the Ministry of Defence, local councils, nearby airports, and air operators using this region's airspace.

3.11.5 We received over 2,400 responses to the consultation. We analysed the responses, summarised and categorised them all. We drew conclusions from the analysis, and developed actions for the next stage, based on those conclusions.

3.11.6 We published our Step 3D Consultation Feedback Report explaining the above.

3.12 At Stage 4 we analysed all the disparate design change suggestions and summarised them into specific recommendations.

3.12.1 We explained how each recommendation could be acted upon, and the influence it would have on the final design.

3.12.2 We changed elements of the airspace design in accordance with the recommendations, unless recommendations could not be acted upon, and we explained why either way in the Step 4A Consultation Response Document (Ref 10D).

3.12.3 We also published the Final Design technical map (with switchable data layers, Ref 10B), and Final Options Appraisal document (Ref 10C).

3.12.4 This Airspace Change Proposal (ACP) document set comprises our formal application to the CAA (Stage 4B in the CAP1616 process, Ref 11).

Summary of changes made to the airspace design, following consultation feedback analysis

3.13 At upper altitudes (c.8,000ft and above) we moved the hold, reoriented it, amended its availability such that aircraft would hold 1,000ft higher under normal operating conditions, and reduced the impacts on other airspace users by reducing the dimensions of CAS and agreeing mutually acceptable operating practices for airspace sharing.

3.14 We also reduced the fuel / CO_2 disbenefit by shortening some of the arrival routes, keeping some aircraft higher for longer, and increasing the controllers' ability to organise a viable arrival sequence as a consequence of the moved/reoriented hold.

3.15 We concluded that Option 1 would progress at lower altitudes, reducing the likelihood of flightpath concentration with its associated noise impacts taking cognisance of the consultation feedback, even though our stated preference was for Option 2 which is more aligned with the Government's Airspace Modernisation Strategy (AMS, Ref. 14).

Secretary of State Call-In Criteria

3.16 The final decision on an Airspace Change Proposal may be called-in by the Secretary of State (i.e. they may decide to make the decision instead of the CAA) if any of the following four criteria are met:

1. Is of strategic national importance;
2. Could have a significant impact (positive or negative) on the economic growth of the UK;
3. Could both lead to a change in noise distribution resulting in a 10,000 net increase in the number of people subjected to a noise level of at least 54 dB LAeq16hr **and** have an identified adverse impact on health and quality of life; or
4. Could lead to any volume of airspace classified as Class G being reclassified as Class A, C, D or E.

3.17 This proposal meets Criterion 4 because new controlled airspace is required at and above FL75, however, this increase at higher flight levels is mitigated by an 88nm2 reduction in an area of controlled airspace below 4,000ft as shown in Figure 6 on page 17. This reduction in CAS is at altitudes where most General Aviation aircraft operate. This proposal does not meet Criteria 1, 2 or 3.

4. Current Airspace Description

4.1 Structures and Routes

4.1.1 This proposal concerns the separation of LLA arrival flows from Stansted arrival flows, which under the current airspace design are entwined until the terminal holds LOREL and ABBOT. For full details see the Consultation Document (Ref 8) Section 4, extract below.

4.1.2 LLA and Stansted traffic both arrive from all directions at high levels into the shared airborne holding patterns called LOREL (near Royston, Herts) and ABBOT (near Sudbury, Suffolk and Great Yeldham, Essex) and descend to about 8,000ft. Figure 1 illustrates how LLA and Stansted flights arrive, high-level, from the upper network to the shared airborne holding patterns.

4.1.3 Each holding pattern contains a mix of traffic, for example two LLA arrivals may be held above a Stansted arrival at LOREL, with the opposite at ABBOT, or any other combination. Together with the wider operations within the airspace, this results in a very complex air traffic situation.

4.1.4 Once within the holding patterns at LOREL and ABBOT, air traffic controllers then separate the shared arrivals using vectoring (Radar Control). This requires intense and complex air traffic control interactions to be solved within the congested airspace, mostly at lower altitudes from 8-7,000ft and below.

4.1.5 Once the aircraft have been separated, they are vectored to the final approach. It is this vectoring that, at present, tends to disperse aircraft tracks across a swathe when aircraft are descending from 7,000ft.

4.1.6 As the aircraft get closer to the final approach and converge to line up along the extended runway centreline, the swathes narrow.

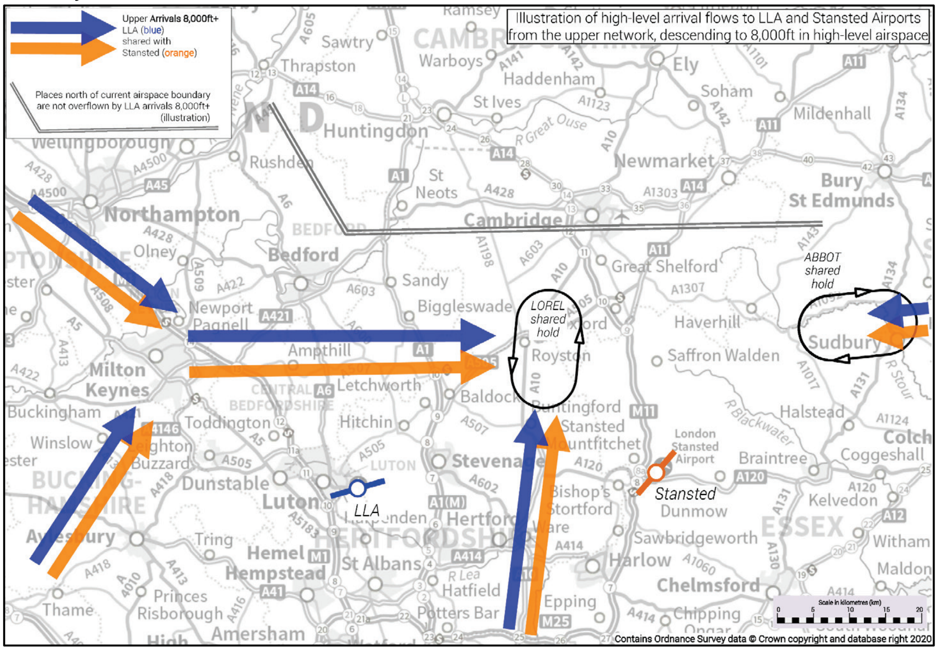


Figure 1 LLA and Stansted shared arrival flows at high level

4.1.7 In the map on the previous page, areas north of the grey airspace boundary are not currently overflown by LLA arrivals.

4.1.8 This includes Bury St Edmunds, Newmarket, most of Cambridge, Huntingdon and St Neots.

Runway 07 easterly arrivals (lower diagram in Figure 2)

4.1.9 Controllers descend the holding traffic, then separate out the LLA traffic from each hold, vectoring it from 5,000ft near Royston heading west between Letchworth and Biggleswade. The LLA arrival flow continues west, level at 5,000ft for about 40-50km, over the northern part of the Chilterns AONB, with the controller vectoring most aircraft south of Leighton Buzzard (but some are vectored to the north).

4.1.10 As the traffic reaches an area northeast of Aylesbury the controller turns the aircraft left, roughly perpendicular to the extended runway centreline, and descends it to 4,000ft, then turns left and descends once more to establish on final approach, typically somewhere between the east of Stoke Mandeville area around 4,000ft and Pitstone Hill around 3,000ft.

4.1.11 Vectoring naturally causes some dispersion, but the area within the black lines is typically the most commonly used flightpath (see lower diagram in Figure 2 below).

4.1.12 Some aircraft are given shortcuts or alternate routes as illustrated by the blue dashed arrows.

4.1.13 The swathe generally gets narrower until it aligns with the runway on final approach.

4.1.14 The final approach path to Runway 07 always overflies part of the Chilterns Conservation AONB, from Pitstone Hill to Kensworth Common, in a narrow swathe.

Runway 25 westerly arrivals (lower diagram in Figure 3)

4.1.15 Controllers descend the holding traffic, then separate out the LLA traffic from each hold, vectoring it from 5,000ft near Royston heading west between Letchworth and Biggleswade. The LLA arrival flow may continue generally west, level at 5,000ft for about 15km before the controller turns it south (Biggleswade, Henlow), or they may turn south soon after passing Royston, but generally somewhere in between. That turn to the south might be in an S-shape, or it may be straight.

4.1.16 As the traffic reaches the Letchworth-Baldock-Wallington area the controller turns the aircraft roughly perpendicular to the extended runway centreline, and descends it to 4,000ft, then turns right and descends once more to establish on final approach typically around Buntingford from 4,000ft to 3,000ft and Stevenage 3,000ft and below.

4.1.17 Vectoring naturally causes some dispersion, but the central third of the swathe is typically the most commonly used flightpath (see lower diagram in Figure 3 on p.10).

4.1.18 Some aircraft are given shortcuts, or alternate routes as illustrated by the blue dashed arrows.

4.1.19 The swathe generally gets narrower until it aligns with the runway on final approach.

4.1.20 The final approach path to Runway 25 always overflies Ardeley, Walkern, Stevenage and St Paul's Walden in a narrow swathe.

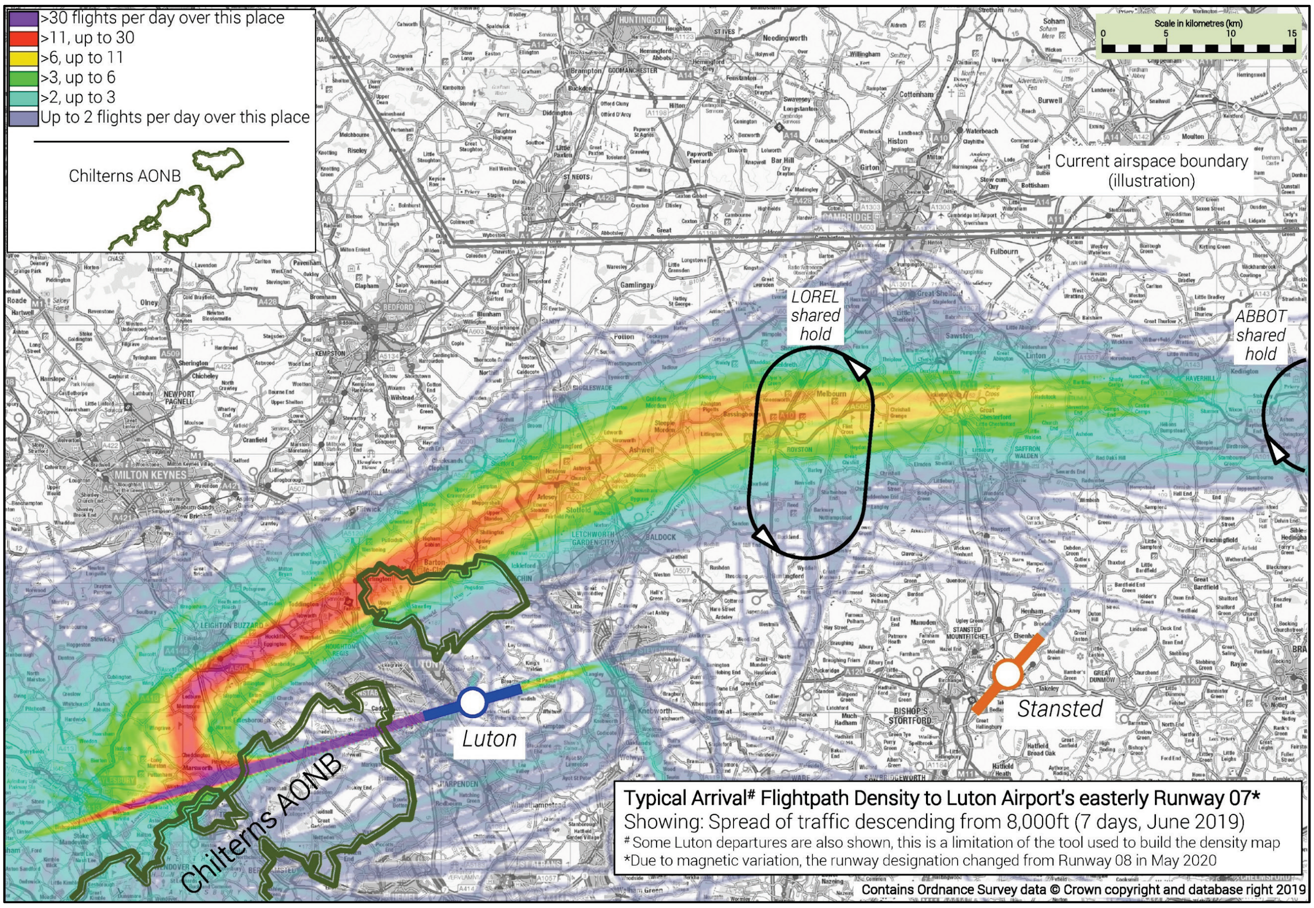
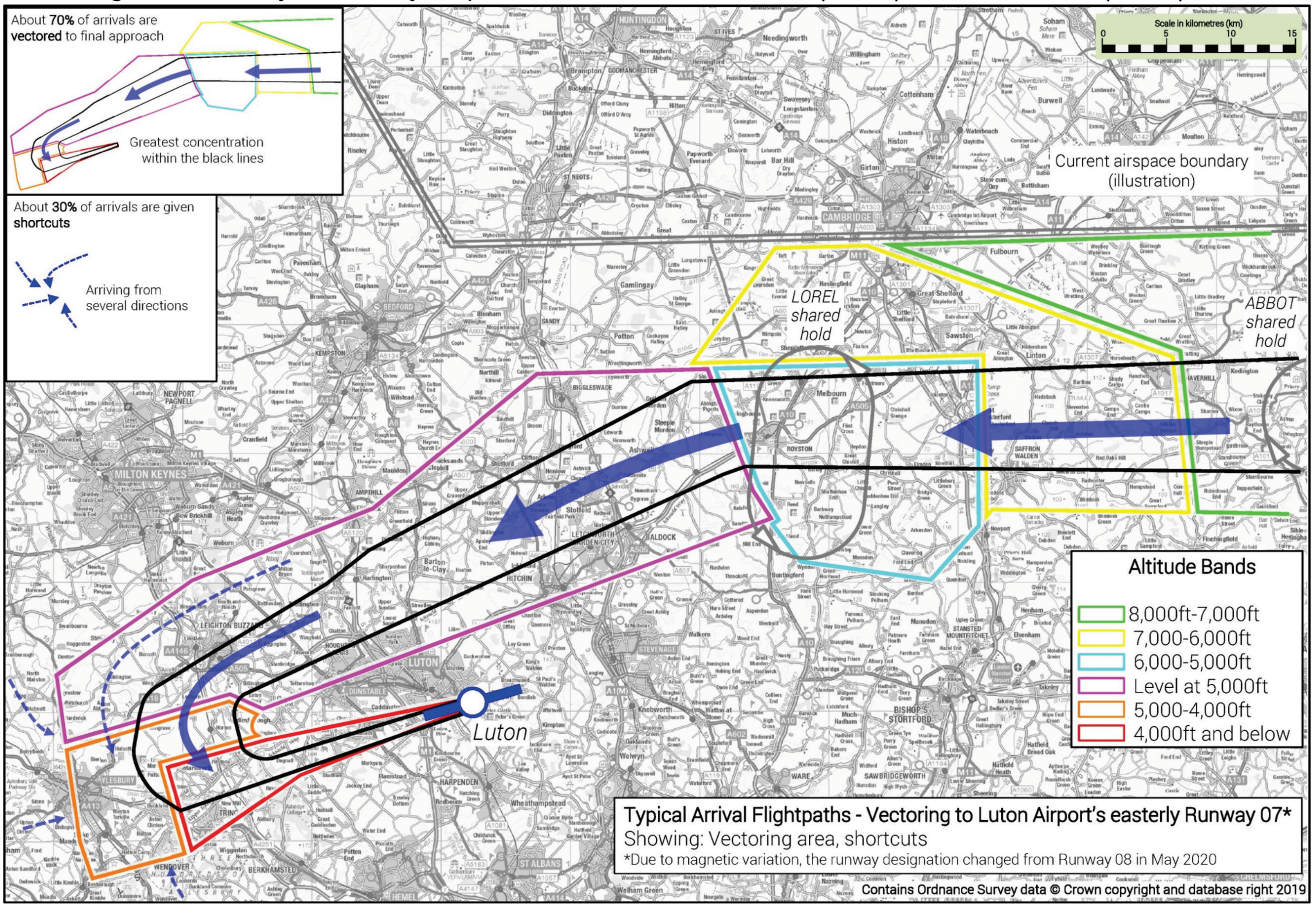


Figure 2 Runway 07 Density map of LLA arrivals from 8,000ft (above), flow schematic (below)



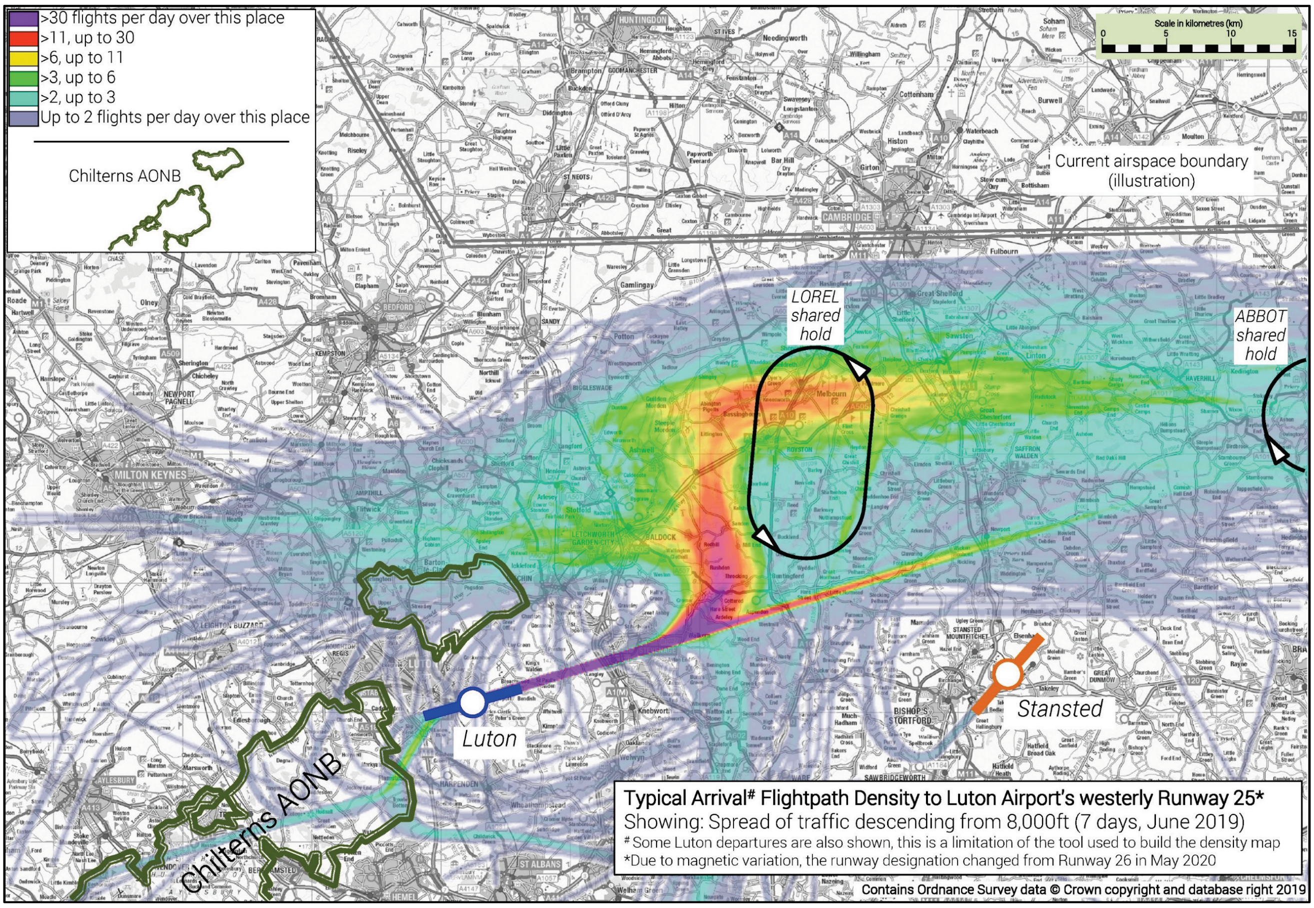
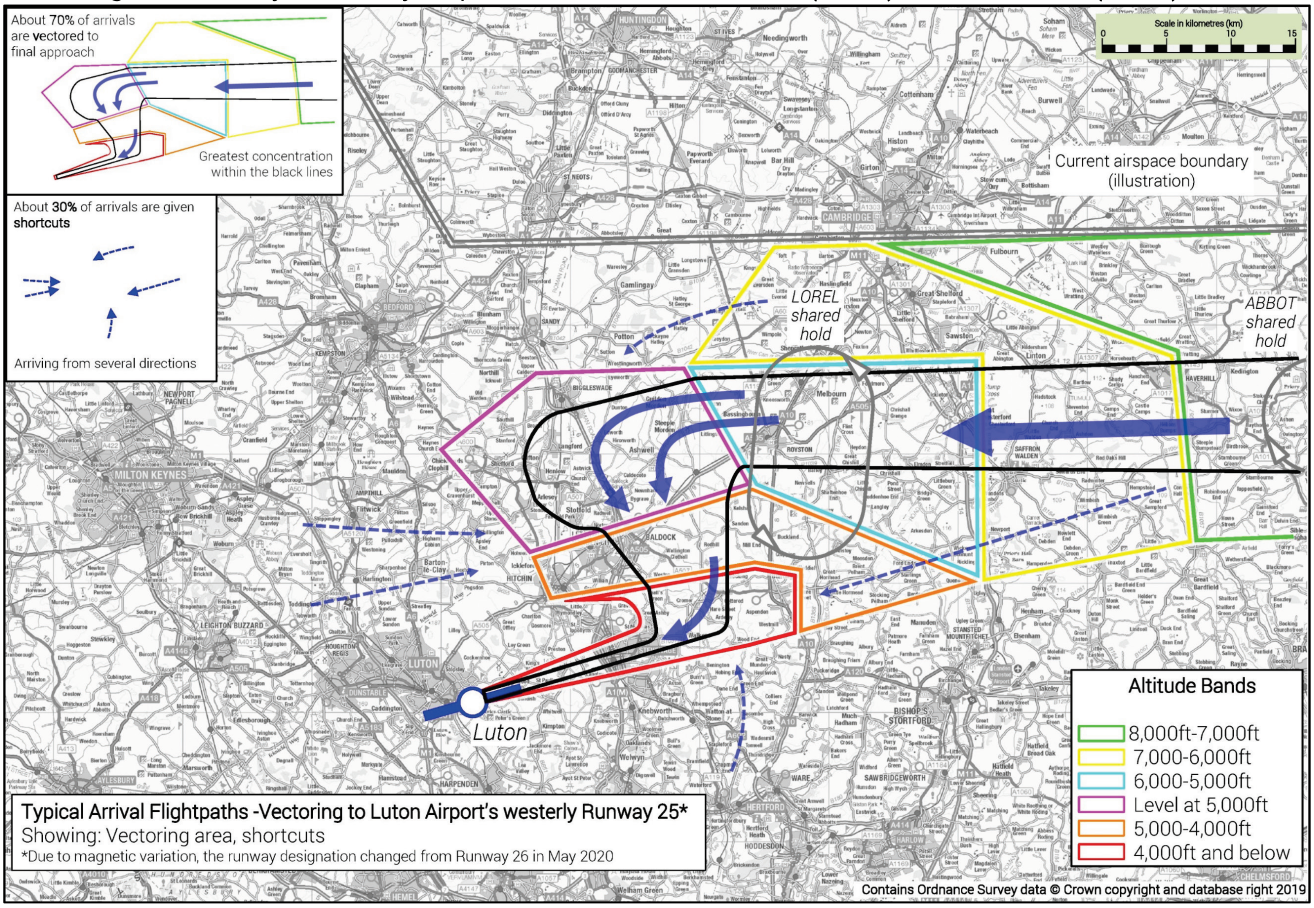


Figure 3 Runway 25 Density map of LLA arrivals from 8,000ft (above), flow schematic (below)



4.2 Airspace usage and proposed effect

4.2.1 The proportion of aircraft types or airlines is not expected to change as a consequence of this airspace change. The following paragraphs and tables break down the most common aircraft types and airlines arriving at LLA in 2019.

4.2.2 Most aircraft that operate at LLA fall into the category of '125-180 seat single-aisle 2-engined jet' which comprise similar types with similar noise such as Airbus A320 and Boeing 737 versions, with the A320 family being the most common. The proportions of arrivals at LLA in each noise category are detailed in Table 1, for 2019. We expect these proportions to continue, and we do not predict that this proposal would cause a change in the proportions of aircraft types using LLA.

Noise category	Count	Proportion
Turboprop* (inc all sizes of corporate aircraft, both turboprop and jet)	12,196	17.4%
50 seat regional jet	1,109	1.58%
70-90 seat regional jet	54	0.08%
125-180 seat single-aisle 2-eng jet	55,224	78.6%
250 seat twin-aisle 2-eng jet	1,585	2.26%
300-350 seat twin aisle jet	98	0.14%
Other	8	0.01%
Total arrivals 2019	70,274	

Table 1 Proportions of arrivals at London Luton Airport by noise category (full year 2019)

*Note that corporate and business travel occurs in a range of aircraft types, from small single turboprop aircraft up to larger business jets and there is no CAA-defined noise category. For consistency, all these types have been placed in the turboprop category.

Airline*	Aircraft Type	Proportion# (2019)
easyJet	A320 family	35%
Wizzair	A320 family	29%
Ryanair	B737 family	10%

Table 2 Proportions of arrivals at London Luton Airport by Airline (full year 2019)

*Airlines operating more than 10 LLA flights per day #Rounded to nearest integer

4.2.3 The proposed effect will reduce the airspace complexity in the region, remove the current interdependency of LLA arrivals on Stansted's and vice-versa, decrease controller workload, reduce the likelihood of delay, and increase safety by design.

4.3 Operational efficiency, complexity, delays and choke points

4.3.1 The primary issue with this region is the 'designed-in' complexity of the combined arrival routes for LLA and Stansted.

4.3.2 The current airspace design has been fundamentally unchanged for many years, since before the low-fare carrier expansion and their associated subsequent growth. It forces LLA and Stansted, which are two of the five busiest airports in the UK, to share the same arrival flows, in a relatively small region north of London (if combined, the figures for LLA and Stansted would make it the second busiest in the UK).

4.3.3 The more complex the airspace, the greater the need for the airborne holding of arrivals when it gets busy, delaying and disrupting the travelling public.

4.3.4 Controllers take each aircraft from the shared flows towards the destination airport, descending them safely to their respective runways. This can be an intense task and is unique in the UK; arrival flows to most busy airports are separated, by airspace design, higher and further away.

4.3.5 LLA's and Stansted's arrival flows are shared until aircraft descend through c.8,000ft (around 25 miles from the airport), which is comparatively close and leaves little room for controllers to operate. Any arrival delay or disruption at one airport causes unnecessary arrival delay to the other, because the flows are so closely shared.

4.3.6 During periods where the workload of our air traffic controllers is predicted to become too intense, safety dictates that we apply temporary limits (known as flow restrictions) to the numbers of aircraft that a controller can manage, before safe limits are exceeded. This causes delay to the travelling public (at both LLA and Stansted), and is a short-term, temporary solution to the underlying problem.

4.3.7 The workload intensity typically happens in the vicinity of the LOREL and ABBOT holds. Arrivals at LOREL for Stansted have to head east towards ABBOT. Arrivals at ABBOT for LLA have to head west, towards and beneath LOREL. Departures from LLA and Stansted heading northwest have to traverse the area. Departures from Heathrow and London City heading northwest constrain LLA arrivals and departures. This is all simultaneous and the current system 'designs in' crossing flightpath complexity (all LLA and Stansted arrivals follow the same Standard Terminal Arrival Routes (STARs) to two shared holds).

4.3.8 We have identified that, unless we do something now, the intensity of air traffic control workload may become unsustainable for air traffic controllers in the longer term. This would make arrival delays and airborne holding more common, creating increased environmental impacts - including the aviation fuel burnt and greenhouse gases, such as CO_2.

4.3.9 The amount of air traffic has been impacted by the 2020 coronavirus pandemic, but the need to change the design of this airspace remains. We must ensure it is fit for purpose when traffic recovers to pre-pandemic levels, and we must allow for future growth in the region.

4.3.10 The efficiency of the region's system is limited by the current Sector Monitor Values (MV) for Luton and Stansted, which are inextricably linked without a changed design.

4.4 Safety issues

4.4.1 The main safety issue this proposal seeks to address is declared on our Statement of Need (see extract from Section 5 below):

NATS have conducted an internal safety survey on TC Essex sector, which has identified some latent risk within the sector. This report has been shared with the CAA. NATS would like to look at options to address the safety issues identified and also work with co-sponsor Luton Airport to improve capacity within the TC Essex sector.

Safety imperative identified within NATS safety report makes adherence to minimum timeline achievable under CAP 1616 process highly desirable.

4.4.2 The designed-in complexity described in paragraph 4.3 above is the cause of the safety issue that initiated this ACP.

4.5 Environmental issues

4.5.1 This proposal is not attempting to resolve environmental issues within the relevant areas of airspace, in the current operation.

4.5.2 Our efforts focus on the resolving the safety issue described above, while minimising noise impacts, increases in fuel use and consequential greenhouse gas emissions such as CO_2.

5. Statement of Need

5.1 The following text is extracted from the DAP1916 Statement of Need form (Ref 2).

Joint NATS (NERL) proposal with London Luton Airport Operations Ltd

Current Situation:

Inbound traffic to Luton and Stansted share Standard Arrival Routes and holding capacity at LOREL and ABBOT and is largely managed by a single Terminal Control sector, Essex Radar. As traffic levels at both airports have significantly increased, the complexity, (number of interactions within the sector) has also significantly increased. Continued growth is anticipated at both airports.

Issue or opportunity to be addressed and the cause:

NATS have conducted an internal safety survey on TC Essex sector, which has identified some latent risk within the sector. This report has been shared with the CAA. NATS would like to look at options to address the safety issues identified and also work with co-sponsor Luton Airport to improve capacity within the TC Essex sector.

Desired outcome:

A reduction in complexity, workload and delays in relation to arriving traffic at Luton and, as a consequence, Stansted.

Specific challenges:

Safety imperative identified within NATS safety report makes adherence to minimum timeline achievable under CAP 1616 process highly desirable.

This is a joint application sponsored by NATS and London Luton Airport meaning that all portions of the application require coordination, agreement and resource commitment by both parties.

5.2 This proposal is not part of the plan to deliver the Airspace Modernisation Strategy (Ref 14). It does not conflict with the plan.

6. Proposed Airspace Description

6.1 Objectives/Requirements for Proposed Design

6.1.1 The objectives for this proposed airspace change are:

- to reduce complexity in the northern London Terminal Manoeuvring Area (LTMA), specifically for LLA and Stansted arrivals;
- to resolve the latent risk within Terminal Control (TC) Essex.

6.1.2 The requirements for this proposal are:

- Separate LLA's arrival flows from Stansted's;
- Do not change other traffic flows (including LLA departures, Stansted arrivals and departures)

6.1.3 The Design Principles for this proposal are:

- DP1 Safety is the highest priority. Optimise the complexity of the TC Essex sector within the scope of this project.
- DP2 Environmental – Must meet the 3 aims of the NPSE, Air Navigation Guidance 2017 and all appropriate Government aviation policies, and updates thereof
- DP3 Technical – Minimise impacts on Ministry of Defence (MoD) United States Air Force Europe (USAFE) Lakenheath operations to a level acceptable to MoD
- DP4 Operational – Should not constrain the airport's capacity, providing the environmental objectives/ requirements have been met
- DP5 Technical – Minimise dependency of LLA's arrivals on those of Stansted Airport.
- DP6 Operational – Increase the predictability of LLA's arrivals

6.1.3 continued:

- DP7 Environmental – Should enable continuous descent from at least 7,000ft & facilitate continuous descent above that
- DP8 Environmental – Minimise the requirement to change future low altitude arrival flows within the next ten years
- DP9 Technical – There must be agreement between stakeholder Air Navigation Service Providers (ANSPs) that the design concept being progressed suits all operations: MoD (other than USAFE Lakenheath), MoD (USAFE Lakenheath), Stansted Airport, Cambridge Airport, Cranfield Airport
- DP10 Environmental – Should provide an equitable distribution of traffic where possible, through e.g. use of multiple routes, new route structures, options/mechanisms for respite
- DP11 Economic – Reduce fuel burn
- DP12 Economic – Minimise potential increases in fuel burn
- DP13 Environmental – Should avoid overflying the same communities with multiple routes, & take into account routes of other airports, below 7,000ft
- DP14 Operational – Should minimise tactical intervention by ATC below 7,000ft
- DP15 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 Flexible Use of Airspace (FUA) if possible

6.2 Proposed New Airspace/ Route Definition and Usage

Staffing requirements (presuming approval)

6.2.1 The following statements presume approval and subsequent implementation of this proposal.

6.2.2 A comprehensive Operational Conversion Training (OCT) activity is planned as part of the transition from the current to the proposed airspace arrangements and operating procedures. This activity will support the training and briefing of more than 200 operational controllers and support staff at the London Terminal Control operations room at Swanwick and for controllers and support staff in the visual control room (VCR) at London Luton Airport.

6.2.3 The briefing and training activities will enable these operational staff to operate the new airspace arrangements and associated change in procedures and the plan and its progress will be reviewed internally and by the CAA as part of their overall safety oversight and assurance responsibilities.

6.2.4 LLA is a 24-hour operation; appropriately qualified staff will be in place to manage the operation presuming approval and implementation.

Upper System

6.2.5 The Consulted arrival routes (STARs) and Final Design STARs are shown in the schematic opposite.

6.2.6 All shared Standard Arrival Routes (STARs) would be updated and separated, so LLA and Stansted arrivals would have their own exclusive routes.

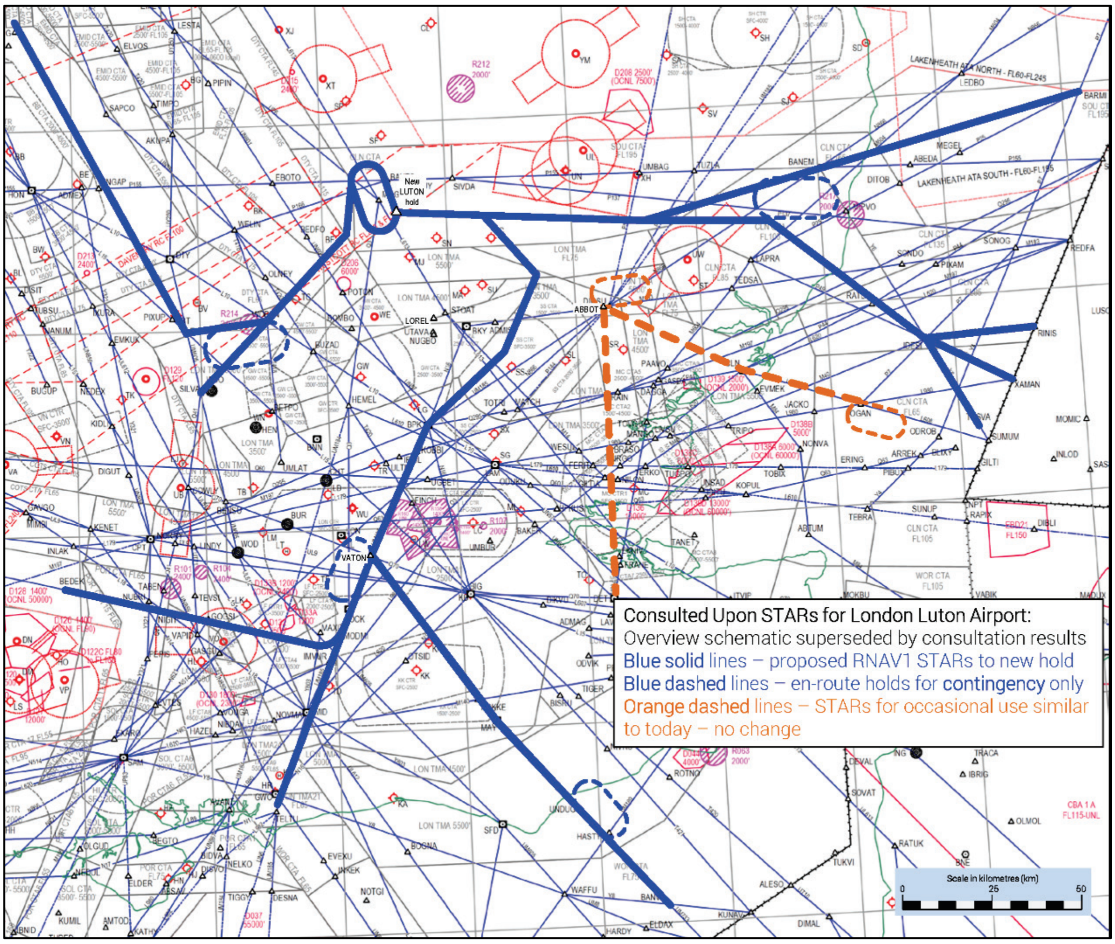
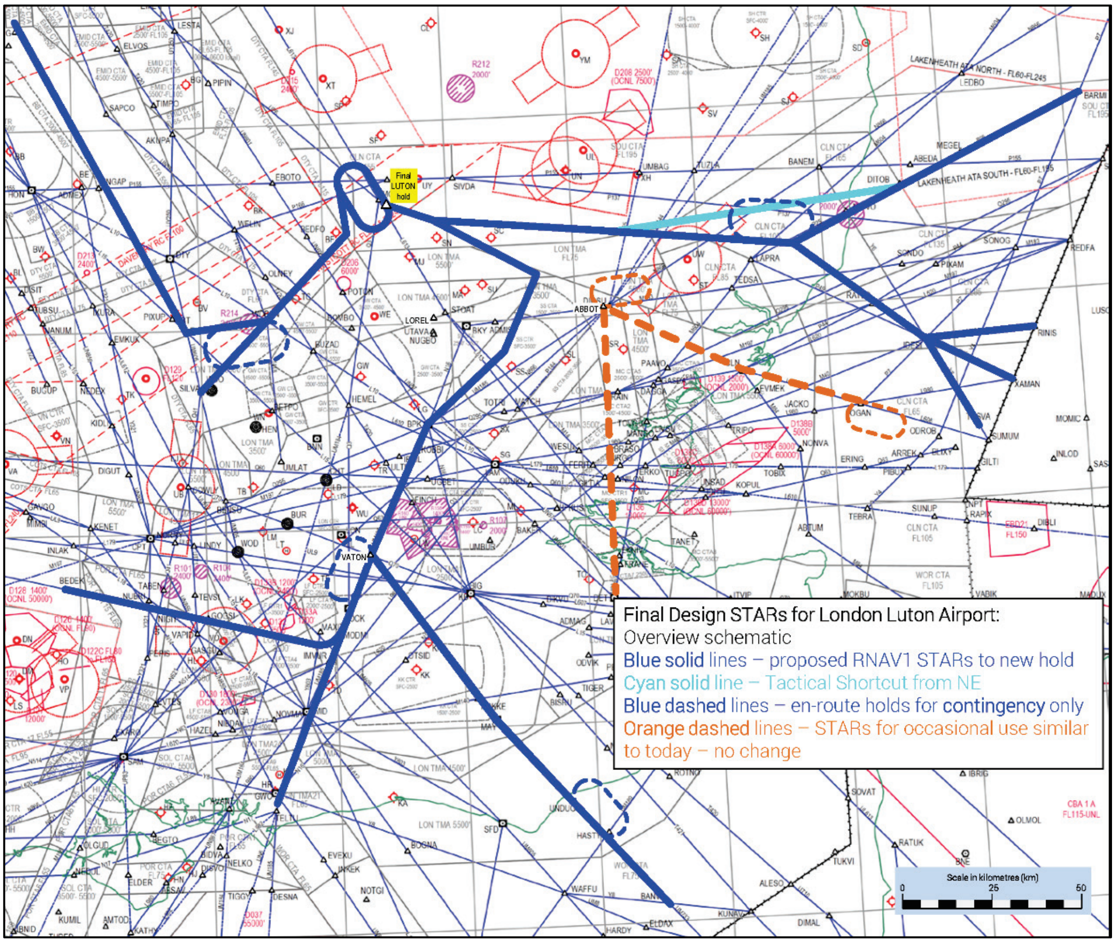


Figure 4 LLA STAR schematic as consulted (above), Final Design (below)



6.2.7 The proposed new hold would be located over Grafham Water, close to the junction of the A1 and the A14 west of Huntingdon. Following consultation, we have changed the availability of the lowest standard holding level from FL80 to FL90, retaining FL80 for contingency purposes only.

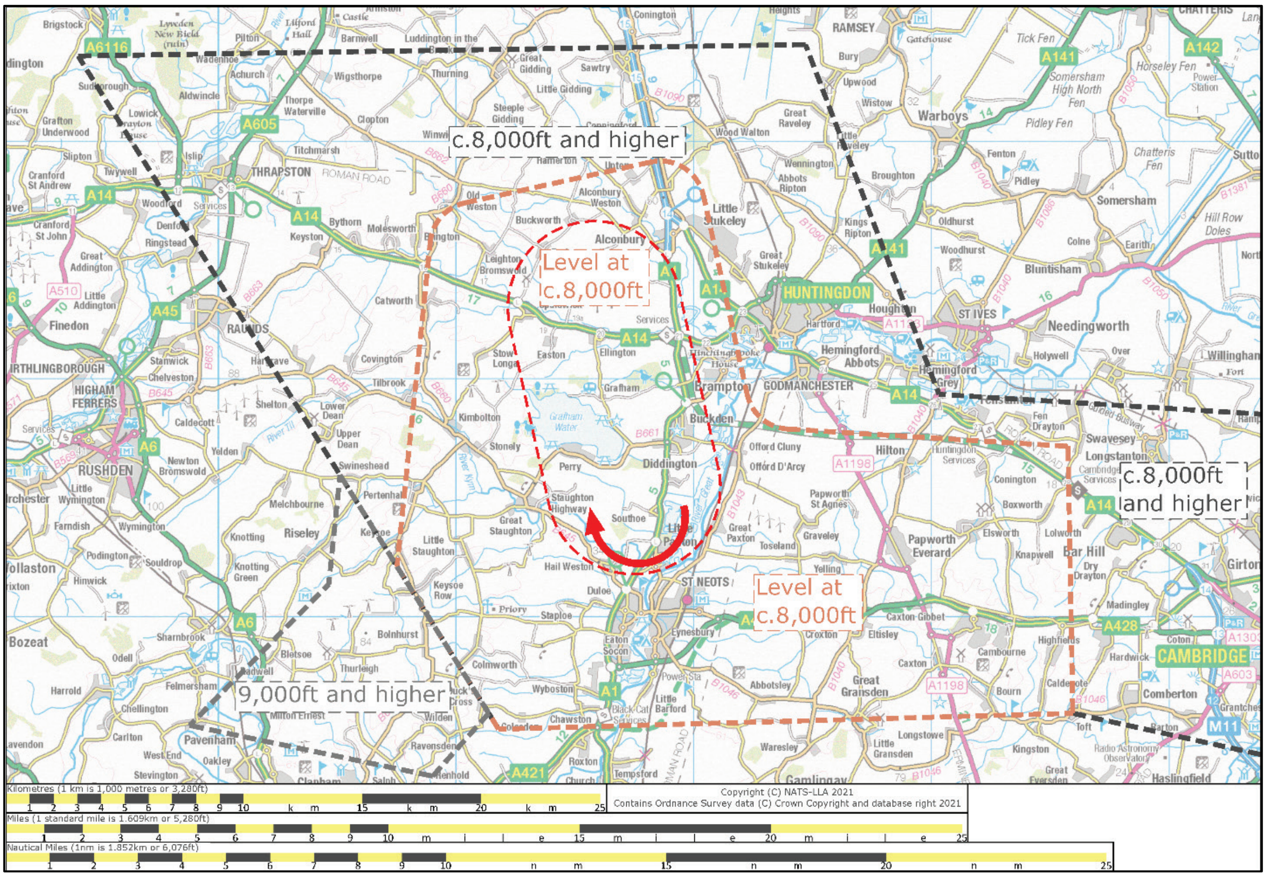
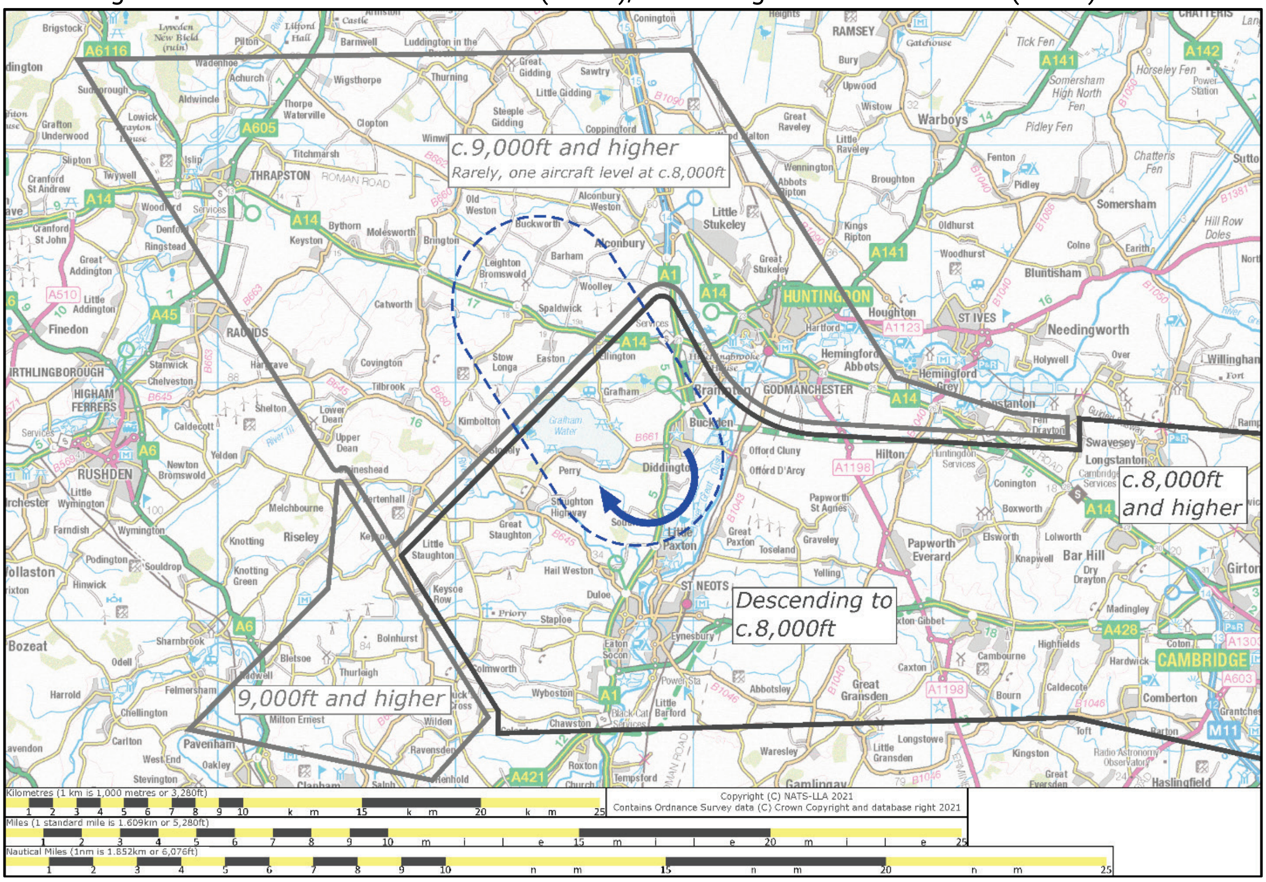


Figure 5 Consulted hold location FL80 (above), Final design hold location FL90 (below)



6.2.8 If the hold was active, the lowest would descend to FL90 with subsequent arrivals held above at 1,000ft intervals in DTY CTA21. When leaving the hold, aircraft would be instructed to descend to FL80 and head south. The line of descent from FL90 is illustrated in the lower diagram in Figure 5.

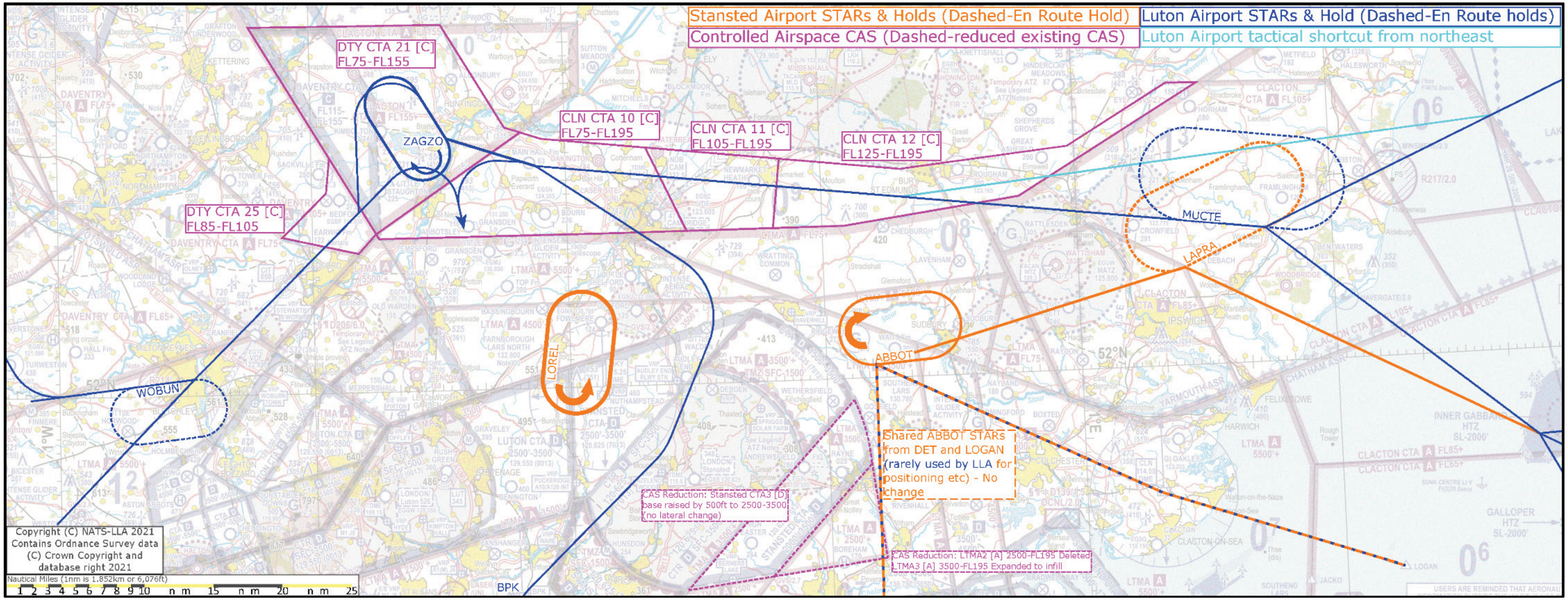


Figure 6 Upper System's Final Design CAS volumes with RNAV1 STARs, holds, and RNAV5 shared STARs

6.2.9 New controlled airspace (CAS) is needed to contain those routes and the hold. These CAS volumes were reduced in size where possible, to minimise impacts on other airspace users.

6.2.10 The proposed new LLA STARs are illustrated above by the blue lines. The cyan line is a tactical direct shortcut available for controllers to issue, should the traffic situation allow. The orange holds are currently shared between both airports, they would become dedicated to aircraft arriving at Stansted except for specific, rare scenarios (non-RNAV1 arrivals to LLA, and some intra-LTMA positioning flights) that would continue to flightplan via ABBOT.

6.2.11 One other Stansted STAR is shown via rarely-used en route hold LAPRA, illustrating the southern constraint on the proposed LLA STARs from the east.

6.2.12 The aircraft on all of these new blue STARs would descend from the cruise phase of flight to FL80, in CLN CTA10 or the southern half of DTY CTA21. Under pre-pandemic traffic conditions we expect aircraft to bypass the hold as illustrated by the blue arrows, and route them to the runway as described for the lower options later in this section.

6.2.13 The proposed upper airspace system is less likely to require holding, but some holding would still be necessary.

6.2.14 The increased efficiency of the system allows the current Sector Monitor Values (MV) for Luton and Stansted to be decoupled – this decoupling is impossible without a changed airspace design.

6.2.15 In so doing we estimate a delay avoidance of 10,200 minutes per year (2022) rising to 11,200 minutes per year (2032 without, or with, Luton's Development Consent Order DCO).

6.2.16 See Figure 7[3]. As aircraft are vectored south towards the runway, we expect them to behave as consulted, i.e. c.70% would be vectored in the new region between FL80-5,000ft, and below 5,000ft it is unlikely there would be a noticeable change. As stated in the consultation, c.30% would be given tactical shortcuts similar to those already issued as per the current (pre-pandemic) operation.

6.2.17 Note that, in the region between FL80-5,000ft, the greatest concentration is still expected to be between the black lines as per the consultation. However, the adjustment of the hold position and orientation has allowed for the potential widening of the spread across that black-lined area.

6.2.18 We estimated the greatest number of overflights per hour, and how they are likely to behave. (Noting that the coronavirus pandemic has temporarily reduced the numbers of flights in the UK and across Europe.) This illustrates the expected pattern of busiest hours and most likely proportions of vectored traffic vs shortcut traffic as volumes recover, and grow beyond, pre-pandemic levels.

Summer Flights	2022		2032 No DCO		2032 With DCO	
Daily range (Min-Max)	192-249		192-249		246 - 319	
Daily average	219		219		280	
Average Per Hour	9		9		12	
Expected Peak Per Hour	24		24		31	
Split between shortcuts and vectoring	Shortcut approx. 7	Vectors approx. 17	Shortcut approx. 7	Vectors approx. 17	Shortcut approx. 9	Vectors approx. 22
Likely Busiest hours	0700-0800, 1200-1300, 1800-1900, 2200-2300		0700-0800, 1200-1300, 1800-1900, 2200-2300		0700-0800, 1800-1900, 1900-2000, 2200-2300	

Table 3 Estimated number of LLA arrival flights per day & peak hour, split into shortcuts and vectoring

6.2.19 These are **indicative** figures for the **peak hour** (whichever runway is in use). This gives an indication of the greatest number of flights we expect to be experienced in an hour ('worst case' for overflight). Should air traffic recover from the effects of the coronavirus pandemic more slowly, then these numbers per day and per hour would be lower and the impacts would be lesser.

6.2.20 In the lower region as the aircraft cross the boundary southbound between CLN CTA10 and the current northern boundary of LTMA9, there would be no change to CAS in the region except to the reduction/release of two regions southeast of Stansted.

6.2.21 Stansted CTA3's base would raise by 500ft to 2,500ft, and LTMA2 (base 2,500ft) would be deleted, with LTMA3 (base 3,500ft) expanded to 'fill' the gap. This is technically slightly different from the Consultation Document paragraph 7.32. That paragraph stated that we would raise the base of LTMA2 from 2,500ft to 3,500ft contiguous with LTMA3, however in so doing, there could remain an unnecessary 'triangle' of CAS boundaries on aviation navigation charts. Our justification for this minor technical change is that exactly the same objectives will be achieved – a reduction in GA impacts in that region – but there would be fewer unnecessary lines on charts. In the interests of simplicity, we contend this is an improvement over the consultation statement with no negative impacts.

[3] These diagrams are from the Consultation Document (Ref 8) and show, in grey, the consulted hold and CAS outline (upper diagram in Figure 5) not the final design (lower diagram in Figure 5).

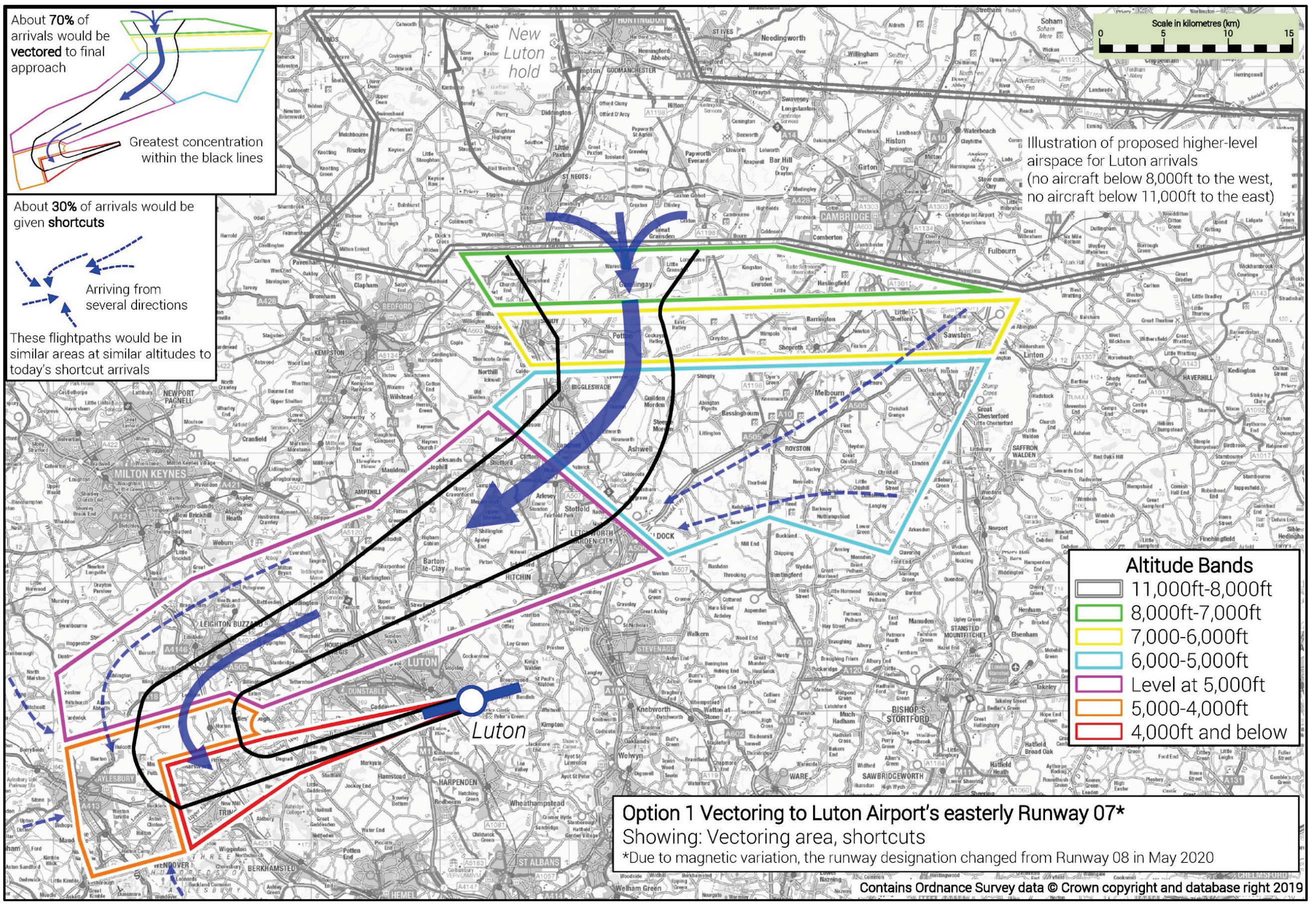
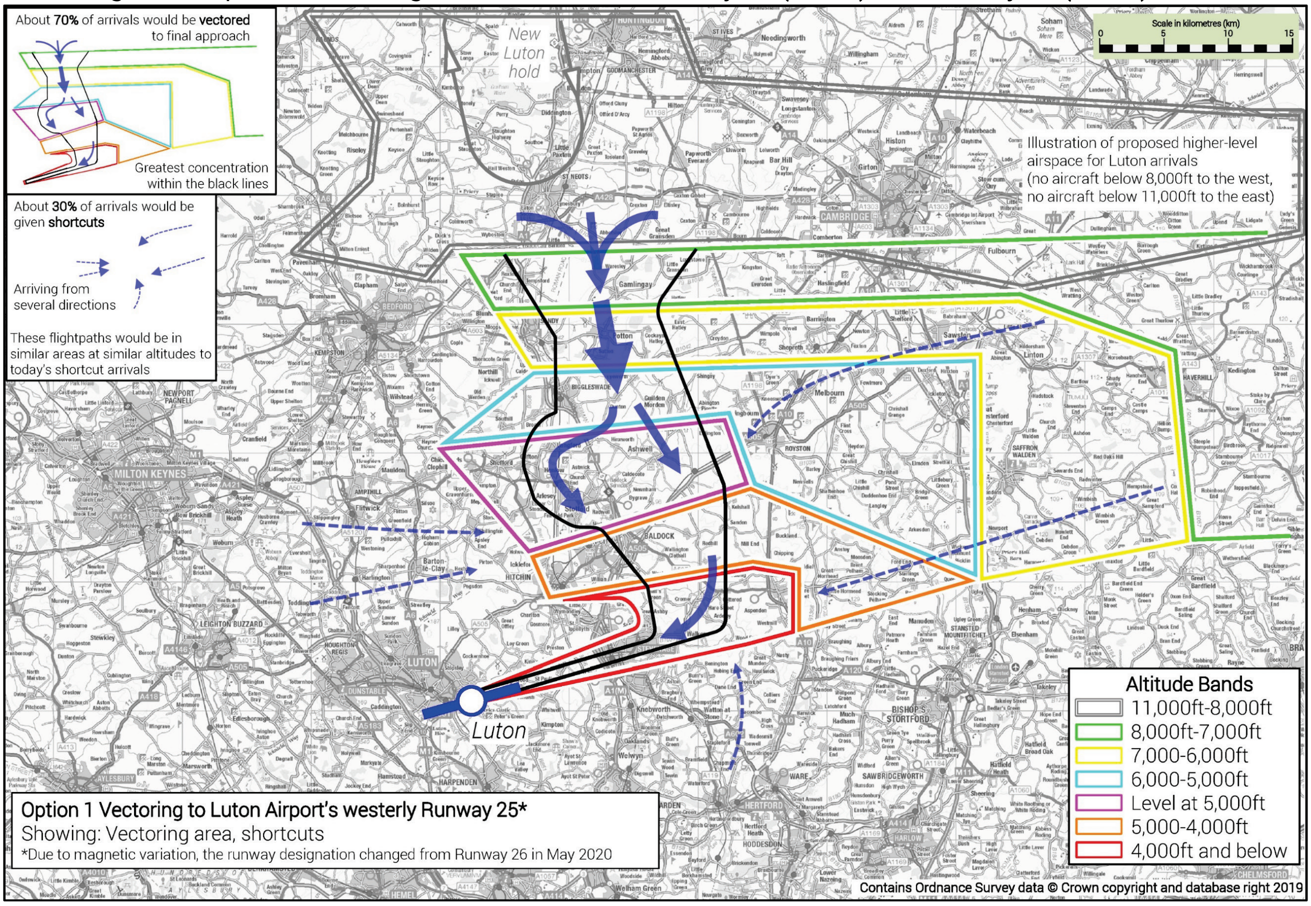


Figure 7 Expected Vectoring and Shortcuts for Runway 07 (above) and Runway 25 (below)



6.2.22 As noted in both the Consultation Document (Ref 8 p.57 paragraph 7.46-7.47) and the Step 4A Consultation Response Document (Ref 10D), pilots need to have routes available from the hold to the runway for use in emergency circumstances where communications with ATCOs is lost or disrupted, such as a failed radio. Pilots would only be able to fly these routes under extremely rare circumstances where it would be necessary for the pilot to self-navigate, unaided, to the runway.

6.2.23 PBN Routes 1 and 3 as described in the Consultation Document Section 5 Option 2 will be progressed, but would be used only under these rare contingency circumstances.

6.2.24 ATCO instruction documentation will ensure that, day-to-day, they will exclusively use the vectoring method.

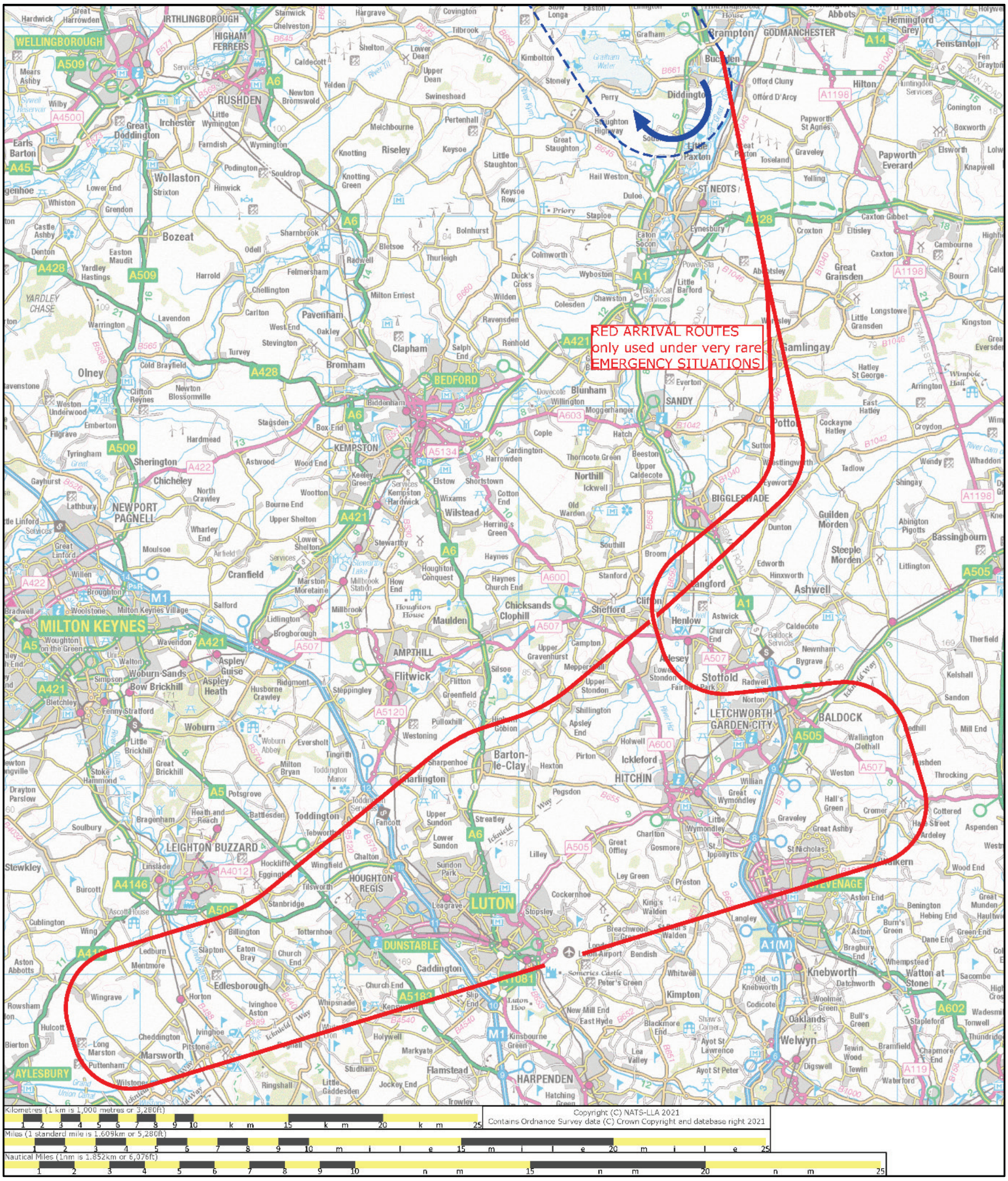


Figure 8 PBN Route1 (to Runway 07) and PBN Route 3 (S-bend, to Runway 25) – Emergencies only

6.2.25 The following lists summarise the main AIP design points under this proposal. See the separate Draft AIP Supplementary document (Sup 14) for full details.

Current	Proposed	Notes
TELTU 1L	TELTU 2L	New design increases validity indicator
LISTO 1L	LISTO 2L	New design increases validity indicator
BANVA 1L	UNDUG 1L	New design, from intermediate waypoint so validity indicator is 1
FINMA 1L	FINMA 2L	New design increases validity indicator
SILVA 1L	SILVA 2L	New design increases validity indicator
AVANT 1L	(withdrawn from LLA use)	AVANT STAR retained for Stansted traffic only, new route designator (see next table)
BEDEK 1L	BEDEK 2L	New design increases validity indicator
BARMI 2A	BARMI 1L	New design from same waypoint, the route indicator has changed to L so the validity indicator must be reset to 1
RINIS 1A	RINIS 1L	New design from same waypoint, the route indicator has changed to L so the validity indicator must be reset to 1
TOSVA 1A	TOSVA 1L	New design from same waypoint, the route indicator has changed to L so the validity indicator must be reset to 1
XAMAN 1A	XAMAN 1L	New design from same waypoint, the route indicator has changed to L so the validity indicator must be reset to 1
LOGAN 2A	(no change)	For rare non-RNAV1 arrivals from the east. Shared with Stansted.
DET 2A	(no change)	For rare non-RNAV1 arrivals from all other directions, and for some intra-LTMA positioning flights. Shared with Stansted.
ABBOT 1Z	(withdrawn from LLA use)	ABBOT stack swap to LOREL retained for Stansted traffic only, new route designator (see next table)
(new)	ZAGZO 1X	RNAV1 Transition to Runway 07 final approach (contingency only)
(new)	ZAGZO 1Y	RNAV1 Transition to Runway 25 final approach (contingency only)
Initial Approach Procedures ILS07 and ILS25 Without Radar Control	Initial Approach Procedures ILS07 and ILS25 Without Radar Control (from ABBOT only)	LOREL content removed Disambiguation that these IAPs are from ABBOT only
DTY CTA21 [C]	DTY CTA21 [C]	Lateral and vertical dimensions changed (Hold containment)
(new)	DTY CTA25 [C]	New CAS volume (FINMA, SILVA and LISTO 2L STAR containment)
(new)	CLN CTA10. [C]	New CAS volume (BARMI, RINIS, XAMAN, TOSVA, UNDUG 1L, TELTU, BEDEK 2L STAR containment, vectoring area for LLA arrival sequencing)
(new)	CLN CTA11[C]	New CAS volume (BARMI, RINIS, XAMAN, TOSVA 1L STAR containment)
(new)	CLN CTA12 [C]	New CAS volume (BARMI, RINIS, XAMAN, TOSVA 1L STAR containment, MUCTE en route hold containment)

Table 4 List of AIP changes relevant to London Luton Airport

Current	Proposed	Notes
TELTU 1L	TELTU 1E	Route indicator has changed to E so the validity indicator must be reset to 1
LISTO 1L	LISTO 1E	Route indicator has changed to E so the validity indicator must be reset to 1
BANVA 1L	BANVA 1E	Route indicator has changed to E so the validity indicator must be reset to 1
FINMA 1L	FINMA 1E	Route indicator has changed to E so the validity indicator must be reset to 1
SILVA 1L	SILVA 1E	Route indicator has changed to E so the validity indicator must be reset to 1
AVANT 1L	AVANT 1E	Route indicator has changed to E so the validity indicator must be reset to 1
BEDEK 1L	BEDEK 1E	Route indicator has changed to E so the validity indicator must be reset to 1
BARMI 2A	BARMI 1E	Route indicator has changed to E so the validity indicator must be reset to 1
RINIS 1A	RINIS 1E	Route indicator has changed to E so the validity indicator must be reset to 1
TOSVA 1A	TOSVA 1E	Route indicator has changed to E so the validity indicator must be reset to 1
XAMAN 1A	XAMAN 1E	Route indicator has changed to E so the validity indicator must be reset to 1
LOGAN 2A	LOGAN 2A	No change (shared with LLA)
DET 2A	DET 2A	No change (shared with LLA)
ABBOT 1Z	ABBOT 1E	Route indicator has changed to E so the validity indicator must be reset to 1
BPK 1X	BPK 1E	Route indicator has changed to E so the validity indicator must be reset to 1
BKY 1X	BKY 1E	Route indicator has changed to E so the validity indicator must be reset to 1
Stansted CTA3 [D]	Stansted CTA3 [D]	CAS base raised by 500ft, was 2000-3500 now 2500-3500, no lateral change
London TMA2 [A]	(withdrawn)	CAS volume deleted (see LTMA3 on next row of this table)
London TMA3 [A]	London TMA3 [A]	CAS volume expanded to infill the gap left by LTMA2 deletion.

Table 5 List of AIP changes relevant to London Stansted Airport

NB Stansted STARs also apply to Cambridge Airport. Cranfield Airport arrival procedures remain unchanged.

7. Impacts and Consultation

During Stage 1 of this process, 15 Design Principles (DPs) were set. These were defined in the Stage 1 Design Principles document (Ref 4) and copied into this document, paragraph 6.1.3 on p.13.

We created design concepts, evaluated them against the DPs, progressed some, rejected others, and refined the remaining designs into Design Option 1 and Option 2 ready for consultation.

The consultation ran from 19th Oct 2020 to 5th Feb 2021, a period of 15 weeks 5 days.

We executed all the consultation and engagement activities described in our Strategy Document (Ref 10), and targeted those stakeholders listed in Annex A of that document.

The Step 3D Collate and Review document (Ref 10A) provides a detailed summary of the consultation and engagement activities, and provides analysis of the feedback.

The Step 4A(i) Consultation Response document (Ref 10D) describes how that feedback was addressed and the final design refined from the consulted design.

7.1 Net impacts summary

Category	Impact	Evidence
Safety/Complexity	Safety benefit: reduced designed-in complexity and ATC workload due to separation of LLA arrivals from Stansted arrivals	See paragraphs 4.3 and 4.4
Capacity/Delay	Capacity increase with consequential delay reduction. Stansted and Luton Monitor Values (MV) can be decoupled due to changed airspace design. Delay avoidance of 10,200 minutes (2022) rising to 11,200 minutes (2032, without or with DCO)	See paragraphs 4.3.10 on page 12, and 6.2.14-6.2.15 on page 18
Fuel Efficiency/CO_2	Net disbenefit 2022: Fuel 1,932t CO_2 6,144t Net disbenefit 2032 without DCO: Fuel 1,310t CO_2 4,166t Net disbenefit 2032 with DCO: Fuel 1,330t CO_2 4,229t	See paragraph 7.6
Noise – Leq/SEL	Minimal change below 5,000ft, same overall vectoring concept. WebTAG assessment: 2022-2032 Without DCO £471,000 overall 10-year benefit 2022-2032 With DCO £572,000 overall 10-year benefit	See Paragraph 7.7
Tranquillity, visual intrusion (AONBs & National Parks)	Minimal change below 5,000ft, same overall vectoring concept. No change in impacts on Chilterns AONB.	See Paragraph 7.7
Local Air Quality	No changes below 1,000ft, no change in impacts.	See Paragraph 7.7
Other Airspace Users	This proposal would introduce new routes and volumes of Class C airspace at and above FL75. All affected users and stakeholders have been engaged and consulted with.	See Paragraphs 7.2 to 7.5

Table 6 Net Impacts Summary

7.2 Units affected by the proposal

DP9 stated that there must be agreement between stakeholder ANSPs that the design concept being progressed suits all operations, and lists the following ATC unit stakeholders:
MoD (other than USAFE Lakenheath), MoD (USAFE Lakenheath), Stansted Airport, Cambridge Airport, Cranfield Airport.

7.3 Military impact and consultation

7.3.1 MoD (other than USAFE Lakenheath):
During the consultation the MoD's Defence Airspace and Air Traffic Management (DAATM) representative identified RAF Wittering and 78 Sqn Swanwick (Military) as needing engagement sessions. We engaged each unit directly.

7.3.2 Some of RAF Wittering's operations would be negatively impacted by this proposal. We discussed an airspace sharing arrangement, however RAF Wittering declined due to the type of operations impacted. For the time being, RAF Wittering is content to avoid the new volumes of CAS. The offer to reopen discussions was mutually agreed should Wittering reconsider, in light of experience with the new CAS volumes (presuming approval and implementation).
For more details see Step 4A Consultation Response document (Ref 10D) paragraph 9.12.

7.3.3 Swanwick (Military) would be partially impacted by the proposal and have agreed, in principle, with a draft Letter of Agreement (LoA) setting out how we will mitigate the impacts of this ACP on their DTY Corridor operation.
For more details see Step 4A Consultation Response document (Ref 10D) paragraph 9.13.

7.3.4 MoD (USAFE Lakenheath, includes Mildenhall as a combined ATC operation):
USAFE operations would be negatively impacted by this proposal. We have continuously engaged with USAFE from Stage 1 of this proposal and have both visited their air base and held regular update sessions to work through details, including two sessions during and two post-consultation. USAFE, via DAATM, have agreed in principle with a draft LoA setting out how we will mitigate the impacts of this ACP on their airways arrivals and departures, along with further modifications made to CAS volumes to minimise impacts on their other operations outside CAS.
For more details see Step 4A Consultation Response document (Ref 10D) paragraph 9.11.

7.4 General Aviation (GA) airspace users impact and consultation

7.4.1 DP15 stated that we should 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.

7.4.2 We engaged GA representative organisations via the National Air Traffic Management Advisory Committee (NATMAC) and other organisations identified in the Consultation Strategy document (Ref 10).

7.4.3 We offered meetings and held engagement sessions with the General Aviation Alliance, Airspace4All, British Gliding Association, London Gliding Club, East Anglian Rocketry Society, National Flying Laboratory Cranfield and Cranfield ATC, British Skydiving and Old Warden (Shuttleworth Collection).

7.4.4 We also held a public webinar dedicated to the GA community.

7.4.5 In addition to general feedback regarding reducing the need for CAS and the planned reduction/removal of CAS southeast of Stansted Airport (both of which we will action), the following engagements led to mitigating LoAs:

- National Flying Laboratory Cranfield (NFLC) and Cranfield ATC:
  NFLC's representative made themselves known during the public GA webinar and we offered a private engagement session. NFLC's operation would be impacted by the proposed CAS volume DTY CTA21. Following this engagement session and follow-up contact, NFLC and Cranfield ATC have agreed in principle with a draft LoA regarding an airspace sharing arrangement in that area, mitigating the impacts of this ACP on their operation. For more details see Step 4A Consultation Response document (Ref 10D) paragraph 9.15.

- East Anglian Rocketry Society EARS:
  EARS' operations would be impacted rarely, by the proposed CAS volume CLN CTA10. We engaged EARS as part of our Stage 2 stakeholder engagement. We held another engagement session with EARS during the consultation. Following this engagement session and follow-up contact, EARS has agreed in principle with a draft LoA regarding an airspace sharing arrangement in that area, mitigating the impacts of this ACP on their operation. For more details see Step 4A Consultation Response document (Ref 10D) paragraph 9.17.

The following engagement provided valuable feedback but did not require LoA mitigating actions:

7.4.6 London Gliding Club and British Gliding Association:
Under Stage 2 we visited LGC and learnt about their operation. We held an engagement session with LGC and their parent national organisation during the consultation. The primary focus of both stakeholders was the small diamond-shaped CAS volume specifically required under Option 2, for CAS containment of proposed PBN Route 2 to LLA's Runway 07, due to the negative impact it would have on LGC. Page 56 of the Consultation Document (Ref 8 paragraphs 7.40-7.41 and Figure 23) was dedicated to the impacts and suggested mitigating LoA for LGC's operation.

Their contribution, combined with other factors, led us to not progress Option 2, so that specific diamond-shaped CAS volume was therefore not progressed.

7.4.7 Overall GA engagement led us to further minimise CAS volumes as per paragraph 9.19 of the Step 4A Consultation Response document (Ref 10D).

7.4.8 Below FL75, where the vast majority of GA fly, there is no increase due to this proposal, which in fact provides an 88nm^2 **reduction** in CAS due to the raising of CAS bases southeast of Stansted.

7.4.9 The Final Design CAS total lateral area is 10% smaller than those on which we consulted (Option 1A area 424nm^2 vs Option 1 area 473nm^2, both excluding the low-altitude reduction described above).

7.5 Commercial air transport impact and consultation

7.5.1 As per paragraph 7.2 above, DP9 specifies Stansted Airport and Cambridge Airport (with Cranfield airport discussed in paragraph above). Stansted supports this proposal and Cambridge Airport has agreed in principle to an amended LoA, ensuring the continuance of an effective operational relationship.

7.5.2 DP11 (reduce fuel burn) could not be achieved, however we can relate consultation feedback to DP12 (minimise potential increases in fuel burn) from an aircraft operator point of view.

7.5.3 NATS has engaged and consulted directly with airline operators who were identified as being relevant carriers within the associated area of airspace; these are listed in Annex A of the Step 3A Consultation Strategy document (Ref 10).

7.5.4 Three airlines operating at LLA responded to this consultation: EasyJet, TUi and Ryanair which operates at both LLA and Stansted. One airline (Jet2), operating at Stansted but not LLA, also responded. Three executive jet operators at LLA responded: NetJets, London Executive Aviation Lux UK and Signature.

7.5.5 Most operators (5 of 7) expressed a preference for Option 2 in order to exploit the modern technology already employed in most aircraft. One had no preference, with the other stating that Option 1 would have greater flexibility. Predictability and reduced complexity, enhancing safety, were also relevant factors.

7.5.6 Two responses concerned fuel use, with one explicitly disappointed that the proposal would cause negative fuel impacts and associated carbon disbenefits. Others included the desire for aircraft speeds to be managed via Continuous Descent Approaches (CDA), where speed limits should be designed to minimise fuel use and reduce ground noise impacts due to idling engines.

7.5.7 The British Airline Pilots Association (BALPA) response preferred Option 2 to make the best use of aircraft technology and supported the proposal in general due to the separation of holding areas with the increased predictability and consistency this would enable.

7.5.8 All consultation feedback is summarised in the Stage 3 Step 3D Consultation Feedback Report and Technical Compliance Supplement (Ref 10A) and the action we took on that feedback can be found in the Stage 4 Step 4A(i) Consultation Response Document (Ref 10D).

7.5.9 There is no forecast increase in air transport movements, passenger numbers or cargo carried as an outcome of this proposal.

7.6 CO_2 environmental analysis impact and consultation

7.6.1 The virtual exhibition and public engagement webinars helped inform participants on the need for the separation of traffic, which lengthened some routes causing a fuel/CO_2 disbenefit. These engagement exercises led to informed feedback on the subject.

7.6.2 Engagement with airline operators (see above) also helped inform their consultation responses.

7.6.3 All the changes leading to the final airspace design, known as Option 1A, were driven by the results of the consultation and engagement as described in Step 3D Consultation Feedback Report (Ref 10A) and Step 4A(i) Consultation Response document (Ref 10D).

7.6.4 Compared with the consulted Option 1, Option 1A causes a reduced fuel and CO_2 disbenefit due to the consultation-led adjustments to the routes, the raised standard hold FL, and the increased vectoring space in that region. It also causes a benefit to Stansted arrivals due to reduced likelihood of holding.

7.6.5 Two sets of data are provided: Without LLA's DCO, and With LLA's DCO.

Net disbenefit 2022:	Fuel 1,932t	6,144t CO_2e
Net disbenefit 2032 without DCO:	Fuel 1,310t	4,166t CO_2e
Net disbenefit 2032 with DCO:	Fuel 1,330t	4,229t CO_2e

Table 7 CO_2 analysis

7.6.6 A UK government transport analysis, known as 'WebTAG', has been completed in order to quantify the monetary value of the impact on the environment due to greenhouse gas emissions (specifically using CO_2e as the measure).
Details of the WebTAG results are given in the Step 4A(iii) Final Options Appraisal (Ref 10C).

7.7 Local environmental impacts and consultation

7.7.1 The virtual exhibition and ten public engagement webinars helped inform participants on the need for the separation of traffic, which meant flightpaths needed to change above 5,000ft. We also engaged in private webinars with local authority representatives and Members of Parliament. These engagement exercises led to informed feedback on the subject.

7.7.2 All the changes leading to the final airspace design, known as Option 1A, were driven by the results of the consultation as described in Step 3D Consultation Feedback Report (Ref 10A) and Step 4A(i) Consultation Response document (Ref 10D). As explained in that document, the decision to use a modified Option 1 vectoring concept means that there would be minimal change to arrivals below 5,000ft, and an increased likelihood of dispersal above 5,000ft following the hold adjustment/increase in standard minimum FL and adjustment of STARs. The hold adjustment/increase in standard minimum FL also reduces the noise impacts on the towns of St Neots and Huntingdon as per consultation feedback.

7.7.3 This means the noise analysis used in the Consultation Document (Ref 8) and the Stage 3 Full Options Appraisal (Ref 9) remains valid, as the noise analysis typically accounts for impacts up to 4,000ft.

7.7.4 A UK government transport analysis, known as 'WebTAG', has been completed in order to quantify the monetary value of the impact on the environment due to noise.

7.7.5 WebTAG results summary:

2022-2032 Without DCO	£471,000 overall 10-year benefit
2022-2032 With DCO	£572,000 overall 10-year benefit

Tranquillity, visual intrusion, AONB, National Parks

7.7.6 No change in impacts on the Chilterns AONB. Flightpaths and altitudes of aircraft using the Option 1-concept of vectoring would be comparable to current (pre-pandemic) flightpaths and altitudes.

Local air quality

7.7.7 In accordance with the ANG2017 (Ref 15), there would be no changes to flightpaths below 1,000ft, therefore no change in local air quality impacts.

7.7.8 Details of all the above are given in the Step 4A(iii) Final Options Appraisal (Ref 10C).

7.8 Economic impacts

7.8.1 On average, each LLA arrival's fuel costs would increase by c.£12 (without DCO) or £10 (with DCO). This is a significant reduction of c.£20 (without DCO) or £19 (with DCO) compared with the consulted design. Stansted arrivals would save between c.£2 (without DCO) or £4 (with DCO), all based on IATA jet fuel costs and USD/GBP currency rates frozen at February 2020 values, to allow direct comparison with the Stage 3 Full Options Appraisal (Ref 9).

7.8.2 The cost-benefit analysis of the final design proposal results in a negative Net Present Value NPV of c.£10.9m over the ten year period 2022-2032, without or with LLA's DCO. This NPV is a combination of all monetised costs including the economic impacts of greenhouse gas emissions and the effects of noise on health and amenity (Government WebTAG assessments, see Sup 16). This is a significant reduction of c.£17m (without DCO) or c£19m (with DCO) compared with the consulted design.

7.8.3 Details of the above are given in the Step 4A(iii) Final Options Appraisal (Ref 10C).

7.8.4 All the changes leading to the final airspace design, known as Option 1A, were driven by the results of the consultation as described in Step 3D Consultation Feedback Report (Ref 10A) and Step 4A(i) Consultation Response document (Ref 10D).

8. Analysis of Options

8.1 At Stage 1 we developed 15 Design Principles via engagement with representative stakeholder groups.

8.2 At Stage 2 we developed 5 Upper Design Options and 9 Lower Design Options, via further engagement with the same representative stakeholder groups. We evaluated each Design Option and rejected those that did not best meet the Design Principles.

Of those that were accepted, we conducted an Initial Options Appraisal (Ref 7) and stated that some or all Design Options could be combined into systems of options for the next stage.

8.3 At Stage 3 we developed a documentation set for consultation that was approved by the CAA. This included a Full Options Appraisal (Ref 9). We held a 15-week consultation on two combined systems of options, which we named Option 1 Vectoring, and Option 2 PBN Routes with Vectoring.

Option 1 Vectoring sought to establish a new airborne hold, or stack, for LLA arrivals, with associated airspace and air routes, above approximately 8,000ft. From that new hold, the method air traffic controllers use to bring arrivals from 8,000ft to the runway would be similar to today – providing each aircraft with heading, descent and speed instructions, manually managing each flight (known as vectoring). This reduces complexity and minimises the change from today's flightpaths at lower altitudes.

Option 2 PBN Routes with Vectoring also sought to establish a new airborne hold, or stack, for LLA arrivals, with associated airspace and air routes, at 8,000ft and above. From that new hold, air traffic controllers would still use the vectoring method described in the first option, to descend aircraft to the runway. However, there would also be a number of predetermined arrival flightpaths which pilots could be instructed to fly, their aircraft could fly them automatically and without intervention by controllers. These predetermined arrival flightpaths would reduce air traffic complexity even more than the first option, making this our preferred option.

We provided comprehensive material including a virtual exhibition hall, hosted ten video conferences for the general public to watch a presentation then interact and ask questions of the host and expert panel. All ten were recorded and are available for repeat viewing in the virtual exhibition hall.

We held private video conferences with other stakeholders such as MPs, a variety of General Aviation representative groups, the Ministry of Defence, local councils, nearby airports, and air operators using this region's airspace.

We received over 2,400 responses to the consultation. We analysed the responses, summarised and categorised them all. We drew conclusions from the analysis, and developed actions for the next stage, based on those conclusions.

We published our Step 3D Consultation Feedback Report explaining the above.

8.4 At Stage 4 we analysed all the disparate design change suggestions and summarised them into specific recommendations.

We explained how each recommendation could be acted upon, and the influence it would have on the final design.

We changed elements of the airspace design in accordance with the recommendations, unless recommendations could not be acted upon, and we explained why in the Step 4A Consultation Response Document (Ref 10D).

We also published the Final Design technical map (with switchable data layers, Ref 10B), and Final Options Appraisal document (Ref 10C). The latter document compares the consulted design with the modified design and concludes that the modified design should progress.

9. Airspace Description Requirements

	The proposal should provide a full description of the proposed change including the following:	Description for this proposal
a	The type of route or structure; for example, airway, UAR, Conditional Route, Advisory Route, CTR, SIDs/STARs, holding patterns, etc	PBN Routes, CAS volumes, STARs, Holds (paragraph 6.2 from page 14) See Figure 4 (lower), Figure 6, Figure 7 and Figure 8 for proposal schematics.
b	The hours of operation of the airspace and any seasonal variations	The proposed airspace change would need to be applied H24. See paragraph 6.2.4 on page 14.
c	Interaction with domestic and international En-route structures, TMAs or CTAs with an explanation of how connectivity is to be achieved. Connectivity to aerodromes not connected to CAS should be covered	See Figure 4 (lower) and Figure 6 for ATS route schematics. See Final Airspace Design (Ref 10B). Such connectivity has been covered (paras 7.3.4, 7.4.5, 7.5.1)
d	Airspace buffer requirements (if any). Where applicable describe how the CAA policy statement on 'Special Use Airspace – Safety Buffer Policy for Airspace Design Purposes' has been applied.	Not Applicable. There are no volumes of SUA within the airspace where change is being proposed.
e	Supporting information on traffic data including statistics and forecasts for the various categories of aircraft movements (passenger, freight, test and training, aero club, other) and terminal passenger numbers	See paragraph 4.2 on page 11 and Stage 3 Full Options Appraisal (Ref 9 section 6).
f	Analysis of the impact of the traffic mix on complexity and workload of operations	Separating the Luton and Stansted arrival flows reduces complexity. See paragraph 7.1 on page 22 and Full Options Appraisal (Ref 10C)
g	Evidence of relevant draft Letters of Agreement, including any arising out of consultation and/or airspace management requirements	Paras 7.3.3, 7.3.4, 7.4.5, 7.5.1 Draft LoAs (Sup 06, 07, 08, 09, 10)
h	Evidence that the airspace design is compliant with ICAO Standards and Recommended Practices (SARPs) and any other UK policy or filed differences, and UK policy on the Flexible Use of Airspace (or evidence of mitigation where it is not)	See Figure 6, Figure 7 and Figure 8 for ATS route schematics. FUA was considered throughout the proposal (see row above). See RSAD (Sup 03) for evidence of CAP1385 compliance. STARs and holds comply with relevant PANS-OPS.
i	The proposed airspace classification with justification for that classification	All new CAS is proposed as Class C. See paragraph 6.2 on page 14 and Figure 6. Some CAS would be reclassified to Class G airspace. See Stage 4 Consultation Response Doc (Ref 10D) para 9.18-9.19.
j	Demonstration of commitment to provide airspace users equitable access to the airspace as per the classification and where necessary indicate resources to be applied or a commitment to provide them in line with forecast traffic growth. 'Management by exclusion' would not be acceptable	See rows g and i above. NATS commits to provide the same level of access post-implementation in line with forecast growth.
k	Details of and justification for any delegation of ATS	Not applicable. No ATS delegation is proposed.

10. Safety Assessment

NATS has a dedicated safety manager for the SAIP project. Their role is to assess the scale of each airspace change, to ensure the CAA-compliant NATS Safety Management System is followed. Also, their role is to submit safety arguments with supporting evidence to the CAA's En-route safety regulator, to clearly demonstrate each airspace change is acceptably safe for implementation and the right assurances are in place.

The NATS safety manager has assessed the SAIP AD6 proposed change. Due to the drivers for change[4] and the scale of the project the full Safety Assurance process was applied in accordance with the NATS Safety Management Manual (SMM).

As part of the ongoing safety work for SAIP AD6, a full safety analysis was conducted which will result in the production of a Project Safety Assurance Report (PSAR) and Human Factors Assurance Report (HFAR). These documents are technical in nature and are designed to be read by experts in the field of aviation safety with full contextual awareness of the contents. These documents are confidential and would not be published as part of the airspace change process. A Hazard ID Summary Report is supplied (Sup 02), this fulfils the ACP requirement in advance of the wider safety evidence work directly coordinated between SARG and NATS.

The post-consultation design changes (described in this document) would have no impact on this subject. The following text is the same as that submitted for Stage 3 Full Options Appraisal (Ref 9) and has also been copied into Stage 4 Step 4A(iii) Final Options Appraisal (Ref 10C):

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

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

[4] See statement of Need (Ref 2)

11. Operational Impact

	An analysis of the impact of the change on all airspace users, airfields and traffic levels must be provided, and include an outline concept of operations describing how operations within the new airspace will be managed. Specifically, consideration should be given to:	Evidence of compliance/ proposed mitigation
a	Impact on IFR General Air Traffic (GAT) and Operational Air Traffic (OAT) or on VFR General Aviation (GA) traffic flow in or through the area	For IFR GAT impact see paragraph 4.2.1 on page 11, paragraph 7.1 on page 22 and paragraph 7.5 on page 24. For IFR OAT impact see paragraph 7.3.3 on page 23. For GA impact see paragraph 7.4 on page 23. Further detail available in Full Options Appraisal (Ref 10C).
b	Impact on VFR operations (including VFR routes where applicable);	Paragraph 7.4 on page 23.
c	Consequential effects on procedures and capacity, i.e. on SIDs, STARs, and/or holding patterns. Details of existing or planned routes and holds	See paragraph 6.2 on page 14 for full description, with paras 6.2.14-6.2.15 describing capacity. For further details on impacts see paragraph 7.1 on page 22 and the Full Options Appraisal (Ref 10C).
d	Impact on aerodromes and other specific activities within or adjacent to the proposed airspace	For impacts on adjacent aerodromes see paragraph 7.2, 7.3 and 7.4 from page 23. See Draft LoAs with relevant aerodromes, (Sup 06, 07, 08, 09, 10).
e	Any flight planning restrictions and/or route requirements	LLA expects arrivals to be RNAV1 compatible, with infrequent RNAV5 arrivals routing via ABBOT only (see Figure 6 p.17). Appropriate RAD/SRD action will be taken.

12. Supporting Infrastructure/ Resources

	General requirements	Evidence of compliance/ proposed mitigation
a	Evidence to support RNAV and conventional navigation as appropriate with details of planned availability and contingency procedures	See RNAV coverage report Sup 12
b	Evidence to support primary and secondary surveillance radar (SSR) with details of planned availability and contingency procedures	See Surveillance coverage report Sup 13
c	Evidence of communications infrastructure including R/T coverage, with availability and contingency procedures	See Air -Ground-Air radio coverage report Sup 11
d	The effects of failure of equipment, procedures and/or personnel with respect to the overall management of the airspace must be considered	Existing contingency procedures and management protocol will continue to apply as today.
e	Effective responses to the failure modes that will enable the functions associated with airspace to be carried out including details of navigation aid coverage, unit personnel levels, separation standards and the design of the airspace in respect of existing international standards or guidance material	As above (12d)
f	A clear statement on SSR code assignment requirements	No change
g	Evidence of sufficient numbers of suitably qualified staff required to provide air traffic services following the implementation of a change	See paragraph 6.2.2 and 6.2.3 on page 14 where we described the need to train c.200 operational controllers and support staff, presuming the approval and implementation of this proposal. This training will be complete in good time for the planned implementation date.

13. Airspace and Infrastructure

	General requirements	Evidence of compliance/ proposed mitigation
a	The airspace structure must be of sufficient dimensions with regard to expected aircraft navigation performance and manoeuvrability to fully contain horizontal and vertical flight activity in both radar and non-radar environments	See paragraph 6.2.9 on page 17 and RSAD (Sup 03) for CAS containment and route separation considerations.
b	Where an additional airspace structure is required for radar control purposes, the dimensions shall be such that radar control manoeuvres can be contained within the structure, allowing a safety buffer. This safety buffer shall be in accordance with agreed parameters as set down in CAA policy statement 'Safety Buffer Policy for Airspace Design Purposes Segregated Airspace'. Describe how the safety buffer is applied, show how the safety buffer is portrayed to the relevant parties, and provide the required agreements between the relevant ANSPs/ airspace users detailing procedures on how the airspace will be used. This may be in the form of Letters of Agreement with the appropriate level of diagrammatic explanatory detail.	Request for reduced CAS containment of 2NM– see RSAD (Sup 03).
c	The Air Traffic Management system must be adequate to ensure that prescribed separation can be maintained between aircraft within the airspace structure and safe management of interfaces with other airspace structures	See paragraph 6.2 on page 14. See RSAD (Sup 03) for evidence of CAP1385 compliance.
d	Air traffic control procedures are to ensure required separation between traffic inside a new airspace structure and traffic within existing adjacent or other new airspace structures	See paragraph 6.2 on page 14. See RSAD (Sup 03) for evidence of CAP1385 compliance. See item b above.
e	Within the constraints of safety and efficiency, the airspace classification should permit access to as many classes of user as practicable	Proposed CAS volumes are Class C which allows for VFR access.
f	There must be assurance, as far as practicable, against unauthorised incursions. This is usually done through the classification and promulgation	Proposed CAS volumes are Class C. Promulgation via the normal AIRAC cycle.
g	Pilots shall be notified of any failure of navigational facilities and of any suitable alternative facilities available and the method of identifying failure and notification should be specified	Existing contingency procedures would continue to apply.
h	The notification of the implementation of new airspace structures or withdrawal of redundant airspace structures shall be adequate to allow interested parties sufficient time to comply with user requirements. This is normally done through the AIRAC cycle	This change will be promulgated by AIRAC as per the typical cycle schedule.
i	There must be sufficient R/T coverage to support the Air Traffic Management system within the totality of proposed controlled airspace	See Air -Ground-Air radio coverage report Sup 11
j	If the new structure lies close to another airspace structure or overlaps an associated airspace structure, the need for operating agreements shall be considered	See Draft LoAs (Sup 06, 07, 08, 09, 10). Other procedures and operating agreements will be implemented as per CAA-approved MATS Part 2.
k	Should there be any other aviation activity (low flying, gliding, parachuting, microlight site, etc) in the vicinity of the new airspace structure and no suitable operating agreements or air traffic control procedures can be devised, the change sponsor shall act to resolve any conflicting interests	Should this occur, we would act appropriately and expeditiously.
	ATS route requirements	Evidence
a	There must be sufficient accurate navigational guidance based on in-line VOR/DME or NDB or by approved RNAV derived sources, to contain the aircraft within the route to the published RNP value in accordance with ICAO/ Eurocontrol standards	Primarily we would expect flights to use GNSS navigation to RNAV1 standards. See RNAV coverage report Sup 12
b	Where ATS routes adjoin terminal airspace there shall be suitable link routes as necessary for the ATM task	See paragraph 6.2 on page 14.
c	All new routes should be designed to accommodate P-RNAV navigational requirements	Proposed new STARs and transitions are all RNAV1. See Figure 4 on page 15 and Table 4 on page 21.
	Terminal airspace requirements	Evidence
a	The airspace structure shall be of sufficient dimensions to contain appropriate procedures, holding patterns and their associated protected areas	See paragraph 6.2.9 on page 17 and RSAD (Sup 03) for CAS containment and route separation considerations.
b	There shall be effective integration of departure and arrival routes associated with the airspace structure and linking to designated runways and published instrument approach procedures (IAPs)	New IAPs see Figure 8 and paras 6.2.22-6.2.24 These are only expected to be used in emergency situations.
c	Where possible, there shall be suitable linking routes between the proposed terminal airspace and existing En-route airspace structure	STARs as per Figure 4 (lower) and para 6.2.25
d	The airspace structure shall be designed to ensure that adequate and appropriate terrain clearance can be readily applied within and adjacent to the proposed airspace	No terrain clearance issues, lowest new CAS FL75.
e	Suitable arrangements for the control of all classes of aircraft (including transits) operating within or adjacent to the airspace in question, in all meteorological conditions and under all flight rules, shall be in place or will be put into effect by the change sponsor upon implementation of the change in question (if these do not already exist)	No change to existing procedures. Paras 7.3.3, 7.3.4, 7.4.5, 7.5.1 Draft LoAs (Sup 06, 07, 08, 09, 10)

f	The change sponsor shall ensure that sufficient visual reference points are established within or adjacent to the subject airspace to facilitate the effective integration of VFR arrivals, departures and transits of the airspace with IFR traffic	No change to current arrangements
g	There shall be suitable availability of radar control facilities	The airspace is part of NATS Terminal Control, a 24hr radar operation.
h	The change sponsor shall, upon implementation of any airspace change, devise the means of gathering (if these do not already exist) and of maintaining statistics on the number of aircraft transiting the airspace in question. Similarly, the change sponsor shall maintain records on the numbers of aircraft refused permission to transit the airspace in question, and the reasons why. The change sponsor should note that such records would enable ATS managers to plan staffing requirements necessary to effectively manage the airspace under their control	No change to standard procedures, with LoA agreement on new procedures. Draft LoAs (Sup 06, 07, 08, 09, 10)
i	All new procedures should, wherever possible, incorporate Continuous Descent Approach (CDA) profiles after aircraft leave the holding facility associated with that procedure	CDA is not possible in this airspace volume due to crossing interactions at 6,000ft, forcing aircraft to descend to 5,000ft and fly level for a period. However, at higher FLs to the hold CDA is more likely, and from 5,000ft to the runway CDAs will continue at the same rate.
	Off-route airspace requirements	Evidence
a	If the new structure lies close to another airspace structure or overlaps an associated airspace structure, the need for operating agreements shall be considered	See paragraph 7.3.3-7.3.4
b	Should there be any other aviation activity (military low flying, gliding, parachuting, microlight site etc) in the vicinity of the new airspace structure and no suitable operating agreements or air traffic control procedures can be devised, the change sponsor shall act to resolve any conflicting interests	See paragraph 7.3.3-7.3.4 If any new activity occurs, we shall so act.

14. Environmental Assessment

	Theme	Content	Evidence of compliance/ proposed mitigation
a	WebTAG analysis	Output and conclusions of the analysis (if not already provided elsewhere in the proposal)	Provided in Step 4A(iii) Final Options Appraisal (Ref 10C).
b	Assessment of noise impacts (Level 1/M1 proposals only)	Consideration of noise impacts, and where appropriate the related qualitative and/or quantitative analysis If the change sponsor expects that there will be no noise impacts, the rationale must be explained	Noise Metric Images (contours) and Data Tables are provided in the consultation document. Annex D for 2022, Annex E for 2032 without DCO, and Annex F for 2032 with DCO. See Full Options Appraisal (Ref 9) Section 6 for the analysis forecasts and methodology summaries.
c	Assessment of CO_2 emissions	Consideration of the impacts on CO_2 emissions, and where appropriate the related qualitative and/or quantitative analysis If the change sponsor expects that there will be no impact on CO_2 emissions impacts, the rationale must be explained	See paragraph 7.6 on page 24 and Stage 4 Step 4A(iii) Final Options Appraisal (Ref 10C).
d	Assessment of local air quality (Level 1/M1 proposals only)	Consideration of the impacts on local air quality, and where appropriate the related qualitative and/or quantitative analysis If the change sponsor expects that there will be no impact on local air quality, the rationale must be explained	No change See para 7.7.7.
e	Assessment of impacts upon tranquillity (Level 1/M1 proposals only)	Consideration of any impact upon tranquillity, notably on Areas of Outstanding Natural Beauty or National Parks, and where appropriate the related qualitative and/or quantitative analysis If the change sponsor expects that there will be no tranquillity impacts, the rationale must be explained	No change See para 7.7.6
f	Operational diagrams	Any operational diagrams that have been used in the consultation to illustrate and aid understanding of environmental impacts must be provided	See Stage 3 Consultation Document (Ref 8)
g	Traffic forecasts	10-year traffic forecasts, from the anticipated date of implementation, must be provided (if not already provided elsewhere in the proposal)	Provided in Stage 3 Full Options Appraisal para 6.10 Table 1 (Ref 9)
h	Summary of environmental impacts and conclusions	A summary of all of the environmental impacts detailed above plus the change sponsor's conclusions on those impacts	See paragraphs 7.1, 7.6, 7.7

15. Supplementary Documents

Those marked NO PUBLISH will not be available publicly due to:

Containing personal information;

Legitimate commercial interests that would be harmed if published; or

Information on critical national infrastructure that cannot be placed in the public domain.

They will be supplied to the CAA for their eyes only.

Sup No.	Supplementary Document Title	Remarks
01	Validation Simulation Executive Summary and Safety Assessment Executive Summary	(NO PUBLISH)
02	Post-Consultation Validation Simulation Activity SP406 HAZID Summary	(NO PUBLISH)
03	Route Separation Assurance Document RSAD	(NO PUBLISH)
04	DAP1917 Application for IFP Reg Approval: LLA-TRAX	(NO PUBLISH)
05	DAP1917 Application for IFP Reg Approval: NATS	(NO PUBLISH)
06	Draft LoA USAFE and supporting email	(NO PUBLISH)
07	Draft LoA 78 Sqn Swanwick Mil and supporting email	(NO PUBLISH)
08	Draft LoA Cambridge and supporting email	(NO PUBLISH)
09	Draft LoA Cranfield NFLC and supporting email	(NO PUBLISH)
10	Draft LoA East Anglian Rocketry Society and supporting email	(NO PUBLISH)
11	Air Ground Air Radio Coverage Assessment	(NO PUBLISH)
12	RNAV1 Coverage Assessment	(NO PUBLISH)
13	Surveillance Coverage Assessment	(NO PUBLISH)
14	AIP Changes	NATS-LLA Public
15	Cost Benefit Analysis Calculation Excel Workbook	(NO PUBLISH)
16	WebTAG Excel workbooks and summaries	NATS-LLA Public

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