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London Luton Airport Operations Ltd FASI-S ACP ACP-2018-70

Initial Options Appraisal
CAP1616 Stage 2B Gateway Submission Document

Document Control

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Contents

Glossary

Acronym	Term	Description
AD6	Swanwick Airspace Improvement Programme - Airspace Deployment 6 (SAIP AD6)	ACP-2018-65 (known as SAIP AD6) was an ACP co-sponsored between LLAOL and NATS which made improvements to arrivals to address a latent risk identified. The ACP was implemented in February 2022.
AMS	Airspace Modernisation Strategy	UK Government has tasked the aviation industry to modernise airspace in the whole of the UK. The long-term strategy of the CAA and the UK Government is called the Airspace Modernisation Strategy (AMS). The AMS identifies fifteen initiatives to modernise airspace. Its CAA document reference number is CAP1711.
AONB	Area of Outstanding Natural Beauty	
-	Approach Transition / arrival 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
ATC	Air traffic control	
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	Controlled Airspace	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.
-	Centreline	The nominal track for a published route

Acronym	Term	Description
-	Concentration	Refers to a density of aircraft flight paths over a given location, this generally refers to high density where tracks are not spread out; this is the opposite of Dispersal
CCO	Continuous Climb Operations	An aircraft operating technique facilitated by the airspace and procedures design and assisted by appropriate ATC procedures, allowing the execution of a flight profile optimised to the performance of aircraft, leading to significant economy of fuel and environmental benefits in terms of noise and emissions reduction
CDO	Continuous Descent Operations	An aircraft operating technique in which an arriving aircraft descends from an optimal position with minimum thrust and avoids level flight to the extent permitted by the safe operation of the aircraft and compliance with published procedures and ATC instructions
-	Conventional navigation	The historic navigation standard where aircraft fly with reference to ground based radio navigation aids
-	Conventional route	Routes defined to the conventional navigation standard, i.e. using ground based radio navigation beacons to determine their position.
-	Dispersal	Refers to the density of aircraft flight paths over a given location, this generally refers to lower density – tracks that are spread out; this is opposite of Concentration
-	Easterlies	When a runway is operating such that aircraft are taking off and landing in an easterly direction
-	Final Approach	The final part of an arrival flight path that is directly lined up with the runway
FUA	Flexible Use Airspace	Airspace which is not solely designated for a single purpose, but can be allocated flexibly according to need, or switched entirely on/off according to a schedule or agreed process.
-	Flight-path	The track flown by aircraft when following a route, or when being directed by air traffic control
ft	Feet	The standard measure for vertical distances used in air traffic control
FASI-S	Future Airspace Implementation Strategy South	Under the Government's Airspace Modernisation Strategy (AMS, ref 15) airports in the southern UK are required to update their airspace

Acronym	Term	Description
		and routes in a coordinated way. LLA is a part of FASI-S and accordingly has a separate longer term airspace change proposal.
GA	General Aviation	All civil aviation operations other than scheduled air services and nonscheduled 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, balloons and private corporate jet flights.
LR	Luton Rising	London Rising are the owners of the airport (a separate company from LLAOL – see next)
LLAOL	London Luton Airport Operations Ltd	London Luton Airport Operations Ltd are the operators who run the airport (a separate company from LLAL – see above)
-	Lower Airspace	Airspace in the general vicinity of the airport containing arrival and departure routes below 7,000ft. 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 (ATC)		NATS ATC - 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.
NATS NERL		NATS NERL - The UK's licenced air traffic service provider for the en route airspace (upper network) that connects our airports with each other, and with the airspace of neighbouring states.
nm	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 / Upper network	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.
NTK	Noise Track Keeping	A system that monitors and records radar data to monitor aircraft operations and report statistics focused around noise.
PBN	Performance Based Navigation	Referred to as PBN; a generic term for modern standards for aircraft navigation capabilities including satellite navigation (as opposed to 'conventional' navigation standards)

Acronym	Term	Description
RNAV / RNAV 1	aRea NaVigation	This is a generic term for a particular specification of Performance Based Navigation. 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.
RNP-RF	Required Navigation Performance – Radius to fix	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.
RNP-AR	Required Navigation Performance – Authorisation required	An advanced navigation specification under the PBN umbrella. 'Authorisation required' refers to aircraft and operators complying with specific airworthiness and operational requirements. RNP-AR allow airspace designers to set extremely specific curved paths to a greater accuracy than RNAV1, these can be designed before and after the Final Approach Fix.
-	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.
SID	Standard Instrument Departure	Usually abbreviated to SID; this is a route for departures to follow straight after take-off
	Tactical Intervention	Air traffic control methods that involve controllers directing aircraft for specific reasons at that particular moment (see Vector)
TMA	Terminal Manoeuvring Area (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 London Heathrow, London Gatwick, London Stansted, LLA and London City from around 2,000ft-3,000ft up to approximately 20,000ft.

LLAOL FASI-S Initial Options Appraisal

Acronym	Term	Description
-	Vector / vectoring	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

1. Introduction

Airspace Modernisation Strategy

Following the publication of the strategic rationale for airspace modernisation[1], the Government directed the Civil Aviation Authority (CAA) to "prepare and maintain a coordinated strategy and plan for the use of UK airspace up to 2040, including its modernisation". As a result, in 2018 the CAA published the Airspace Modernisation Strategy (AMS)[2], which replaced the earlier 2011 Future Airspace Strategy. The AMS sets out the initiatives required to modernise the existing Airspace System by upgrading the airspace design, technology and operations. The CAA is in the process of reviewing the AMS and expects to publish an updated version of the strategy in early 2022.

One of the most important initiatives required to achieve the AMS objective is known as FASI (Future Airspace Strategy Implementation). 21 airports in the UK comprise FASI and London Luton Airport is one of them. This FASI initiative is considered the UK's Airspace Change National Infrastructure Programme (the Programme). The Programme encompasses the requirement to fundamentally redesign the National Airspace System at lower altitudes and in the terminal airspace that serves commercial air transport across the busiest regions of the UK, making the most of the capabilities of modern aircraft and satellite-based navigation technology. These airspace design projects are sponsored by the 21 airports (for the local arrival and departure routes below 7000ft) and by NERL (for the airspace structures and route network above 7000ft).

Performance Based Navigation

Today's national route network is designed with reference to a grid of ground navigation beacons distributed across the UK. Some of these beacons are outdated and reaching their end of life. Meanwhile, 99% of the current commercial air transport fleet operates almost exclusively using avionics that rely on satellite navigation. Aircraft are able to follow routes designed to satellite navigation standards (known as Performance-based Navigation or PBN) with greater precision than conventional ground navigation. The widespread deployment of routes designed to satellite navigation standards is a cornerstone of airspace modernisation. The opportunity to design a new network of PBN routes with far greater accuracy and flexibility offers the potential to address many of the issues set out in the Government's strategic rationale. Significant improvements in airspace capacity and efficiency can be achieved by positioning routes so that they are safely separated and optimised by design.

Whilst more precise routes can be used to avoid noise sensitive areas, they may also concentrate the impacts of overflight. For this reason, the use of multiple route options that can distribute the impacts more equitably, or be configured to offer predictable relief from noise, must be considered in consultation with local stakeholders when routes are being developed for deployment at lower altitudes.

Airspace Change Organising Group (ACOG) and the Masterplan

The number, complexity and overlapping scope of the individual Airspace Change Proposals (ACPs) needed to deliver the Programme requires a strategic coordination mechanism in the form of a single joined up implementation plan or Masterplan.

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[1] Upgrading UK Airspace Strategic Rationale
[2] UK Airspace Modernisation Strategy, CAA CAP1711, 2018

Given the large number of organisations involved (21 airports and NATS EnRoute Limited (NERL)), the CAA and Department for Transport (DfT) also required NERL to set up an impartial body, The Airspace Change Organising Group (ACOG) to develop a Masterplan, coordinate the Programme and lead the necessary engagement with external stakeholders. In this context, ACOG was established in 2019 as a unit within NERL, separate and impartial from the organisation's other functions.

Masterplan Iteration 23 was accepted by CAA on 27th January 2022. The purpose of Iteration 2 is to provide a system-wide view of the scope of the constituent ACPs and identify the potential interdependencies between the proposals. Collectively, the ACPs that are included in the Masterplan are referred to as the 'constituent airspace change proposals'. Each individual ACP is developed following the same detailed process steps laid out in the CAA's guidance for changing the airspace design – known as CAP1616[4]. The CAA evaluates the progress of every ACP through each stage of the process, via a series of (seven) regulatory gateways and make decisions on whether to approve further development and ultimately the implementation of the proposed changes. A summary of the CAP1616 process is available in the next section.

Iteration 2 places London Luton Airport in the 'LTMA[5] regional cluster' alongside Biggin Hill, Bournemouth, Heathrow, Gatwick, London City, Manston, RAF Northolt, Southampton, Southend and Stansted airports.

Our Airspace Change

London Luton Airport Operations Limited (LLAOL) began their ACP to modernise their airspace in December 2018 and passed through Stage 1 of CAP1616 in June 2019. Stage 2A Options Development began shortly afterward with initial airspace design options shared with stakeholders in Q1 2020. At this time, the project and much of the wider Programme was paused due to COVID-19 pandemic whilst the aviation industry focussed on managing the pandemic and its recovery from it. The Programme was remobilised in March 2021 following the provision of DfT grant funding, allowing LLAOL to recommence their ACP in July 2021.

This document forms part of the London Luton Airport Operations Limited (LLAOL) Stage 2 submission to the CAA. It sets the options that have progressed from Stage 2A to this Initial Options Appraisal (IOA). We then outline the methodology used to assess each option, the outcomes of the IOA. At the end of the document we explain, based on the IOA, the options which we intend to take forward to Stage 3.

All airspace design options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our design principles, our appraisals and stakeholder engagement and consultation.

[3] Link to Iteration 2
[4] CAA CAP 1616, edition 4, March 2021
[5] London Terminal Manoeuvring Area

LLAOL FASI-S Initial Options Appraisal

In December 2017 the Civil Aviation Authority (CAA) published CAP1616 Airspace Design: Guidance on the regulatory process for changing airspace design, including community engagement requirements. The guidance sets out the process for the airspace change process, which a change sponsor of any permanent change to the published airspace design must follow. The airspace change process is split into 7 Stages;

Figure 1 CAP1616 7 Stages

LLAOL Airspace Change Proposal

This Airspace Change Proposal is required to follow the CAP1616 process detailed in the section above. Table 1 below summarises the CAP1616 stages already undertaken for this ACP and the stage where we are at now, providing links to previous submission documents with further information.

Table 1 ACP progress to date

Airspace Change Stage	Summary	Link to Documents (Also available on the ACP portal)
Stage 1A	In December 2018, LLAOL submitted the following statement of need (SoN) to the CAA: *The Department for Transport have notified aviation stakeholders via the Upgrading UK airspace: strategic rationale, published in February 2017, that the controlled airspace in southern England used to support commercial air transport operations is capacity constrained, it has evolved over time and does not exploit modern navigation technology.* *The Future Airspace Strategy Implementation South (FASI South) programme has been established by NATS and a number of key airports operating in southern England, including London Luton Airport Operations Ltd. to coordinate a series of linked ACPs that will modernise the overall airspace structure and route network.* *London Luton Airport Operations Ltd is using this opportunity to look at options of aircraft reaching higher altitudes sooner on departure and remaining higher for longer on arrival enabling significant environmental benefits.*	Statement of Need on CAA's Airspace Change Portal
	LLAOL participated in an assessment meeting with the CAA on the 22nd January 2019 as part of Step 1A of the CAP1616 process. The purpose of the assessment meeting is for the change sponsor to present and discuss their SoN and to enable the CAA to consider whether the proposal falls within the scope of the formal airspace change process.	Assessment meeting minutes
Stage 1B	At Stage 1B LLAOL developed a set of design principles with identified Stakeholders. The aim of the design principles is to provide high-level criteria that the proposed airspace design options should meet. They also provide a means of analysing the impact of different design options and a framework for choosing between or prioritising options.	Stage 1B Design Principle Submission Report

	The final design principles outlined within the Stage 1B submission were given a priority order.	
Stage 2A	Stage 2A requires change sponsors to develop and assess options for the airspace change. In Stage 2A, the change sponsor develops a comprehensive list of options that address the Statement of Need and that align with the design principles from Stage 1. We then share those options with our Stakeholder representatives (the same ones engaged with on the Design Principles). Feedback from the engagement is then used to refine and/or generate further options where feasible. Finally, we qualitatively assess all options developed against the Design Principles and produce a Design Principle Evaluation.	Stage 2A Design Principle Evaluation
Stage 2B	At Stage 2B an Airspace Change Sponsor is required to undertake an Initial Options Appraisal (IOA) of the airspace change options which proceed from Stage 2A. This is where we are now. The following sections of the document initially describe the options under assessment and the baseline option, followed by explaining the methodology used to assess each option, and then the IOA outcome. At the end of the document we explain, based on the IOA, the options which we intend to take forward to Stage 3 and our preferred option.	**This document**

Dependent and Independent Options

As part of our Stage 2A documentation, we explained that some options have been identified which have dependencies on the routes to/from other airports and some options that don't. Those options that do have dependencies are envisaged to deliver greater benefit than those options that don't have dependencies. This Initial Options Appraisal is the first step in exploring the scale of those potential benefits.

The reason for generating such options were to enable Luton to *potentially* progress more quickly with some aspects of their modernisation programme and take part in the Early LTMA Deployment in 2026, as set out by ACOG in Masterplan Iteration 2. Such options are only likely to be progressed as part of an early deployment if they deliver standalone benefit which is deemed considerable enough to return on the project costs and risks.

Any option progressed to a successful early LTMA deployment would not detract from LLAOL's longer-term commitment to progress subsequent changes as part of the core LTMA deployments in 2027 and beyond. **For the avoidance of doubt, an early deployment would not constrain LLAOL, any other airport or the wider FASI programme from delivering wider benefits in future deployments.**

How is this aligned with CAP1616 and the Masterplan?

All the options, both dependent and independent, form part of Luton's Comprehensive List of Options in Stage 2A. These options will all be assessed against a baseline in the same way, against the requirements set out in CAP1616. Following this Initial Options Appraisal, we have evidence on the benefits and impacts of each option, and we have used this as the basis for discontinuing some options. More information can be found in section 5.

As set out in CAA's Assess and Accept Criteria, Sponsors will be unable to progress through the Stage 3 gateway of the CAP 1616 process until the system-wide airspace design of the proposed options, and the cumulative impacts of those options, are represented in an accepted Iteration 3 of the masterplan. To generate Iteration 3, ACOG will require "granular data from ACP sponsors' 'full' options appraisals" and furthermore, Iteration 3 will not be accepted by the CAA until ACOG has published a draft of it and conducted a public engagement exercise on some of its content. This means that LLAOL will not be able to progress options with dependencies on other sponsors until those sponsors are at a similar point in the process. On current timelines, LLAOL's dependent sponsors will not all be into Stage 3 of the process until Q2 2023. The result will be that if LLAOL are successful in this, Stage 2 gateway, any options with dependencies with other airports cannot be progressed for some time.

To enable LLAOL to progress with delivering early benefit in accordance with the AMS as part of a 2026 Early Deployment window, it is proposed that LLAOL would commence the Full Options Appraisal (FOA) of all remaining independent options once into Stage 3. All dependent options would be 'parked' until adjacent airports short listed options become available throughout 2022 and 2023 at which point, they will be integrated, refined and cumulative impacts identified.

If the FOA of independent options identifies that they are truly independent and that benefits can be delivered as part of an early deployment, LLAOL will consider taking those options through into Stage 4 and 5 of CAP1616 as a separate early LTMA deployment. It is expected that such options would be publicly consulted on in Stage 3 as part of a standalone deployment, with impacts and benefits articulated accordingly i.e. the consultation would not be describing or pre-empting the following stages of deployment but would need to assume a permanent introduction.

2. Overview of options under assessment

Options for Assessment

Our comprehensive list of options included 22 options. These are split into easterlies and westerlies, arrivals and departures.

The outcome of our Stage 2A Design Principle Evaluation was that all options on our Comprehensive List progressed to the Initial Options Appraisal for more rigorous assessment. The follow section summarises the options that we will assess as part of this IOA however for more information around our options and the design principle evaluation, please see our Stage 2A submission document on the CAA Airspace Change Portal.

As part of these 22 options, there are 4 baseline 'do nothing' scenarios (easterly departures, easterly arrivals, westerly departures and westerly arrivals). CAP1616 requires the baseline scenario to be appraised as it provides a means of testing the options against the current day operations to better understand and highlight the benefits and impacts of each new option.

The following sections summarise the airspace change options we have taken through to this Initial Options Appraisal. More information about how we have developed and evaluated these options is available in our Stage 2A submission document on the CAA Airspace Change Portal. The Initial Options Appraisal section of this document also contains larger images and a more detailed description of each option.

All airspace design options in this document are subject to change throughout the airspace change process as options are matured in detail and refined in accordance with safety requirements, our design principles, our appraisals and stakeholder engagement and consultation.

LLAOL FASI-S Initial Options Appraisal

Runway 25 Westerly Departures

Table 2 Runway 25 Westerly Departure Options

Option name	Summary	Independent to other airports
WD Group 1 (Baseline)	This option is the do nothing scenario for Luton Westerly SIDs. Aircraft departing Luton largely keep to the SID centrelines up to 4000ft. Beyond 4000ft, some concentration can still be seen along the centrelines however aircraft are routinely vectored away.	✓
WD Group 2	This option largely aims to replicate current day with the exception of the MATCH SID, which is changed to keep north of Heathrow and Northolt departures.	✓
WD Group 3	This option sees the initial departure track split early to separate MATCH from OLY and CPT departures as soon as possible. The MATCH SID aims to keep north of Heathrow and Northolt departures.	✓
WD Group 4	This option has two sets of SIDs (Period 1 and Period 2) which would alternate at a set time.	✓
WD Group 5	This option follows the same lateral paths as WD Group 2 however this group assumes all departures are able to continuously climb to at least 6,000ft.	
WD Group 6	This is the same as WD Group 3 except that the Period 2 CPT and OLY SIDs are further south to provide more respite.	
WD Group 7	This option has two different sets of SIDs which can be used depending on whether the Dunstable gliding area is active. Some SIDs turn right shortly after departure and aim to follow the M1 as closely as possible.	
WD Group 8	This option has two different sets of SIDs which can be used depending on whether the Dunstable gliding area is active. Some SIDs turn right shortly after departure but aim to avoid the populated areas of Luton and Dunstable.	

Further information around our Options can be found in our Stage 2A submission document on the CAA Airspace Change Portal

LLAOL FASI-S Initial Options Appraisal

Runway 07 Easterly Departures

Table 3 Runway 07 Easterly Departure Options

Option name	Summary	Independent to other airports
ED Group 1 (Baseline)	This option is the do nothing scenario for Luton Easterly SIDs. Aircraft departing Luton largely keep to the SID centrelines up to 4000ft. Beyond 4000ft, some concentration can still be seen along the centrelines however aircraft are routinely vectored.	✓
ED Group 2	This option aims to replicate current day with the exception of the OLY SID which can't be replicated closely with PBN. The OLY SID in this option aims to route between Hitchin and Letchworth Garden City.	✓
ED Group 3	This option is the same as ED Group 2 with the exception of the CPT departure which aims to avoid Harpenden.	
ED Group 4	This option has offset departures to the right (south) of final approach to help avoid Breachwood Green and Hitchin and also to provide some respite to those under RWY25 final approach. The CPT departure turns back west earlier than today to reduce track miles/CO_2.	✓
ED Group 5	This departure option also has offset departures to the right (south) but compared to ED Group 4, this option has CPT SIDs turning left to track north of Luton to increase opportunities for continuous climb operations and provide some respite for communities south of Luton. The MATCH SID takes a more direct route to the upper airspace.	
ED Group 6	This is similar to ED Group 5 but with a pair of MATCH SIDs and a pair of CPY/OLY SIDs which could be switched on/off for respite purposes.	

Further information around our Options can be found in our Stage 2A submission document on the CAA Airspace Change Portal

Runway 25 Westerly Arrivals

Table 4 Runway 25 Westerly Arrival Options

Option name	Summary	Independent to other airports
WA Group 1 (Do nothing baseline)	All arrivals would be vectored from ZAGZO exactly as per the AD6 ACP (with the same vertical profiles). This is also the 'do nothing' baseline scenario.	✓
WA Group 2	This option would see the majority of arrivals vectored from ZAGZO as per WA Group 1, but we also introduce a PBN (RNP-AR) arrival route which some arrivals could use during periods of low traffic.	✓
WA Group 3	This option would see the majority of arrivals from ZAGZO vectored but with the opportunity for continuous descent from 7000ft. There is also an opportunity for a PBN route which could be used during periods of low traffic (as per WA Group 2)	
WA Group 4	This option would see two PBN arrival transitions from ZAGZO used in rotation to offer some respite. A third more direct RNP-AR route is also available for periods of low traffic.	

Further information around our Options can be found in our Stage 2A submission document on the CAA Airspace Change Portal

LLAOL FASI-S Initial Options Appraisal

Runway 07 Easterly Arrivals

Table 5 Runway 07 Easterly Arrival Options

Option name	Summary	Independent to other airports
EA Group 1 (Do nothing baseline)	All arrivals would be vectored from ZAGZO exactly as per the AD6 ACP (with the same vertical profiles). This is also the 'do nothing' baseline scenario.	✓
EA Group 2	This option would see the majority of arrivals vectored from ZAGZO as per EA Group 1, but we also introduce a PBN (RNP-AR) arrival route which some arrivals could use during 2100 – 0700.	✓
EA Group 3	This option would see the majority of arrivals from ZAGZO vectored but with the swathe moved significantly further north. It would give the opportunity for continuous descent from 7000ft. The arrivals would join final approach in the same place as today. This arrivals option enables some departure options to climb continuously. There is also an opportunity for a PBN route which could be used when the gliding area is not active.	
EA Group 4	This option would see two PBN arrival transitions from ZAGZO used in rotation to offer some respite. A third more direct RNP-AR route is also available for periods of low traffic.	

Further information around our Options can be found in our Stage 2A submission document on the CAA Airspace Change Portal

3. Initial Options Appraisal Methodology

The Initial Options Appraisal (IOA) is the first stage in a three-phase appraisal of airspace change options. It involves the mainly qualitative appraisal of the airspace change options that have proceeded from Stage 2A (outlined in Section 2 of this document). As options progress through the airspace change process, the two following appraisals, the Full Options Appraisal and Final Options Appraisal undertaken at Stage 3 and 4, will quantitively evaluate options in further detail. The following sections outline the methodology we have followed whilst appraising our airspace change options as part of this IOA.

Baseline and Year of Implementation

As part of this IOA CAP1616 requires airspace change sponsors to set a baseline which is used for environmental evaluation of the options. CAP1616 explains that this will be a 'do nothing' scenario and will largely reflect the current-day scenario, although taking due consideration of known or anticipated factors that might affect that baseline, for example a planned housing development close to an airport, forecast growth in air traffic, or expected changes in airlines' fleet mix. Therefore, all environmental assessments must illustrate the difference between a pre-implementation ('do nothing') scenario and a post-implementation scenario, ensuring that the periods are comparable.

Year of Implementation

At present the exact implementation date for the FASI-S airspace changes is unknown as the timeline for implementation will be dependent on a number of factors, including the upper airspace changes (above 7000ft) which form part of a separate ACP sponsored by NATS NERL. Current deployments of the Core LTMA Clusters within Masterplan Iteration 2 are to expect an implementation date between 2027 and 2029.

Movement numbers and schedule

Our IOA modelling is based on a 2028 92-day summer forecast (16th June to the 15th September). The forecast is representative of a 19 million passengers per annum (mppa) operation, considered to be the worst case scenario for which a planning application has been made. LLAOL submitted a planning application to grow from 18million to 19million passengers per year in 2021, the local planning authority (Luton Borough Council) voted to approve this application in December 2021. The application has subsequently been referred to the Department for Levelling Up, Housing and Communities, which may decide to call in the application. The forecast has therefore assumed 34,849 movements over the 92-day period during the 16-hour daytime period, with 5,002 during the 8-hour night-time period. The diurnal profile of the forecast is based on 2019 operations. As outlined in our Stage 2A documents, we've generated the forecast from 2019 rather than 2020 or 2021 as it is most representative of a post COVID-19 recovered scenario.

As part of our Stage 3 Full Options Appraisal we will quantitatively appraise the pre-implementation baseline for the year of implementation and future scenarios (plus 10 years). In addition to this, we expect to undertake appraisal showing the outcomes with and without Luton Rising's ongoing Development Consent Order (DCO) application which looks at long-term expansion of the airport up to 32 million passengers.

AD6 ACP

In November 2021 ACP-2018-65 (known as SAIP AD6) was approved; this was an ACP co-sponsored between LLAOL and NATS which made improvements to arrivals to address a latent risk identified. AD6 has been in operation from the 24th February 2022, and therefore our baseline scenario has been adjusted to take into account this change. There is more information regarding this as part of our Initial Options Appraisal Methodology section and as noted as part of the Initial Options Appraisal of our arrivals options later in this document.

Fleet Mix

We have adjusted the data from 2019 to reflect the 2028 fleet forecast within our baseline scenario. This fleet forecast has been aligned with the forecast used as part of the 19mppa application.

Planned developments

As part of our preparation of the baseline, we have identified planned developments in the area surrounding Luton airport so that these can be considered as part of appraisal of the benefits and impacts of each option:

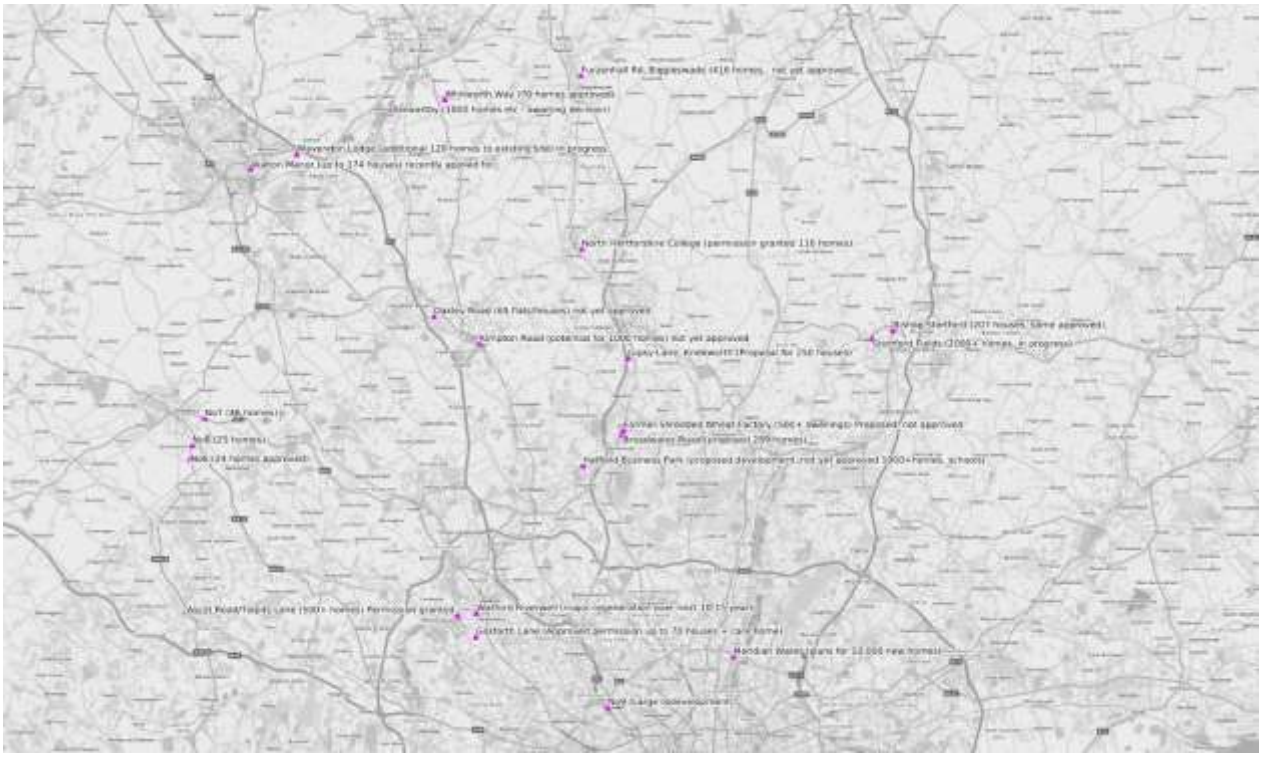


Figure 2 Planned Developments around Luton

Table 6 Planned Developments around Luton

Local Authority	Development Name (status)	Development Details
Aylesbury Vale	Tingewick Road (awaiting decision)	397 houses
	Fenny Road (approved)	74 houses
	Aston Clinton Road, Weston Turville (approved)	37 houses
	Kingsbrook Village (approved - completed by 2025)	100 houses
	The Hawthorns, Stoke Mandeville (approved – completed by 2022)	35 houses

LLAOL FASI-S Initial Options Appraisal

	Risborough Road, Stoke Mandeville (approved - completed by end 2021)	24 houses
	Aston Reach, Weston Turville (approved – completed by 2022)	46 houses
	Eskdale Road, Stoke Mandeville	25 houses
Barnet	Ongoing development of Brent Cross Cricklewood Area	Up to 10,000 new houses
Bedford	Stewartby (awaiting decision)	1000 houses, school
	Whitworth way (approved)	70 houses
Central Bedfordshire	Biggleswade (awaiting decision)	416 houses
East Hertfordshire	Stortford Fields Hadham Road (approved, construction in progress)	2200 houses
	St Michael's Hurst Bishops Stortford Hertfordshire CM23 1JJ (in progress)	207 houses
Enfield	Meridien Water - plans to build new homes.	10,000 houses
Hertsmere	Planning a minimum target of 12,160 homes between 2022 and 2038.	
Luton	Kimpton Road (potential for 1000 homes - land for sale)	1000 houses
	Oakley Road (awaiting decision)	65 flats/houses
	Wavendon Lodge	Additional 120 homes to existing build of 1000+ homes
North Hertfordshire	Gipsy Lane Knebworth Hertfordshire (awaiting decision)	250 houses
	North Hertfordshire College (permission granted)	116 homes
Three Rivers	Gosforth Lane (permission approved)	70 houses, plus a care home
Watford	Watford Riverwell, major regeneration over next 10-15 years, including hospital/homes	Hospital and houses
	Western Gateway project (Ascot Road/Tolpits Lane)	500 houses
Welwyn Hatfield	Broadwater Road (awaiting decision)	289 houses
	Hatfield Business Park (awaiting decision)	1000+ homes, schools
	Former Shredded Wheat Factories - North & South (awaiting decision)	500 + dwellings

LLAOL FASI-S Initial Options Appraisal

Initial Options Appraisal Categories and Criteria

At Stage 2B CAP1616 requires sponsors to carry out an initial qualitative assessment of the benefits and impacts of each option, tested against the 'do nothing' baseline scenario. The purpose of this initial appraisal is to highlight to change sponsors, stakeholders and the CAA the relative differences between the impacts, both positive and negative, of each option.

Our assessment criteria shown in the table below have been categorised based on the example in CAP1616 Appendix E, however we have added an additional category called 'Interdependencies, conflicts and trade-offs' to satisfy the requirements to outline potential interdependencies with other FASI-S ACPs, and 'Airspace Modernisation Strategy' to satisfy the 7 confirmed indicators that the CAA will use to assess whether this Stage 2 submission accords with the AMS including iteration 2 of the Masterplan. We will follow this table structure across the appraisal of all of our options.

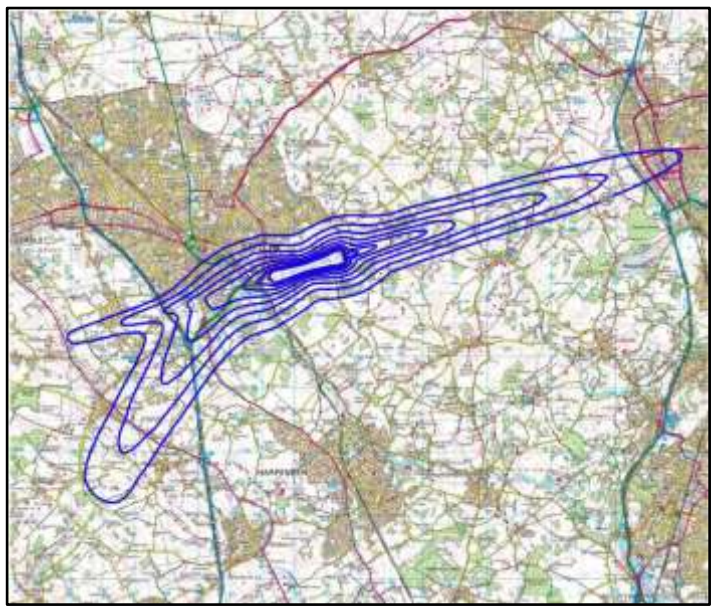
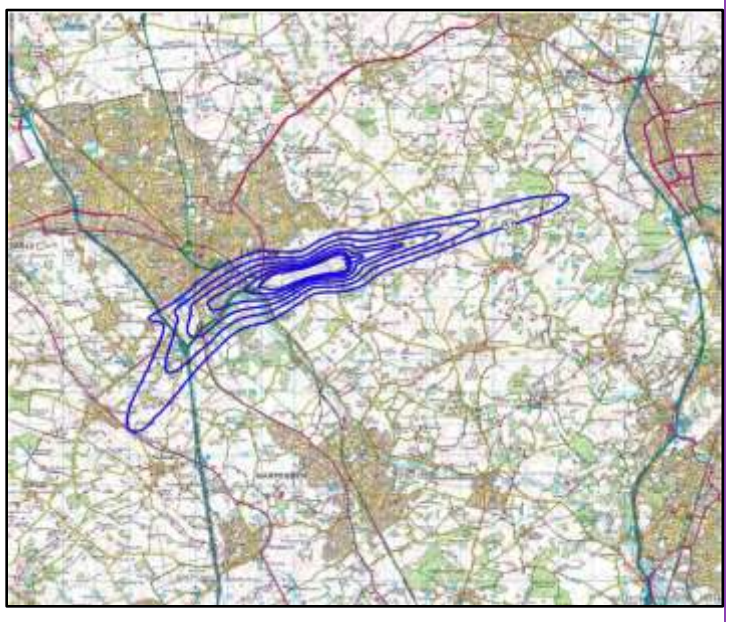
Table 7 Initial Options Appraisal Assessment Criteria (Based on CAP1616 Appendix E)

Group	Impact
Communities	Noise impact on health and quality of life
	Air Quality
Wider Society	Greenhouse gas impact
	Capacity / resilience
General Aviation	Access
General Aviation / Commercial airlines	Economic impact from increased effective capacity
	Fuel burn
Commercial airlines	Training costs
	Other costs
Airport / Air navigation service provider	Infrastructure costs
	Operational costs
	Deployment costs
All	Safety
All	Interdependencies, conflicts and tradeoffs
All	Airspace Modernisation Strategy (AMS) (CAP1711)

Initial Options Appraisal: Methodology

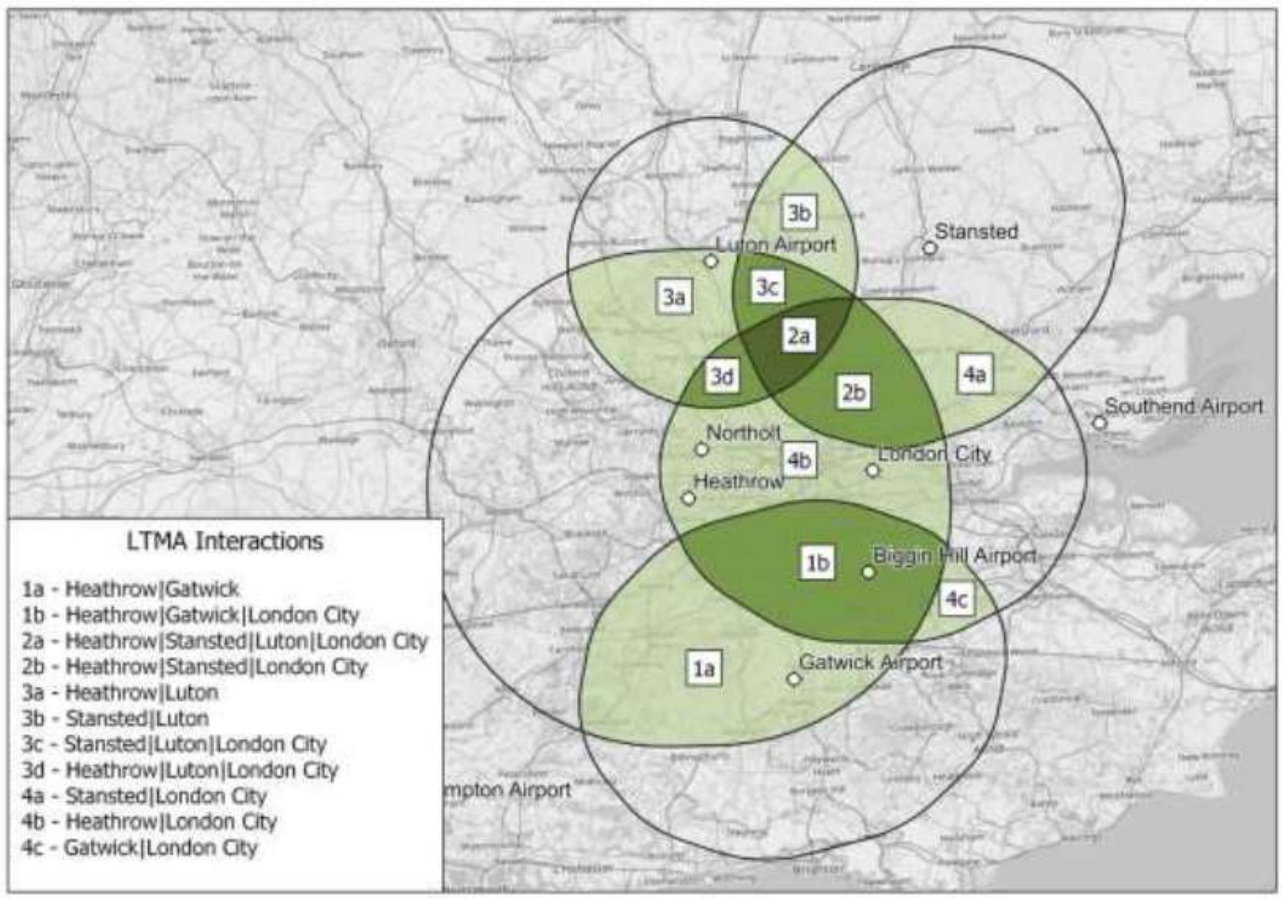
The table below presents the IOA methodology that will be followed. This methodology will be used to compare the airspace change options against the baseline.

Table 8 IOA Methodology

IOA Methodology		
Group	**Impact**	**Qualitative Assessment**
		Our noise assessment for each airspace change option includes a qualitative description of the expected benefits and impacts to noise, supported by some proportionate quantitative analysis: **L_{Aeq} Contours and WebTAG** 51dB $L_{Aeq16hr}$ (daytime noise) and 45dB L_{Aeq8hr} (night time noise) contours form part of the primary CAP1616 metrics used to evaluate the benefits and impacts of airspace changes. The contours are sometimes known as the day time and night time lowest observable adverse effect level (LOAEL) contour. L_{Aeq} contours, are the equivalent sound level of aircraft noise in dBA. This is based on the daily average movements that take place in the 16 hour period (07:00-23:00 local time) during the 92 day period 16 June to 15 September inclusive. This metric is the measure of noise exposure adopted by Government for the purposes of considering aircraft noise annoyance. It forms the basis of the Government's policies in relation to daytime aircraft noise. Luton's planning conditions require that they produce and publish daytime (57 dB LAeq,16h) and night-time 48 dB LAeq,8h contours on an annual basis. A constraint within Luton's planning conditions mandates a limit on the area (km^2) of those contours, not the population numbers within them. The *size* of these contours are determined largely by four main factors: • The type of aircraft using the airport • The number of aircraft using the airport • The frequency of use of each flight path • The height of aircraft on those flight paths The *shape* of these contours are directly influenced by the position of the flight paths, especially at c.4,000ft and below. This condition is extremely important for this ACP, as it means that if any airspace design option is assessed as breaching this condition or in any way limiting LLAOL in achieving future reductions to the size of these contours, the option would be not progressed by LLAOL. However, to determine the size of the forecast contours based on the new airspace design option, requires noise modelling at a system level. This requires a complete system design of arrivals and departures modelled with a forecast schedule and fleet mix which is very detailed and time-consuming work. At this stage in the process, given the number of arrival and departure options and the subsequent permutations when combining these, it is not proportionate to quantify the L_{Aeq} metrics. We will however make a qualitative assessment of the anticipated benefits or impacts to L_{Aeq} as a result of each option. Full quantitative analysis will be undertaken in the Full Options Appraisal in Stage 3 on LLAOL's shortlisted options. We've used the overall contours from 2019, as outlined in our Stage 2A documents, as an indicative contour for 2028 as it is expected that contours will be a similar size or smaller in 2028 as Luton has a planning condition to reduce the size. The AD6 airspace change Full Options Appraisal model predicted a very small change to these contours, which was attributed to the modelling rather than expecting a change in real life. We have also taken this into account when qualitatively describing the baseline and comparing it to our other airspace change options (see arrivals baseline for further details).
Communities	Noise impact on health and quality of life	 *Figure 4 Annual Day Noise Contours Summer 2019 (average)*  *Figure 3 Annual Night Noise Contours Summer 2019 (average)* **WebTAG** The data from the 51dB $L_{Aeq16hr}$ (daytime noise) and 45dB L_{Aeq8hr} (night time noise) contours form part of a key input into WebTAG. WebTAG is the Department for Transport's suite of guidance on how to assess the expected impacts of transport policy proposals and projects. These workbooks can be used to monetise certain aspects of the noise impact, given the correct inputs are available.

		As explained above, owing to the number of permutations and the complexity of the noise modelling, we will qualitatively describe the expected changes to the L_{Aeq} contours as part of this IOA. As we do not have the quantitative information we are unable to use the WebTAG workbook at this stage, however this analysis will be undertaken as part of our Stage 3 Full Options Appraisal. **Overflight Contours** Technical Appendix A includes images and data tables of overflight information which we have used to inform our qualitative assessment of each option. Our IOA uses CACI population forecast data. This data is supplied to one decimal place and for this IOA we have not rounded the data. As part of our FOA at Stage 3 the data will be rounded to the nearest person. The contours are based on the movement numbers outlined in the section here. A modal split of 70% westerly and 30% easterly operations has been applied to both the daytime and night-time periods. The anticipated use of each route within an option has been based on actual 2019 data, with adjustments made on an option-by-option basis (for example where the option introduces a respite route). Noise Consultant Limited's OnTrack software has been used to generate overflight contours using the 48.5 degree observer angle. Calculations have been undertaken having regard for local terrain heights and the point at which aircraft are calculated to pass through 4,000ft and 7,000ft. Flight profiles for each aircraft have been taken from the noise model and applied to each route the aircraft is forecast to operate on so to generate altitude profiles on each route. Overflight calculations have been undertaken for each event and route, and then summed together taking into account the specific number of aircraft using each route as indicated by the forecast schedule. These have then been scaled to reflect modal split. At this stage, owing to the complexity of modelling vectoring, we have modelled each departure option based on aircraft flying the PBN centreline however for some options, particularly the independent ones, vectoring will still apply. We have noted throughout the IOA where this applies and added a qualitative assessment alongside the data. As part of our Stage 3 Full Options Appraisal modelling of the vectoring will be investigated. Some data is available between 0-7000ft for the vectoring of arrival options as the AD6 Final Options Appraisal meant that parts of this noise model were already available; we have noted where this applies within the IOA section and where further modeling will be required at Stage 3 for some of the options. **CAP2091** All modelling reflects Category A requirements of CAP2091. The noise-power-distance data for aircraft have been adjusted taking into account measurements taken in 2019 at each of the airport's noise monitoring terminals. Arrival and departure flight profiles have been generated with reference to cross-sectional analysis of speed, altitude and angle using radar data. The modelling has been undertaken for arrival and departures in each direction of operation taking into account aircraft route use as per the overflight calculations. All noise metrics are also scaled to reflect the modal split. **Continuous Climb** As part of some of the departure options, we describe how they are anticipated to continuously climb to above 5000ft. The scope of this Level 1 ACP is up to 7000ft and therefore typically we would seek continuous climb to 7000ft. As discussed in our Stage 2A document, even with a redesign and modernisation of the airspace there is another significant and fixed constraint that requires consideration when looking at continuous climb up to 7000ft. This is the Transition Altitude (TA), which is 6000ft in the LTMA. Our Stage 2A document has further details, but in summary, any SIDs that climb above 6,000ft need to climb continuously from the runway, to at least FL90 in order to guarantee continuous climb above 7000ft. As the NATS NERL ACP, which looks at the airspace above 7000ft, is not yet at the stage to be able to inform whether climb to FL90 is achievable, for the basis of this IOA we have stated continuous climb to above 5,000ft. Without any further information from the network, for the purposes of the noise modelling at this stage, we have assumed that aircraft will be able to continuously climb to 7000ft. We will revisit this as part of our Full Options Appraisal when we have further information from NERL around the upper airspace network.
	Air Quality	Impacts to air quality are considered for changes below around 650ft (200m). Aircraft flying above this are unlikely to have a significant impact on local ground air quality. **Assessment of Arrivals Options** Aircraft arriving at Luton fly a standard 3-degree angle of approach and descend through 650ft whilst aligned with the extended runway centreline. This is in the last stages of the final approach. It's therefore very unlikely that any arrivals options will offer any significant impact air quality however we will review each option for changes below 650ft. **Assessment of Departure Options** Owing to high climb performance, aircraft departing from Luton are typically already above 650ft above ground level (AGL) when reaching the departure end runway (DER). This means that our options are unlikely to have a significant impact on ground-level air quality, however as part of our IOA we will review each option to understand any changes below 650ft. Recent air quality assessments for Luton Airport, in support of the 19 million passengers per annum (mppa) planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals, so is even less likely

		to have significant impacts on air quality.
Wider Society	Greenhouse gas impact	As emissions of greenhouse gases arise from the combustion of aviation fuel and fuel burn is linked to track mileage, for this IOA we have estimated the differences in track miles between the baseline and the options, and then used these estimates to undertake high level CO_2 calculations. At this stage, we have estimated the difference of a single flight against the baseline. As part of the Full Options Appraisal (Stage 3A), we appraise track mileage, fuel burn and the associated greenhouse gas impact in further detail. A spreadsheet showing the calculations is shown in Technical Appendix A.
	Capacity / resilience	Aviation specialists will qualitatively assess any impacts to capacity and/or resilience against the baseline scenario.
	Tranquillity	CAP1616 outlines the consideration of impacts upon tranquility is with specific reference to National Parks and Areas of Outstanding Natural Beauty (AONB), plus any locally identified 'tranquil' areas that are identified through community engagement and are subsequently reflected within an airspace change proposal's design principles. At this stage of the ACP we will qualitatively assess whether the option differs from current day and whether this has the potential to impact tranquillity with regards to noise and AONB.
	Biodiversity	Consideration of the potential effects on statutory sites designated for nature conservation formed the basis of the biodiversity assessment. This included the consideration of the following: • Ramsar sites and proposed Ramsar sites • Special Areas of Conservation and possible Special Areas of Conservation • Special Protection Areas and potential Special Protection Areas • Sites of Special Scientific Interest These were identified using data sets available from MAGIC (www.Magic.gov.uk), with details on individual designations obtained through the Natural England "Designated Sites View" website (https://designatedsites.naturalengland.org.uk/) For each potential option under consideration the potential for air quality effects (e.g. nitrogen deposition) were considered for all sites that were underneath the proposed flightpaths and associated noise contours when within 3km (departures) and 6km (arrivals); measured along the flightpath as opposed to a buffer of the airfield. This is based on CAA guidance that notes air quality effects at ground level are associated with aircraft below 1,000ft. For the potential effects of disturbance the same approach was taken, except the proposed flightpath lengths under consideration were lengthened to be 6km (departures) and 18km (arrivals) to represent the need for aural and visual disturbances to be considered up to an altitude of 3,000ft. Where designated sites were identified that were overflown at altitudes where potential effects could occur a review of the designated features (and supporting systems) was undertaken. This review determined the potential for an effect to occur (e.g. a SSSI designated for geological features of habitats, as opposed to specific fauna, is not at risk of challenge to its favourable conservation status through visual or aural disturbance. A qualitative description, including the naming of individual designated sites, was then provided for further consideration as necessary at later stages.
General Aviation	Access	As part of this IOA, we will qualitatively describe the impacts and benefits to general aviation access as a result of each option. At the full options appraisal stage, we will have detailed plans for CAS and will quantify any increase or decreases in CAS volume.
General Aviation / Commercial airlines	Economic impact from increased effective capacity	The IOA will qualitatively estimate the differences between the option and the baseline. As part of the FOA at Stage 3 we will quantitively appraise any economic benefits or impacts in further detail.
	Fuel burn	As the combustion of aviation fuel is linked to track mileage, for this IOA we have estimated the differences in track miles between the baseline and the options, and then used these estimates to undertake high-level fuel burn cost calculations. A spreadsheet showing the calculations is shown in technical appendix a. Please note that the initial fuel burn / CO_2 calculations include some assumptions that are applied to all calculations. We have aligned these with the assumptions undertaken for the AD6 ACP at Stage 2B. For example, we've used a figure for fuel flow that is associated with level flight at FL160, whereas we're aware that our ACP focuses on changes under 7000ft, and when aircraft climb fuel flow is higher. Applying these assumptions means that we have an even comparator between options that gives us an indicative outcome at this early stage; as part of the Full Options Appraisal (Stage 3) we will investigate track mileage, fuel burn and the associated greenhouse gas impact in further detail. Alongside the estimated quantitative information, we will provide a qualitative statement around continuous climb and continuous descent operations that also have the potential to impact fuel burn.
Commercial airlines	Training costs	The IOA will qualitatively estimate whether any training costs would be incurred by Commercial airlines in order to implement the option.
	Other costs	The IOA will qualitatively estimate whether any other costs would be incurred by Commercial airlines in order to implement the option.
Airport / Air navigation service provider	Infrastructure costs	The IOA will qualitatively estimate whether any infrastructure costs would be incurred by the airport or ANSP in order to implement the option.
	Operational costs	The IOA will qualitatively estimate whether any operational costs would be incurred by the airport or ANSP in order to implement the option.

	Deployment costs	The IOA will qualitatively estimate whether any deployment costs would be incurred by the airport or ANSP in order to implement the option.
All	Safety	A qualitative safety assessment of each option will be undertaken which compares against the baseline.
All	Interdependencies, conflicts and tradeoffs	An airspace change proposal at a Stage 2 gateway in the CAP 1616 process should specify any interdependencies with other airspace changes identified in Iteration 2 of ACOG's Airspace Change Masterplan. This IOA will take the information contained within the masterplan document around potential areas of conflict / interdependencies, and identify if the option falls within these areas. This will give an indication of whether there is the potential for tradeoffs with other airspace change sponsors required during Stage 3. The figure below shows the illustration provided within the masterplan that outlines Luton's potential interdependencies. *Figure 5 LTMA Interactions (From ACOG Masterplan)* 
All	Airspace Modernisation Strategy	Our IOA will include a qualitative, high level, assessment of how the design options perform against the vision and parameters/strategic objectives of the Airspace Modernisation Strategy. CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* And the parameters as: • *create sufficient airspace capacity to deliver safe and efficient growth of commercial aviation* • *progressively reduce the noise of individual flights, through quieter operating procedures and, in situations where planning decisions have enabled growth which may adversely affect noise, require that noise impacts are considered through the airspace design process and clearly communicated* • *use the minimum volume of controlled airspace consistent with safe and efficient air traffic operations* • *in aiming for a shared and integrated airspace, facilitate safe and ready access to airspace for all legitimate classes of airspace users, including commercial traffic, General Aviation and the military, and new entrants such as drones and spacecraft* • *not conflict with national security requirements (temporary or permanent) specified by the Secretary of State for Defence.*

4. Initial Options Appraisal

The following tables outline our Initial Options Appraisal for each option.

Westerly SID Group 1 (Do Nothing)

Westerly SID Group 1 (Do Nothing Baseline)

This option represents the do nothing scenario for Luton Westerly SIDs. Aircraft departing Luton largely keep to the SID centrelines up to 4000ft. Beyond 4000ft, some concentration can still be seen along the centrelines however aircraft are routinely vectored away.

Further details around our do nothing scenario can be found within our Step 2A submission document on the CAA's Airspace Change Portal.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	Due to wind direction, westerly operations on runway 25 occur approximately 70% of the year. The noise data and qualitative assessment has considered this modal split with daily movements averaged across the year. Aircraft departing Luton on westerlies follow the MATCH, OLY and HEN (CPT) standard instrument departures (SIDs) shown in yellow on the image opposite. These SIDs follow the Noise Preferred Routings outlined in Luton's AIP. The obligations of Noise Preferential Routings for conventional SIDs cease when a height of 3/4000ft[6] has been reached. Aircraft keep to the SID centerlines up to around 3/4000ft before they are vectored by ATC, which aligns with the obligations of the NPRs. This vectoring creates some dispersion although the noise track keeping (NTK) data shown in purple shows that there is still some concentration along the SID centrelines.

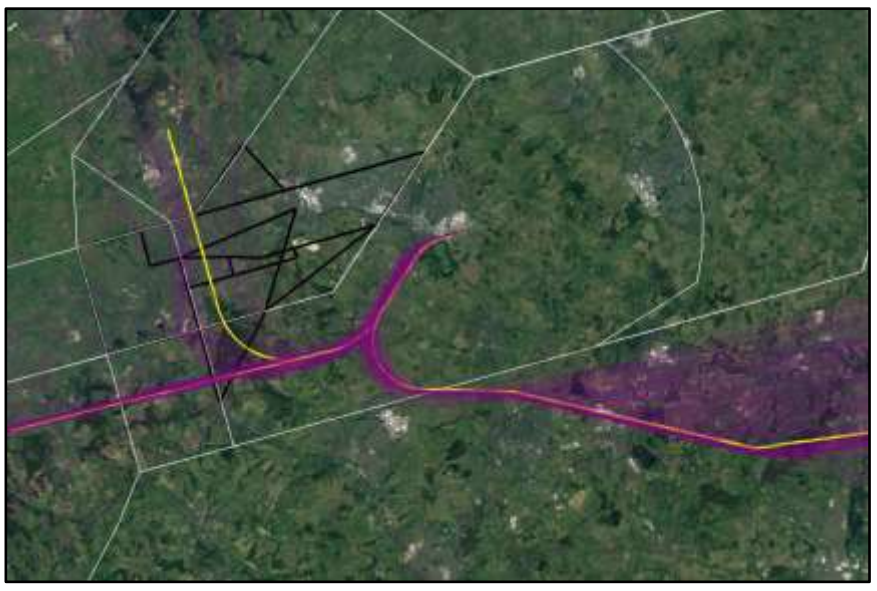


Figure 6 Current Westerly SID centrelines (Yellow) and NTK data (purple)

The technical appendix to this document includes images and maps showing the current areas of overflight. The overflight data, generated from actual radar tracks and using the CAA's definition of overflight, gives us information about this baseline scenario. To aid comparison, we have included the overflight data for the actual dispersion of the vectored tracks, and data for if all aircraft were to follow the centerline of the current published SID:

Table 9 Westerly departures baseline overflight data

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
DAY	Baseline Westerly Dep Option 1 (Vector)*	614324.0	79163.0	5722.0	1447.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	153814.2	86233.8	14940.9	2535.9	0.0
NGT	Baseline Westerly Dep Option 1 (Vector)*	98936.0	6666.0	0.0	0.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	93645.0	14597.6	0.0	0.0	0.0

[6] Conventional: 3000 FT QNH (between 0700-2300 (0600-2200)) and 4000 FT QNH (during night time, 2300-0700 (2200-0600)). RNAV1 SIDs cease when a height of 4000ft has been reached.

<table>
<tr><td></td><td></td><td>The data from these tables will be used to compare the westerly departure options against the ‘do nothing’ baseline.

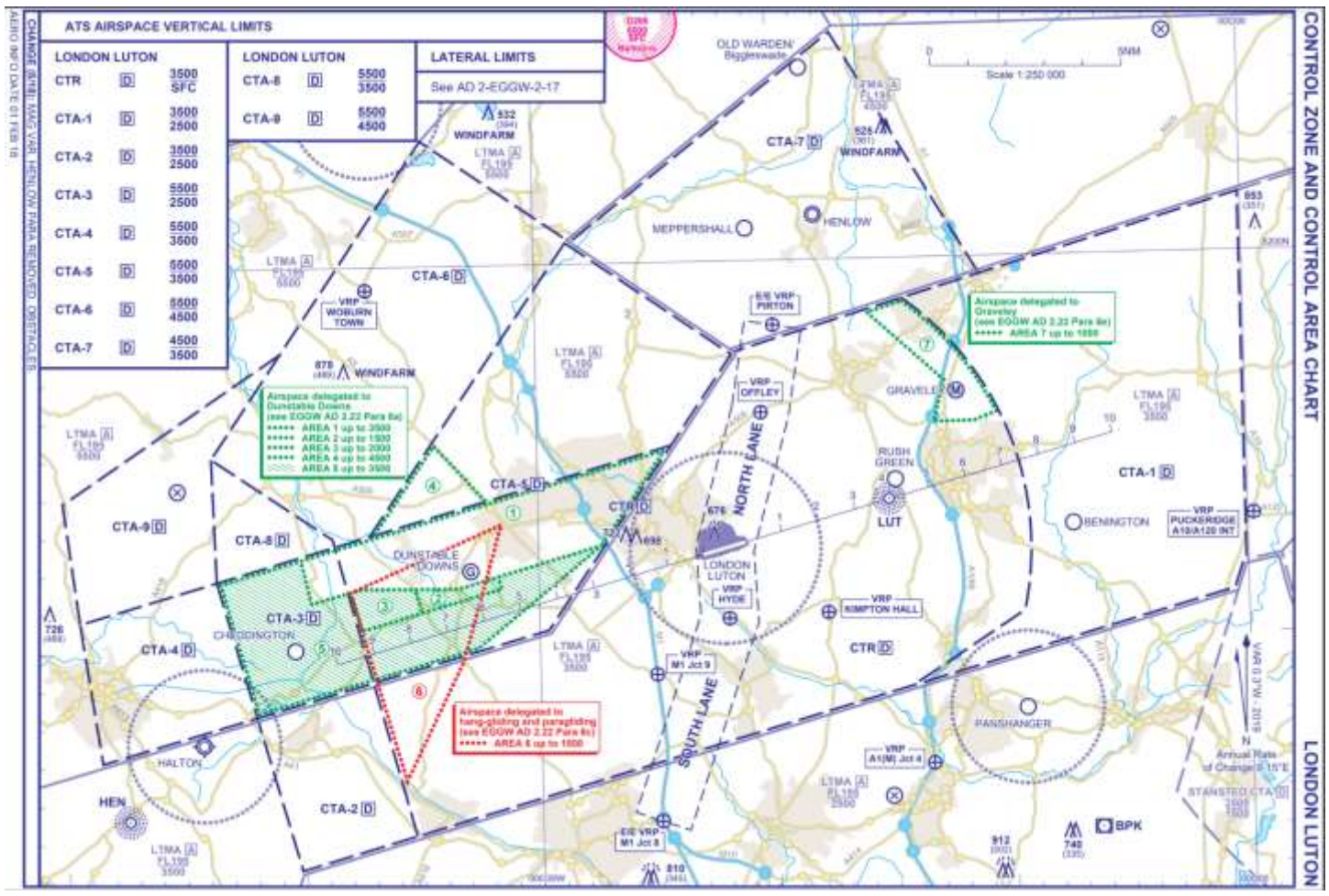
In addition to population overflown, we also have data on the overflight of noise sensitive buildings such as schools, hospitals and places of worship; the full data around these is shown in technical appendix a, and as part of this IOA we will provide a qualitative statement around this data.
L_{Aeq}
The westerly departures make up a component of the overall L_{Aeq} day time and night time contours. We have used the overall contours from 2019, as an indicative contour for 2028 as it is expected that contours will be a similar size or smaller in 2028 as Luton has a planning condition to reduce the size. The AD6 airspace change Final Options Appraisal model predicted a very small change to these contours which was put down to the modelling rather than expecting a change in real life. We have also taken this into account when qualitatively describing the baseline and comparing it to our other airspace change options (see arrivals baseline for further details).
Noise Preferred Routes
As this baseline reflects current day, there would be no changes to NPRs as a result of this option.
Respite
The existing SIDs configuration does not offer any opportunities for respite.</td></tr>
<tr><td></td><td>Air Quality</td><td>Impacts to air quality are considered for changes below around 650ft (200m). Aircraft flying above this are unlikely to have a significant impact on local ground air quality.

Owing to high climb performance, aircraft departing from Luton are typically already above 650ft when reaching the departure end runway (DER). This means that our options are unlikely to have a significant impact on ground-level air quality however as part of our IOA we will review each option to understand any changes against this baseline.</td></tr>
<tr><td>Wider Society</td><td>Greenhouse gas impact</td><td>Emissions of greenhouse gases arise from the combustion of aviation fuel, and as the combustion of aviation fuel is linked to track length, we have initially looked at the track length for the baseline westerly SIDs.

When departing from Luton, some aircraft are vectored after 3/4000ft, which means that the track length varies from flight to flight. For the purposes of comparing our westerly SID options against the baseline scenario, we have taken the track length of the SID centerlines as an initial indication of ‘do nothing’ track length. We know that although vectoring does occur above 3/4000ft, there is concentration along the centerline and therefore at this stage, it is a proportionate approach; at the Stage 3 full options appraisal track length will be modelled in further detail.
Table 10 Westerly departure baseline - Indicative track miles
<table>
<tr><th rowspan="2">Option</th><th colspan="3">Indicative track miles (nautical miles) to/abeam</th></tr>
<tr><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th></tr>
<tr><td>Baseline Westerly Dep (centreline) Option 1</td><td>33</td><td>29</td><td>18</td></tr>
</table>
We will estimate the differences between this baseline and the option, to understand if there are any anticipated advantages/disadvantages of the option against current day. This estimation will consider whether the aircraft tracks will be longer or shorter than a typical flight today. As CO_2 emissions are linked to the difference in aviation fuel burnt, this will allow us to calculate a high level estimation of the greenhouse gas impacts as a result of the option. Full details are shown in technical appendix a.</td></tr>
<tr><td></td><td>Capacity / resilience</td><td>Although Luton has recently undertaken a separate ACP to remove interdependencies between Luton and Stansted arrivals, in future, increased forecast movement levels across the LTMA are anticipated to result in capacity and resilience disbenefits. As traffic increases, the extra complexity and workload for air traffic controllers and pilots would likely result in the use of flow regulations. Flow regulations stabilise the number of movements until the peak in traffic subsides, however in doing so they do not allow Luton to optimise capacity.

It is anticipated that, with forecast increases in traffic, in future this baseline scenario would result in a potential increase in the departure delay at the airport. In addition to this, no change to the airspace around Luton may also inhibit the wider FASI programme of change and AMS benefits associated with the programme.</td></tr>
<tr><td></td><td>Tranquillity</td><td>Aircraft today overfly the Chilterns AONB. The highest levels of noise are concentrated on small area before flight paths disperse. The table below provides data on the area of AONB overflown:

Table 11 Westerly departure baseline - AONB overflown
<table>
<tr><th></th><th></th><th>Area (Km2) of AONB overflown. 0-7000ft</th></tr>
<tr><td rowspan="2">DAY</td><td>Baseline Westerly Dep Option 1 (Vector)*</td><td>130.9</td></tr>
<tr><td>Baseline Westerly Dep Option 1 (centreline)</td><td>95.9</td></tr>
<tr><td rowspan="2">NGT</td><td>Baseline Westerly Dep Option 1 (Vector)*</td><td>89.4</td></tr>
<tr><td>Baseline Westerly Dep Option 1 (centreline)</td><td>87.2</td></tr>
</table></td></tr>
<tr><td></td><td>Biodiversity</td><td>On departure all flights will be over 1,000ft after each aircraft has covered 3km. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are</td></tr>
</table>

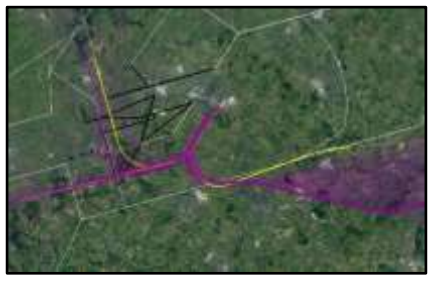
		close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 6km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown.
General Aviation	Access	This baseline scenario would not offer any change from the existing Controlled Airspace (CAS) arrangements in place today. The options will be qualitatively compared against this existing scenario.  *Figure 7 Luton Control Zone and Control Area Chart* Today, Luton's instrument flight procedures are contained within Class D controlled airspace. The base of this airspace varies and is shown on figure 7 (for the current published chart, please see the UK eAIP). Within the Luton TMA, there are areas of airspace delegated to gliding activities. The gliding areas are used differently depending on whether Luton are on easterly or westerly operations. Use of the portions of gliding areas within Controlled Airspace is strictly controlled by a Letter of Agreement between various parties. Luton Approach controllers ensure that all Luton arriving and departing commercial traffic stays within controlled airspace and remain clear of the airspace delegated to gliding activities. There would be no change to these arrangements or letters of agreement as a result of this baseline option. Although the existing baseline scenario will not result in the requirement for more airspace, this option offers no opportunity to simplify the airspace boundaries.
	Economic impact from increased effective capacity	There will be no change from today as a result of this option; later in this IOA we will qualitatively estimate the differences between this and the airspace change options.
General Aviation / Commercial airlines	Fuel burn	As the combustion of aviation fuel is linked to track length, we have initially looked at the track length for the baseline westerly SIDs. When departing from Luton, some aircraft are vectored after around 3/4000ft, which means that the track length varies from flight to flight. For the purposes of comparing our westerly SID options against the baseline scenario, we have taken the track length of the SID centerlines as an initial indication of 'do nothing' track length. We know that although vectoring does occur above 3/4000ft, there is concentration along the centerline and therefore at this stage, it is a proportionate approach; at the Stage 3 full options appraisal track length will be modelled in further detail. *Table 12 Westerly SID Track Mileage* **Option** / **Indicative track miles (nautical miles) to/abeam**: MATCH, OLY, HEN (CPT SID) **Baseline Westerly Dep (centreline) Option 1**: 33, 29, 18 Aircraft departing from Luton are often prevented from continuously climbing to above 7000ft due to the tactical coordination with other traffic within the airspace. We will qualitatively estimate the differences between this baseline and the option, to understand if there are any anticipated advantages/disadvantages of the option against current day. This estimation will consider whether the aircraft tracks will be longer or shorter than a typical flight today and will also consider the opportunity for continuous climb.

LLAOL FASI-S Initial Options Appraisal

Commercial airlines	Training costs	As this option is already in operation, there are no training costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
	Other costs	As this option is already in operation, there are no other costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
Airport / Air navigation service provider	Infrastructure costs	As this option is already in operation, there are no infrastructure costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
	Operational costs	As this option is already in operation, there are no operational costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline. LLAOL's current SIDs are dependent on conventional ground based navigation equipment (VORs) which are currently undergoing a rationalisation programme by NATS NERL. LLAOL is currently investigating RNAV substitution to mitigate VOR rationalization however this is considered an interim measure and failure to implement a long term solution may result in additional operational costs.
	Deployment costs	As this option is already in operation, there are no deployment costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
All	Safety	At current traffic levels, there are no safety concerns with the current arrangements at Luton. Future traffic growth could however result in increased complexity and workload for Air Traffic Controllers and pilots, which may lead to traffic levels within the LTMA being capped to maintain safety.
All	Interdependencies, conflicts and tradeoffs	The ability for Luton westerly departures to continuously climb is currently constrained by movements within the LTMA from neighbouring airport's such as Heathrow, Stansted, London City and Northolt. This is described in more detail in our Stage2A documentation. Doing nothing with Westerly departures will not enable a reduction in the interdependencies, conflicts and tradeoffs between Luton and Heathrow, Stansted, London City and Northolt. In addition, Luton will likely be required to do something in order to enable NERL to make efficiencies within the LTMA.
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* Doing nothing with Westerly departures will not align with the AMS. It will not enable any environmental benefits or help to reduce the interdependencies and constraints within the LTMA. No improvements to vertical profiles from Luton will not enable any reduction in the volume of controlled airspace.

Westerly SID Group 2

Westerly SID Group 2



This option largely aims to replicate current day with the exception of the MATCH SID which is changed to keep north of Heathrow and Northolt departures.

This option is not expected to be dependent on changes at neighbouring airports.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option would see a replication of the existing OLY and CPT SIDs and a change to the latter part of the MATCH SID to keep to the north of Brookmans Park (BPK), away from existing Heathrow and Northolt SIDs to enable more frequent, tactical climb. This could take the MATCH SID slightly closer to Hemel Hempstead however it might be possible to refine that in Stage 3, to minimise any impacts, particularly if RNP+RF specification is considered. The change in the MATCH SID is expected to reduce the overflight from multiple routes (Heathrow, Northolt and Luton) between Hatfield and Harlow; further quantitative analysis of cumulative overflight will be undertaken as part of the Full Options Appraisal at Stage 3.

Figure 8 Westerly SID Group 2 overflight (centreline), with population density and baseline (black outline). Note this option would retain some vectoring which is not shown in these centreline contours.

The lateral dispersion for the OLY and CPT SIDs is expected to be similar to today, however the new position of the MATCH SID north of Brookmans Park would result in more of departures receiving tactical climb continuously to above 5000ft. This will result in a greater concentration of traffic from 4000-7000ft on the MATCH SID however this traffic is anticipated to achieve greater continuous climb performance than the aircraft vectored today. We anticipate that there will be some occasions when ATC are still required to vector to the south of the MATCH SID track to position aircraft to the south of some Heathrow departures, based on where the respective aircraft are leaving UK airspace.

L_{Aeq}

The CPT and OLY SIDs do not change and therefore we do not expect to see any change to the L_{Aeq} contours as a result of these. The change in the MATCH SID could result in a small change to the shape of LOAEL day and night contour, with the contour shifting slightly to the west and south to reflect the change to the MATCH SID. Review of population density maps suggests that this may result in slightly less population within the LOAEL, however this would require further exploration as part of the FOA at Stage 3.

With regards to LLAOL's L_{Aeq} contours that form part of the planning condition, although this option is likely to result in a small change to shape of the contours, we do not expect it to significantly impact the size of the 57dB(A) Leq16hr and 48dB(A) Leq8hr contours.

The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal if this option is taken forward.

Overflight

The overflight diagrams shown in technical appendix A demonstrate the shift in overflight where the MATCH SID has been relocated to the north of Brookmans Park. The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline).

Table 13 Westerly Departure Option 2 Overflight Data

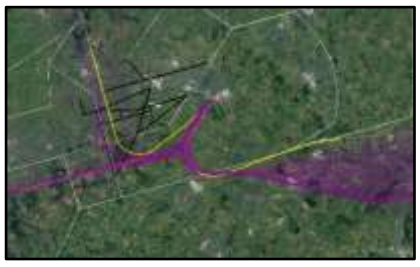
		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
DAY	Baseline Westerly Dep Option 1 (Vector)	614324.0	79163.0	5722.0	1447.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	153814.2	86233.8	14940.9	2535.9	0.0
	Westerly Dep Option 2	129042.5	65989.4	15026.3	986.1	0.0

		<table><tr><td rowspan="3">NGT</td><td>Baseline Westerly Dep Option 1 (Vector)</td><td>98936.0</td><td>6666.0</td><td>0.0</td><td>0.0</td><td>0.0</td></tr><tr><td>Baseline Westerly Dep Option 1 (centreline)</td><td>93645.0</td><td>14597.6</td><td>0.0</td><td>0.0</td><td>0.0</td></tr><tr><td>Westerly Dep Option 2</td><td>71386.6</td><td>14799.9</td><td>0.0</td><td>0.0</td><td>0.0</td></tr></table> The table shows that there is a reduction in the number of people overflown at 0-7000ft between 1, 10 and 100 times per day, however an increase in the number of people overflown 50 times per day. Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows a reduction in the number of sites overflown. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A. **NPR** As there will be no changes to the CPT and OLY SIDs, there will be no impact to their associated Noise Preferred Routes. The change in the MATCH SID between c3000—4000ft will result in an adjustment to the NPR. **Respite** This option does not offer any respite.
	Air Quality	The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.
Wider Society	Greenhouse gas impact	We estimate that there will be no difference in track miles between Westerly SID Group 2 and the baseline. We therefore do not anticipate any significant benefits or impacts to greenhouse gas and CO_2 emissions as a result of this option.
	Capacity / resilience	The repositioning of the MATCH SID to deconflict with Heathrow and Northolt departures is expected to marginally improve capacity within the LTMA. This is because repositioning the MATCH SID towards where it is routinely vectored today reduces the complexity of the region and thus increases capacity and resilience.
	Tranquility	Aircraft today overfly the Chilterns AONB. The CPT and OLY SIDs are not expected to change the area of AONB overflight however the change to the MATCH SID will result in a very small increase in area of AONB overflown when considering the centerline data. The table below provides a comparison of the AONB overflown data however it's important to note that this option will continue to see aircraft vectored above 3/4000ft and the highest levels of noise are concentrated on a small area before the flight paths disperse; this will be investigated in further detail with regards to AONB overflight should this option be progressed into Stage 3. *Table 14 Westerly SID Group 2 AONB overflown* <table><tr><th></th><th></th><th>Area (Km2) of AONB overflown. 0-7000ft</th></tr><tr><td rowspan="3">DAY</td><td>Baseline Westerly Dep Option 1 (Vector)*</td><td>130.9</td></tr><tr><td>Baseline Westerly Dep Option 1 (centreline)</td><td>95.9</td></tr><tr><td>Westerly Dep Option 2 (centreline)</td><td>96.1</td></tr><tr><td rowspan="3">NGT</td><td>Baseline Westerly Dep Option 1 (Vector)*</td><td>89.4</td></tr><tr><td>Baseline Westerly Dep Option 1 (centreline)</td><td>87.2</td></tr><tr><td>Westerly Dep Option 2 (centreline)</td><td>91.9</td></tr></table>
	Biodiversity	On departure all flights will be over 1,000ft after each aircraft has covered 3km. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 6km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown
General Aviation	Access	This option would not be expected to lead to a reduction in the volume of Luton's CAS to the south.
General Aviation / Commercial airlines	Economic impact from increased effective capacity	We expect the small increased effective capacity detailed in the section above will result in a positive economic impact on commercial air traffic compared with the baseline do nothing westerly SID group 1.
	Fuel burn	We estimate that there will be no difference in track miles between Westerly SID Group 2 and the baseline. We therefore do not anticipate any significant benefits or impacts to fuel burn as a result of this option.
Commercial airlines	Training costs	Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This westerly SID option is not anticipated to require any additional

		training costs for airlines.
	Other costs	No other airline costs are foreseen.
Airport / Air navigation service provider	Infrastructure costs	The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.
	Operational costs	This airspace change proposal is not anticipated to change airport or ANSP operational costs. The implementation of PBN SIDs removes LLAOL's dependency on conventional ground based navigation equipment (VORs), which contributes to a reduction in NERL's operational costs as it enables VOR rationalisation[7];
	Deployment costs	This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options. As this option largely replicates current day and is independent of other neighbouring airports, we anticipate that it will require less training that some of the other options, however training still will be required.
All	Safety	The only change of note from the baseline scenario is the move of the MATCH route to the North of BPK. Subject to the published SID vertical profile remaining the same as today and ensuring separation against final approach there are no concerns from a safety perspective at this stage
All	Interdependencies, conflicts and tradeoffs	Moving the MATCH SID to the North of BPK will keep the SID c.5nm away from Northolt and Heathrow's SIDs which route through BPK. This is anticipated to reduce the number of interactions between these departures. However, the move will not enable improvements to the vertical published profiles of the SIDs without wider changes within the LTMA. Luton and NERL have assessed this option as having no negative impact or dependencies on other airports. The change is not expected to constrain the options associated with the core LTMA deployments later because the published SID levels would remain as today, with the SID tracks moved further from those airports.
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* This option would marginally support the modernisation of the airspace. Luton already have a PBN MATCH SID from runway 25 but the re-positioning to the North of BPK can be expected to improve efficiencies within the LTMA and enable more frequent, tactical CCO. This option is unlikely to result in reductions in the volume of Luton's CAS.

[7] LLAOL is currently investigating RNAV Substitution to mitigate VOR rationalisation however this is a temporary solution for the interim period before the deployment of the FASI-S

Westerly SID Group 3

Westerly SID Group 3	
	This option sees the initial departure track split early to separate MATCH from OLY and CPT departures as soon as possible. The MATCH SID aims to keep north of Heathrow and Northolt departures. **This option is not expected to be dependent on changes at neighbouring airports.**

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option sees a change in the initial departure SID tracks from the baseline, so that they split earlier than today solely to provide an equitable distribution of traffic where possible in accordance with DP5. There is also a change to the latter part of the MATCH SID to keep to the north of Brookmans Park (BPK), away from existing Heathrow and Northolt SIDs to enable more frequent, tactical climb. This could take the MATCH SID slightly closer to Hemel Hempstead, however it might be possible to refine that in Stage 3, to minimise any impacts, particularly if RNP+RF specification is considered. The move of the OLY and CPT routes would result in communities under the baseline CPT, MATCH and OLY routes not being overflown to the same extent by the CPT and OLY departures, however this change will result in low level overflight closer to Markyate and Cheverell's Green, leading to an increase in populations overflown within the LOAEL.  *Figure 9 Westerly SID Group 3 overflight (centreline), with population density and baseline (black outline). Note this option would retain some vectoring which is not shown in these centreline contours.* The change in the MATCH SID is expected to reduce the overflight from multiple routes (Heathrow, Northolt and Luton) between Hatfield and Harlow; further quantitative analysis of cumulative overflight will be undertaken as part of the Full Options Appraisal at Stage 3. We would not expect a reduction in cumulative overflight by routes to/from other airports for the CPT and OLY departures. We expect that the published vertical profile of the CPT and OLY SIDs would be the same as today and these routes would still operate with a similar amount of tactical intervention, compared to the baseline, to enable the option to be implemented ahead of the LTMA FASI deployments. This means that once aircraft are above the gliding areas, we would expect OLY departures to be vectored north from the SID centreline, as they are today. We do not anticipate a change to the tactical intervention on the CPT departures. The new position of the MATCH SID north of Brookmans Park would result in more departures receiving tactical climb continuously to above 5000ft. This will result in a greater concentration of traffic from 5000-7000ft on the MATCH SID however this traffic is anticipated to achieve greater continuous climb performance than the aircraft vectored today. We anticipate that there will be some occasions when ATC are still required to vector to the south of the MATCH SID track to position aircraft to the south of some Heathrow departures, based on where the respective aircraft are leaving UK airspace. **L_{Aeq}** The changes to the CPT and OLY SIDs will result in anticipated changes to the shape of the LOAEL day and night contour, with the contour moving slight to the west to reflect the changes in the tracks. Review of population density maps suggests that this will result in an increase in population within the LOAEL however this would require further exploration as part of Stage 3. With regards to LLAOL's L_{Aeq} contours that form part of the planning condition, although this option is likely to result in a change to shape of the contours and the population numbers within them, we do not expect it to significantly impact the size of the 57dB(A) Leq16hr and 48dB(A) Leq8hr contours. The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal. **Overflight** The overflight diagrams shown in technical appendix A demonstrate the changes in overflight from the relocation of the MATCH, CPT and OLY SIDs. We have shown the 0-4000ft data below, as it represents the sections of the SIDs where there is the greatest level of change from the baseline however it is important to note that there are changes beyond 4000ft as well. At this stage in the process, owing to the nature of the vectoring that will occur beyond the NPR and the complexity to model this with regards to noise, we are unable to quantitatively articulate the benefits and impacts. We have however some data for if these routes were to follow the SID centrelines fully up to 7000ft; this information is included in table 14 below.

Table 15 Westerly Departure Option 3 Overflight Data 0-4000ft

	Option	Population over flown 0-4000ft (1 times per day)	Population over flown 0-4000ft (10 times per day)	Population over flown 0-4000ft (50 times per day)	Population over flown 0-4000ft (100 times per day)	Population over flown 0-4000ft (150 times per day)
Day	Baseline Westerly Dep Option 1 (centreline)	8058.7	6305.1	3777.8	2531.5	0.0
	Westerly Dep Option 3	14566.6	14003.7	2915.4	579.4	0.0
Night	Baseline Westerly Dep Option 1 (centreline)	6838.7	3687.4	0.0	0.0	0.0
	Westerly Dep Option 3	14115.8	3360.6	0.0	0.0	0.0

The data shows that there are significant increases in the population overflown 1 and 10 times per day on average, and a decrease in the number of people overflown between 50 and 100 times per day. This decrease is partially due to the split in the departure track which reduces the overflight frequency for communities under sections of the MATCH SID. The increase in overflight 1-10 times per day is due to the CPT/OLY SID routing over Markyate.

The existing SID tracks all route between Markyate and Flamstead and therefore overfly an area of low population which keeps the number of people adversely affected by aircraft noise to a minimum. By splitting the SID tracks whilst keeping a safe distance away from the gliding areas, this results in direct overflight of Markyate where aircraft could be expected to be c.1500-2000ft which would increase the number of people adversely affected. Whilst this is what can be expected from 'sharing of noise', the low level of population under the existing centerline suggests that significantly more people will disbenefit from this change than would benefit from the reduced frequency of overflight.

The below table shows the 0-7000ft centreline population overflight data for the option along with a comparison against the baseline (centreline):

Table 16 Westerly Departure Option 3 Overflight Data 0-7000ft

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
DAY	Baseline Westerly Dep Option 1 (Vector)	614324.0	79163.0	5722.0	1447.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	153814.2	86233.8	14940.9	2535.9	0.0
	Westerly Dep Option 3	132810.8	69760.0	15544.0	579.4	0.0
NGT	Baseline Westerly Dep Option 1 (Vector)	98936.0	6666.0	0.0	0.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	93645.0	14597.6	0.0	0.0	0.0
	Westerly Dep Option 3	77071.8	15856.8	0.0	0.0	0.0

Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows an overall reduction in the number of sites overflown between 0-7000ft however there are increases to schools and places of worship overflown between 0-4000ft. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

NPR

The changes to the CPT, OLY and MATCH SIDs between 0-4000ft will result in a requirement to adjust the baseline Noise Preferred Routes.

Respite

This option does not offer any respite but it does aim to share the noise over more people to reduce the frequency of overflight from those currently overflown.

	Air Quality	The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.
Wider Society	Greenhouse gas impact	We estimate that there will be a small improvement of around 1nm in track mileage compared to the baseline for the OLY and CPT SIDs. The MATCH will remain the same as today. For the CPT and OLY, the equates to around 7.4kg of fuel difference per flight which

is a CO_2 equivalent of 0.023mt. Although this number may seem small, when considered against the total movements operated across an average year, this amounts to overall CO_2 savings. This will be explored in further detail as part of the FOA at Stage 3, should this option progress.

Table 17 Westerly SID Group 3 Track Mileage, Fuel Burn and CO_2

	MATCH	OLY	HEN (CPT SID)	MATCH		OLY		HEN (CPT SID)	
	NM diff to/abeam			A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)
W SID Grp 1 (Baseline)	0	0	0	0	0.000	0	0.000	0	0.000
W SID Grp 3	0	-1	-1	0	0.000	-7.4	-0.023	-7.4	-0.023

Capacity / resilience

The repositioning of the MATCH SID to deconflict with Heathrow and Northolt departures is expected to marginally improve capacity within the LTMA. This is because repositioning the MATCH SID towards where it is routinely vectored today reduces the complexity of the region and thus increases capacity and resilience. In addition to this, the divergence between the CPT/OLY and MATCH SIDs may provide an opportunity to reduce the departure separations to less than 2 mins between successive MATCH + OLY/CPT departures, although it is important to note that these do not currently meet ICAO regulation around 45˚ departure divergence, and therefore a safety case would be required.

If this option is progressed, as part of our full options appraisal we will quantify the anticipated improved capacity, if this reduction in departure interval can be 38realised.

Tranquility

Aircraft today overfly the Chilterns AONB. The changes to the SIDs result in a small increase in area of AONB overflown when considering the centerline data. The table below provides a comparison of the AONB overflown data however it's important to note that this option will continue to see aircraft vectored above 3/4000ft and the highest levels of noise are concentrated on a small area before the flight paths disperse; this will be investigated in further detail with regards to AONB overflight should this option be progressed into Stage 3.

Table 18 Westerly SID Group 3 - AONB overflown

		Area (Km2) of AONB overflown. 0-7000ft
DAY	Baseline Westerly Dep Option 1 (Vector)*	130.9
	Baseline Westerly Dep Option 1 (centreline)	95.9
	Westerly Dep Option 3 (centreline)	99.1
NGT	Baseline Westerly Dep Option 1 (Vector)*	89.4
	Baseline Westerly Dep Option 1 (centreline)	87.2
	Westerly Dep Option 3 (centreline)	95.2

Biodiversity

On departure all flights will be over 1,000ft after each aircraft has covered 3km. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 6km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown.

General Aviation

Access

This option would not be expected to lead to a reduction in the volume of Luton's CAS to the south.

General Aviation / Commercial airlines

Economic impact from increased effective capacity

We expect the increased effective capacity detailed in the section above will result in a positive economic impact on commercial air traffic compared with the baseline do nothing westerly SID group 1.

Fuel burn

We estimate that there will be a small improvement of around 1nm in track mileage compared to the baseline for the OLY and CPT SIDs. The MATCH will remain the same as today. For the CPT and OLY, the equates to around 7.4kg of fuel difference per flight. Although this number may seem small, when considered against the total movements operated across an average year, this amounts to overall fuel burn savings. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 19 Westerly SID Group 3 Track Mileage and Fuel Burn

	MATCH	OLY	HEN (CPT SID)	MATCH	OLY	HEN (CPT SID)
	NM diff to/abeam			A320 fuel difference at FL160 (kg)	A320 fuel difference at FL160 (kg)	A320 fuel difference at FL160 (kg)
W SID Grp 1 (Baseline)	0	0	0	0	0	0
W SID Grp 3	0	-1	-1	0	-7.4	-7.4

Commercial airlines	Training costs	Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This westerly SID option is not anticipated to require any additional training costs for airlines.
	Other costs	No other airline costs are foreseen.
Airport / Air navigation service provider	Infrastructure costs	The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.
	Operational costs	This airspace change proposal is not anticipated to change airport or ANSP operational costs. The implementation of PBN SIDs removes LLAOL's dependency on conventional ground based navigation equipment (VORs), which contributes to a reduction in NERL's operational costs as it enables VOR rationalisation[8];
	Deployment costs	This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options. As this option largely replicates current day and is independent of other neighbouring airports, we anticipate that it will require less training that some of the other options however, training still will be required.
All	Safety	MATCH: Subject to the published SID vertical profile remaining the same as today and ensuring separation against final approach there are no concerns from a safety perspective at this stage. CPT+OLY: This route requires the SID centreline to be closer to Dunstable Gliding Area. There are no prescribed separations from the area at present, controllers can vector 'right to the line'. The existing centreline is 1.7nm from the gliding area (measured at the first turn at altitude waypoint) with aircraft tracks seen to be regularly 1.3nm from the gliding area at this point. This is partly as a result of the turn at altitude, not providing a guaranteed turn point. The proposed centreline is 1.7nm from the gliding area measured at the first turn at altitude waypoint) then remaining 1.6nm thereafter until vertical separation provided. New safety assurances will therefore be required, but an acceptable safety argument is envisaged to be achievable.
All	Interdependencies, conflicts and tradeoffs	Moving the MATCH SID to the North of BPK will keep the SID c.5nm away from Northolt and Heathrow's SIDs which route through BPK. This is anticipated to reduce the number of interactions between these departures. However, the move will not enable improvements to the vertical published profiles of the SIDs without wider changes within the LTMA. The changes to the CPT/OLY SIDs are not expected to reduce the number of interactions between departures from other airports however, nor are they expected to increase them. Luton and NERL have assessed this option as having no negative impact or dependencies on other airports. The change is not expected to constrain the options associated with the core LTMA deployments later because the published SID levels would remain as today, with the SID tracks moved further from those airports.
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* This option would support the modernisation of the airspace. Luton already have a PBN MATCH SID from runway 25 but the re-positioning to the North of BPK can be expected to improve efficiencies within the LTMA and enable more frequent, tactical CCO. Upgrading the CPT and OLY SIDs to PBN would be aligned with the AMS as would the reduction in noise impacts, if they were to be assessed as such. However, as mentioned in the Noise impact on health and quality of life section above, it is currently questionable as to whether the realignment of the CPT and OLY SID track would result in noise improvements. This option is unlikely to result in reductions in the volume of Luton's CAS.

[8] LLAOL is currently investigating RNAV Substitution to mitigate VOR rationalisation however this is a temporary solution for the interim period before the deployment of the FASI-S

Westerly SID Group 4

Westerly SID Group 4	
 **Period 1 (above) Period 2 (below)** 	This option has two sets of SIDs (Period 1 and Period 2) which would alternate at a set time. For this IOA we have assumed they alternative each day, therefore each set of SIDs is in operation an equal amount of time over a year. **This option is not expected to be dependent on changes at neighbouring airports.**

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option is based on two sets of SIDs that would alternate; for this IOA we have assumed that they will alternate on a daily basis and will be operated equally over a year.  *Figure 10 Westerly SID Group 4 overflight (centreline), with population density and baseline (black outline). Note this option would retain some vectoring which is not shown in these centreline contours.* **Period 1:** This option sees a change in the initial departure SID tracks from the baseline, so that they split earlier than today. The MATCH SID is changed to turn earlier. In the illustration used, it provides the earliest and tightest turn possible using RNP+RF within PANS OPS. This would result in some overflight of Harpenden, although as the procedures are developed and refined, there may be the opportunity to minimise this whilst balancing the separation required to achieve respite with the period 2 MATCH SID. There is also a change to the latter part of the MATCH SID to keep to the north of Brookmans Park, away from existing Heathrow and Northolt SIDs to enable more frequent, tactical climb. The change in the MATCH SID is expected to reduce the overflight from multiple routes (Heathrow, Northolt and Luton) between Hatfield and Harlow; further quantitative analysis of cumulative overflight will be undertaken as part of the Full Options Appraisal at Stage 3. This will result in a greater concentration of traffic on the MATCH SID, however this traffic is anticipated to achieve greater continuous climb performance than today. The move of the OLY and CPT routes would result in communities under the baseline CPT, MATCH and OLY routes not being overflown to the same extent by the CPT and OLY departures, however this change will result in overflight closer to Markyate and Cheverell's Green. We expect that the published vertical profile of the CPT and OLY SIDs would be the same as today and these routes would still operate with a similar amount of tactical intervention compared to the baseline to enable the option to be implemented ahead of the LTMA FASI deployments. This means that once aircraft are above the gliding areas, we would expect OLY departures to be vectored north from the SID centreline as they are today. We do not anticipate a change to the tactical intervention on the CPT departures, but we would expect controllers to not tactically intervene until north of Frithsden to ensure we maintain the benefits of respite. **Period 2:** The period 2 SIDs are identical to Westerly SID Option 2, which would see a replication of the existing OLY and CPT SIDs and a change to the latter part of the MATCH SID to keep to the north of Brookmans Park, away from existing Heathrow and Northolt SIDs to enable more frequent, tactical climb. This could take the MATCH SID slightly closer to Hemel Hempstead although as the procedures are developed and refined, there may be the opportunity to minimise this whilst balancing the separation required to achieve respite with the period 1 MATCH SID. The change in the MATCH SID is expected to reduce the overflight from multiple routes (Heathrow, Northolt and Luton) between Hatfield and Harlow; further quantitative analysis of cumulative overflight will be undertaken as part of the Full Options Appraisal at Stage 3. In both periods, we expect that the published vertical profile of the CPT and OLY SIDs would be the same as today, however the new position of the MATCH SID north of Brookmans Park would result in more departures receiving tactical climb continuously to above 5000ft than today. This will result in a greater concentration of traffic on the MATCH SID, however this traffic is anticipated to achieve greater continuous climb performance than today.

The existing SID tracks all route between Markyate and Flamstead and therefore overfly an area of low population which keeps the number of people adversely affected by aircraft noise to a minimum. By splitting the SID tracks whilst keeping a safe distance away from the gliding areas, this results in direct overflight of Markyate where aircraft could be expected to be c.1500-2000ft which would increase the number of people adversely affected. Whilst this is what can be expected from 'sharing of noise', the low level of population under the existing centerline suggests that significantly more people could disbenefit from this change at low level than would benefit from the reduced frequency of overflight.

L_{Aeq}

The changes to the SIDs combined with the reduction in frequency of overflight (owing to sharing the aircraft across multiple routes) are expected to result in changes to the shape of the LOAEL day and night contour. Review of population density maps suggests that this may result in slightly less total population within the LOAEL, however this would require further exploration as part of the FOA at Stage 3.

With regards to LLAOL's LAeq contours that form part of the planning condition, although this option is likely to result in a change to shape of the contours, we do not expect it to significantly impact the size of the 57dB(A) Leq16hr and 48dB(A) Leq8hr contours.

The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal if this option is progressed.

Overflight

The overflight diagrams shown in technical appendix A demonstrate the changes in overflight from the relocation of the MATCH, CPT and OLY SIDs. The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline) however it's important to note that we would still expect tactical intervention (vectoring) as part of this option which we will quantitatively appraise in further detail should this option progress to Stage 3.

Table 20 Westerly Departure Option 4 Overflight Data

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
DAY	Baseline Westerly Dep Option 1 (Vector)	614324.0	79163.0	5722.0	1447.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	153814.2	86233.8	14940.9	2535.9	0.0
	Westerly Dep Option 4	156742.0	90402.6	18957.6	572.6	0.0
NGT	Baseline Westerly Dep Option 1 (Vector)	98936.0	6666.0	0.0	0.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	93645.0	14597.6	0.0	0.0	0.0
	Westerly Dep Option 4	111650.8	11126.3	0.0	0.0	0.0

The table shows that there is an increase in the number of people overflown at 0-7000ft 1, 10 and 50 times a day, and there is a reduction in the number of people overflown 100 times per day compared to the baseline. At night the number of people overflown on average once per night increases and overflown 10 times decreases. These outcomes reflect the nature of respite routes, whereby a greater number of people overall are overflown, however it is on a lower frequency basis because of the periods of respite.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows an increase in the number of sites overflown between 0-7000ft; this again can be attributed to the respite periods whereby there is a greater area of overflight however the frequency of overflight would be lower. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

NPR

The changes to the CPT, OLY and MATCH SIDs between 0-4000ft will result in a requirement to adjustment the baseline Noise Preferred Routes. There would be different NPRs for each respite period.

Respite

This option offers respite via two sets of SIDs which could be alternated. For this IOA we have assumed the period of alternation as daily, however this can be explored in greater detail with stakeholders as part of the Stage 3 consultation.

As outlined in our overflight analysis, there is an increase in the overall population and noise sensitive sites overflown however the impacts of noise are now shared and so there are decreases in the frequency of overflight where the frequency of overflight is currently high. This is something that was requested by stakeholders and formed part of the design principles. The benefits and impacts of this would require further quantitative analysis as part of the Stage 3 Full Options Appraisal. The issue of moving traffic from an area of very low population and sharing over areas of greater population density will need careful consideration and assessment against the wider benefits the option could generate.

<table>
<tr><td></td><td>Air Quality</td><td>The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.</td></tr>
<tr><td rowspan="4">Wider Society</td><td>Greenhouse gas impact</td><td>We estimate that there will be an improvement in track mileage for the period 1 SIDs with the MATCH c.4nm shorter than the baseline, and the CPT and OLY SIDs c.1nm shorter. The period 2 SIDs remain the same as today.

For the period 1 CPT and OLY, this equates to around 7.4kg of fuel difference per flight which is a CO_2 equivalent of 0.023mt. The period 1 MATCH saving equates to around 29.6kg of fuel difference per flight which is a CO_2 equivalent of 0.094mt. When considered against the total movements operated across an average year, this amounts to overall CO_2 savings for this option when the period 1 SIDs are in operation. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 21 Westerly SID Group 4 Track Mileage, Fuel Burn and CO2
<table>
<tr><th></th><th colspan="3">NM diff to/abeam</th><th>MATCH</th><th></th><th>OLY</th><th></th><th>HEN (CPT SID)</th><th></th></tr>
<tr><th></th><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th></tr>
<tr><td>W SID Grp 1 (Baseline)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0.000</td><td>0</td><td>0.000</td><td>0</td><td>0.000</td></tr>
<tr><td>W SID Grp 4 Period 1</td><td>-4</td><td>-1</td><td>-1</td><td>-29.6</td><td>-0.094</td><td>-7.4</td><td>-0.023</td><td>-7.4</td><td>-0.023</td></tr>
<tr><td>W SID Grp 4 Period 2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0.000</td><td>0</td><td>0.000</td><td>0</td><td>0.000</td></tr>
</table></td></tr>
<tr><td>Capacity / resilience</td><td>The repositioning of the MATCH SID to deconflict with Heathrow and Northolt departures is expected to marginally improve capacity within the LTMA. This is because repositioning the MATCH SID towards where it is routinely vectored today reduces the complexity of the region and thus increases capacity and resilience. In addition to this, the divergence between the CPT/OLY and MATCH SIDs during period 1 may provide the opportunity to reduce the departure separations to less than 2 mins between successive MATCH + OLY/CPT departures, although it is important to note that these do not currently meet the regulation around 45˚ departure divergence, and therefore a safety case would be required.</td></tr>
<tr><td>Tranquility</td><td>Aircraft today overfly the Chilterns AONB. The changes to the SIDs with the routes dispersing more quickly after take off mean that noise is spread over a wider area of AONB however the frequency is reduced. The table below provides a comparison of the AONB overflown data however it’s important to note that this option will continue to see aircraft vectored above 3/4000ft; this will be investigated in further detail with regards to AONB overflight should this option be progressed into Stage 3.

Table 22 Westerly SID Group 4 AONB overflown
<table>
<tr><th></th><th></th><th>Area (Km2) of AONB overflown. 0-7000ft</th></tr>
<tr><td rowspan="3">DAY</td><td>Baseline Westerly Dep Option 1 (Vector)*</td><td>130.9</td></tr>
<tr><td>Baseline Westerly Dep Option 1 (centreline)</td><td>95.9</td></tr>
<tr><td>Westerly Dep Option 4 (centreline)</td><td>105.7</td></tr>
<tr><td rowspan="3">NGT</td><td>Baseline Westerly Dep Option 1 (Vector)*</td><td>89.4</td></tr>
<tr><td>Baseline Westerly Dep Option 1 (centreline)</td><td>87.2</td></tr>
<tr><td>Westerly Dep Option 4 (centreline)</td><td>101.7</td></tr>
</table></td></tr>
<tr><td>Biodiversity</td><td>On departure all flights will be over 1,000ft after each aircraft has covered 3km. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 6km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown</td></tr>
<tr><td>General Aviation</td><td>Access</td><td>This option would not be expected to lead to a reduction in the volume of Luton’s CAS to the south.</td></tr>
<tr><td rowspan="2">General Aviation / Commercial airlines</td><td>Economic impact from increased effective capacity</td><td>We expect the increased effective capacity detailed in the section above will result in a positive economic impact on commercial air traffic compared with the baseline do nothing westerly SID group 1.</td></tr>
<tr><td>Fuel burn</td><td>We estimate that there will be an improvement in track mileage for the period 1 SIDs with the MATCH c.4nm shorter than the baseline, and the CPT and OLY SIDs c.1nm shorter. The period 2 SIDs remain the same as today. For the period 1 CPT and OLY, this equates to around 7.4kg of fuel difference per flight. The period 1 MATCH saving equates to around 29.6kg of fuel difference per flight. When considered against the total movements operated across an average year, this amounts to overall fuel burn savings</td></tr>
</table>

<table>
<tr><td></td><td></td><td>for this option when the period 1 SIDs are in operation. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.
Table 23 Westerly SID Group 4 Track Mileage and Fuel Burn
<table>
<tr><th></th><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th></tr>
<tr><th></th><th colspan="3">NM diff to/abeam</th><th>A320 fuel difference at FL160 (kg)</th><th>A320 fuel difference at FL160 (kg)</th><th>A320 fuel difference at FL160 (kg)</th></tr>
<tr><td>W SID Grp 1 (Baseline)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>W SID Grp 4 Period 1</td><td>-4</td><td>-1</td><td>-1</td><td>-29.6</td><td>-7.4</td><td>-7.4</td></tr>
<tr><td>W SID Grp 4 Period 2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table></td></tr>
<tr><td rowspan="2">Commercial airlines</td><td>Training costs</td><td>Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This westerly SID option is not anticipated to require any additional training costs for airlines.</td></tr>
<tr><td>Other costs</td><td>No other airline costs are foreseen.</td></tr>
<tr><td rowspan="3">Airport / Air navigation service provider</td><td>Infrastructure costs</td><td>The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.</td></tr>
<tr><td>Operational costs</td><td>This airspace change proposal is not anticipated to change airport or ANSP operational costs.
The implementation of PBN SIDs removes LLAOL’s dependency on conventional ground based navigation equipment (VORs), which contributes to a reduction in NERL’s operational costs as it enables VOR rationalisation[9];</td></tr>
<tr><td>Deployment costs</td><td>This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options. Owing to the use of the respite periods and the changes to the OLY, CPT and MATCH SIDs, we anticipate that it will require slightly more training that some of the other options.</td></tr>
<tr><td>All</td><td>Safety</td><td>MATCH: Subject to the published SID vertical profile remaining the same as today and ensuring separation against final approach, there are no concerns from a safety perspective at this stage.

CPT+OLY: One of the routes requires the SID centreline to be closer to Dunstable Gliding Area. There are no prescribed separations from the area at present, controllers can vector 'right to the line'. The existing centreline is 1.7nm from the gliding area (measured at the first turn at altitude waypoint) with aircraft tracks seen to be regularly 1.3nm from the gliding area at this point. This is partly as a result of the turn at altitude, not providing a guaranteed turn point. The proposed centreline is 1.7nm from the gliding area measured at the first turn at altitude waypoint) then remaining 1.6nm thereafter until vertical separation provided. New safety assurances will therefore be required, but an acceptable safety argument is envisaged to be achievable

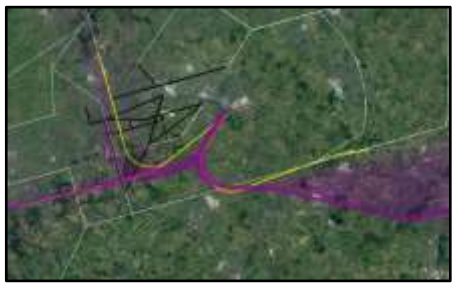
SID Switching: This would be new to Luton and the LTMA. The risk of an aircraft selecting the incorrect SID needs to be managed. For example, if the first MATCH departure was issued and the aircraft flew the longer SID and then the subsequent MATCH departure was issued the longer SID but the aircraft incorrectly flew the shorter SID, there would be a catch-up situation. Alternating between each set of SIDs may need to take place overnight to help mitigate the chances of pilot and ATC error so to avoid changing during busy periods.</td></tr>
<tr><td>All</td><td>Interdependencies, conflicts and tradeoffs</td><td>Moving the MATCH SID to the North of BPK will keep the SID c.5nm away from Northolt and Heathrow’s SIDs which route through BPK. The period 1 MATCH SID is expected to be especially beneficial in this regard. This is anticipated to reduce the number of interactions between these departures. However, the move will not enable improvements to the vertical published profiles of the SIDs without wider changes within the LTMA.

The changes to the CPT/OLY SIDs are not expected to reduce the number of interactions between departures from other airports however, nor are they expected to increase them. Luton and NERL have assessed this option as having no negative impact or dependencies on other airports.</td></tr>
<tr><td>All</td><td>AMS</td><td>CAP1711 describes the objective as:
Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.

This option would support the modernisation of the airspace. Luton already have a PBN MATCH SID from runway 25 but the re-positioning to the North of BPK can be expected to improve efficiencies within the LTMA and enable more frequent, tactical CCO. Upgrading the CPT and OLY SIDs to PBN would be aligned with the AMS and use of multiple SIDs to provide sharing of noise and provision of respite would support the reduction in noise impacts, if they were to be assessed as such. However, as mentioned in the Noise impact on health and quality of life section above, it is currently questionable as to whether the realignment of the CPT and OLY SID track at very low altitude would result in noise improvements. It is possible that to avoid increasing the numbers of people adversely affected by aircraft noise, delaying the turns until after Markyate could be the required outcome.
However, when compared with Westerly Option 3, the use of multiple routes could be expected to help mitigate the negative impacts of the new overflight of Markyate. This option is unlikely to result in reductions in the volume of Luton’s CAS.</td></tr>
</table>

[9] LLAOL is currently investigating RNAV Substitution to mitigate VOR rationalisation however this is a temporary solution for the interim period before the deployment of the FASI-S

Westerly SID Group 5

Westerly SID Group 5	
	This option follows the same lateral paths as WD Group 2 however this group assumes all departures are able to continuously climb to at least 6,000ft. **This option is dependent on the integration with other FASI-S airports and the upper airspace design.**

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option is laterally identical to Westerly SID Group 3, however this option assumes all departures are able to continuously climb to at least 6,000ft. It sees a change in the initial departure SID tracks from the baseline, so that they split earlier than today although noting the findings from the assessment of Option 3, the exact point of divergence would be refined within this option in Stage 3, to see if the route could avoid Markyate (in the absence of the use of multiple routes to help mitigate those impacts). There is also a change to the latter part of the MATCH SID to keep to the north of Brookmans Park, away from existing Heathrow and Northolt SIDs to enable more frequent, tactical climb. This could take the MATCH SID slightly closer to Hemel Hempstead however it might be possible to refine that in Stage 3, to minimize any impacts, particularly if RNP+RF specification is considered. The move of the OLY and CPT routes would result in communities under the baseline CPT, MATCH and OLY routes not being overflown to the same extent by the CPT and OLY departures, however this change will result in overflight closer to Markyate and Cheverell's Green.  *Figure 11 Westerly SID Group 5 overflight (centreline), with population density and baseline (black outline).* We would expect the wider LTMA re-design to have procedurally deconflicted routes to/from adjacent airports and therefore the cumulative impacts from other neighbouring airports to be reduced. The opportunity to avoid cumulative impacts from Luton's routes depends on the arrival configuration; we will explore this in future detail as part of the Full Options Appraisal at Stage 3. Unlike Westerly SID Option 3, all the SIDs in Westerly Option 5 are assumed to deliver guaranteed climb to at least 6000ft. This is because we assume Heathrow, Northolt and London City departures are deconflicted in the new FASI design. This means that there is a lower requirement for routine tactical intervention from air traffic controllers and aircraft are expected to follow the SID centrelines. **L_{Aeq}** The changes to the CPT, OLY and MATCH SIDs result in anticipated changes to the shape of the LOAEL day and night contour, with the contour moving slight to the west to reflect the changes in the tracks. Review of population density maps suggests that this may result in a slight increase in total population within the LOAEL however this would require further exploration as part of Stage 3. With regards to LLAOL's L_{Aeq} contours that form part of the planning condition, although this option is likely to result in a change to shape of the contours, we do not expect it to significantly impact the size of the 57dB(A) Leq16hr and 48dB(A) Leq8hr contours. The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal. **Overflight** The overflight diagrams shown in technical appendix A demonstrate the changes in overflight from the relocation of the MATCH, CPT and OLY SIDs. The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline):

Table 24 Westerly Departure Option 5 Overflight Data

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
DAY	Baseline Westerly Dep Option 1 (Vector)	614324.0	79163.0	5722.0	1447.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	153814.2	86233.8	14940.9	2535.9	0.0
	Westerly Dep Option 5	132254.8	69253.4	15635.4	579.4	0.0
NGT	Baseline Westerly Dep Option 1 (Vector)	98936.0	6666.0	0.0	0.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	93645.0	14597.6	0.0	0.0	0.0
	Westerly Dep Option 5	76543.5	15961.6	0.0	0.0	0.0

The data shows that there are decreases in the population overflown 1 and 10 times per day and a small increase in the number overflown 50 times per day. There is also a decrease in the population overflown 100 times per day. This decrease is partially due to the split in the departure track which reduces the overflight frequency for communities under sections of the MATCH SID.

The existing SID tracks all route between Markyate and Flamstead and therefore overfly an area of low population which keeps the number of people adversely affected by aircraft noise below 4000ft to a minimum. By splitting the SID tracks whilst keeping a safe distance away from the gliding areas, this results in direct overflight of Markyate where aircraft could be expected to be c.1500-2000ft which would increase the number of people adversely affected. Whilst this is what can be expected from 'sharing of noise', the low level of population under the existing centerline suggests that significantly more people will disbenefit from this change below 3000ft than would benefit from the reduced frequency of overflight below 3000ft. However, the improvements in CCO reduce numbers overflown as a whole between 0-7000ft.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows an overall reduction in the number of sites overflown between 0-7000ft however there are increases to schools and places of worship overflown between 0-4000ft. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

NPR
The changes to the CPT, OLY and MATCH SIDs between 0-4000ft will result in a requirement to adjustment the baseline Noise Preferred Routes.

Respite
This option does not offer any respite, but it does aim to share the noise over more people to reduce the frequency of overflight from those currently overflown.

	Air Quality	The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.
Wider Society	Greenhouse gas impact	We estimate that there will be a small improvement of around 1nm in track mileage compared to the baseline for the OLY and CPT SIDs. The MATCH will remain the same as today. For the CPT and OLY, the equates to around 7.4kg of fuel difference per flight which is a CO_2 equivalent of 0.023mt. Although this number may seem small, when considered against the total movements operated across an average year, this amounts to overall CO_2 savings. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.
	Capacity / resilience	The repositioning of the MATCH SID to deconflict with Heathrow and Northolt departures is expected to marginally improve

Table 25 Westerly SID Group 5 Track Mileage, Fuel Burn and CO2

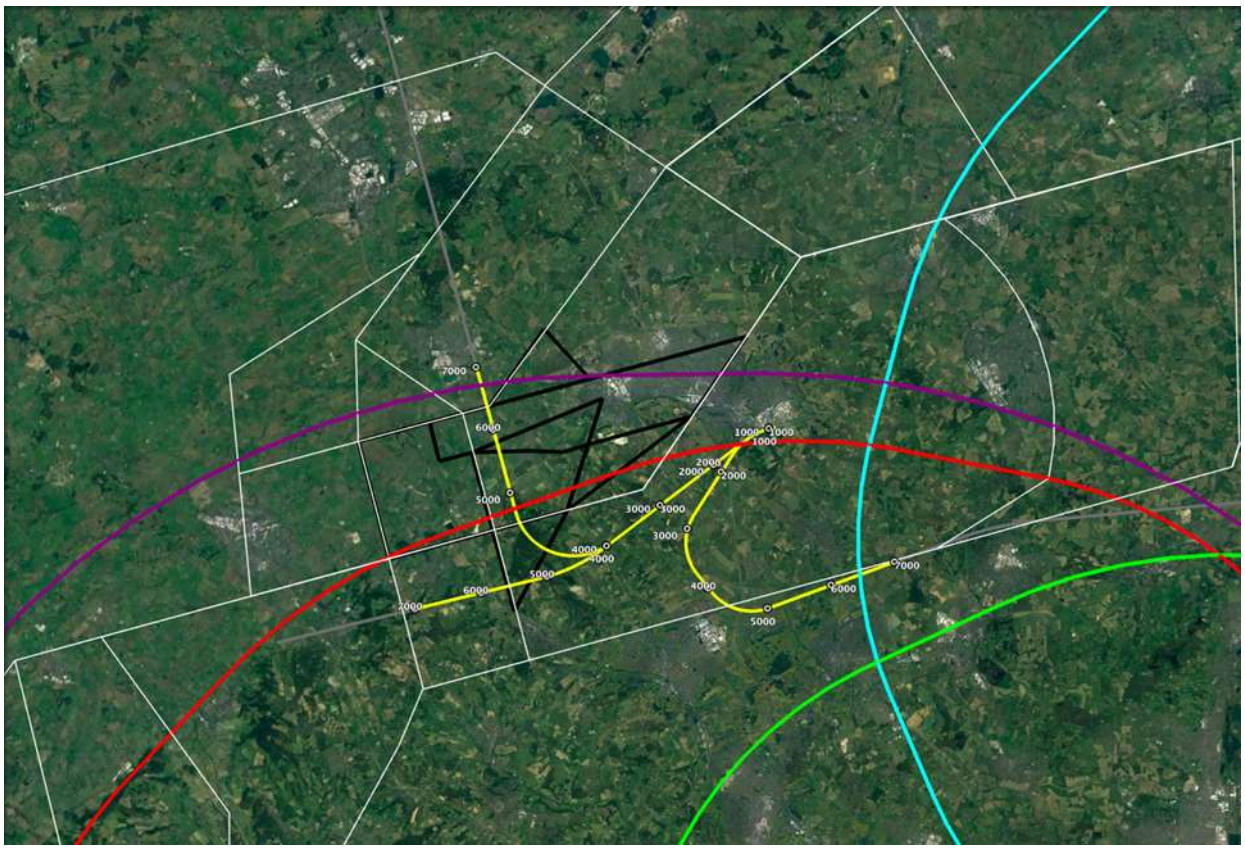
	MATCH	OLY	HEN (CPT SID)	MATCH		OLY		HEN (CPT SID)	
	NM diff to/abeam			A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)
W SID Grp 1 (Baseline)	0	0	0	0	0.000	0	0.000	0	0.000
W SID Grp 5	0	-1	-1	0	0.000	-7.4	-0.023	-7.4	-0.023

<table>
<tr><td></td><td></td><td>capacity within the LTMA. This is because repositioning the MATCH SID towards where it is routinely vectored today reduces the complexity of the region and thus increases capacity and resilience. In addition to this, the divergence between the CPT/OLY and MATCH SIDs during period 1 may provide the opportunity to reduce the departure separations to less than 2 mins between successive MATCH + OLY/CPT departures, although it is important to note that these do not currently meet the regulation around 45˚ departure divergence, and therefore a safety case would be required.</td></tr>
<tr><td></td><td>Tranquility</td><td>Aircraft today overfly the Chilterns AONB. The table below provides a comparison of the AONB overflown data. In the baseline, aircraft are vectored from 3/4000ft creating dispersion across the AONB whereas Westerly SID group 5 uses PBN which will result in a smaller area overflown during the day, however the frequency will increase. At night, the area of AONB overflown increases. The highest levels of noise concentrates on a small areas before the flight paths disperse.

Table 26 Westerly SID Group 5 AONB overflown
<table>
<tr><th></th><th></th><th>Area (Km2) of AONB overflown. 0-7000ft</th></tr>
<tr><td rowspan="3">DAY</td><td>Baseline Westerly Dep Option 1 (Vector)*</td><td>130.9</td></tr>
<tr><td>Baseline Westerly Dep Option 1 (centreline)</td><td>95.9</td></tr>
<tr><td>Westerly Dep Option 4 (centreline)</td><td>105.7</td></tr>
<tr><td rowspan="3">NGT</td><td>Baseline Westerly Dep Option 1 (Vector)*</td><td>89.4</td></tr>
<tr><td>Baseline Westerly Dep Option 1 (centreline)</td><td>87.2</td></tr>
<tr><td>Westerly Dep Option 4 (centreline)</td><td>101.7</td></tr>
</table></td></tr>
<tr><td></td><td>Biodiversity</td><td>On departure all flights will be over 1,000ft after each aircraft has covered 3km. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 6km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown.</td></tr>
<tr><td>General Aviation</td><td>Access</td><td>Improvements in CCO would be expected to enable reductions in the volume of CAS</td></tr>
<tr><td rowspan="2">General Aviation / Commercial airlines</td><td>Economic impact from increased effective capacity</td><td>We expect the increased effective capacity detailed in the section above will result in a positive economic impact on commercial air traffic compared with the baseline do nothing westerly SID group 1.</td></tr>
<tr><td>Fuel burn</td><td>We estimate that there will be a small improvement of around 1nm in track mileage compared to the baseline for the OLY and CPT SIDs. The MATCH will remain the same as today. For the CPT and OLY, the equates to around 7.4kg of fuel difference per flight. Although this number may seem small, when considered against the total movements operated across an average year, this amounts to overall fuel burn savings. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 27 Westerly SID Group 5 Track Mileage and Fuel Burn
<table>
<tr><th></th><th colspan="3">NM diff to/abeam</th><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th></tr>
<tr><th></th><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th><th>A320 fuel difference at FL160 (kg)</th><th>A320 fuel difference at FL160 (kg)</th><th>A320 fuel difference at FL160 (kg)</th></tr>
<tr><td>W SID Grp 1 (Baseline)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>W SID Grp 5</td><td>0</td><td>-1</td><td>-1</td><td>0</td><td>-7.4</td><td>-7.4</td></tr>
</table></td></tr>
<tr><td rowspan="2">Commercial airlines</td><td>Training costs</td><td>Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This westerly SID option is not anticipated to require any additional training costs for airlines.</td></tr>
<tr><td>Other costs</td><td>No other airline costs are foreseen.</td></tr>
<tr><td rowspan="3">Airport / Air navigation service provider</td><td>Infrastructure costs</td><td>The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.</td></tr>
<tr><td>Operational costs</td><td>This airspace change proposal is not anticipated to change airport or ANSP operational costs.
The implementation of PBN SIDs removes LLAOL’s dependency on conventional ground based navigation equipment (VORs), which contributes to a reduction in NERL’s operational costs as it enables VOR rationalisation[10];</td></tr>
<tr><td>Deployment costs</td><td>This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options. Owing to the changes to the OLY, CPT and MATCH SIDs, we anticipate that it will require slightly more training that some of the other options.</td></tr>
<tr><td>All</td><td>Safety</td><td>All SIDs: Climb above 5000ft will require additional safety assurances to assure LTMA separations in all pressures.</td></tr>
</table>

[10] LLAOL is currently investigating RNAV Substitution to mitigate VOR rationalisation however this is a temporary solution for the interim period before the deployment of the FASI-S

		MATCH: Subject to the published SID vertical profile remaining the same as today and ensuring separation against final approach there are no concerns from a safety perspective at this stage. CPT+OLY: This route requires the SID centreline to be closer to Dunstable Gliding Area. There are no prescribed separations from the area at present, controllers can vector 'right to the line'. The existing centreline is 1.7nm from the gliding area (measured at the first turn at altitude waypoint) with aircraft tracks seen to be regularly 1.3nm from the gliding area at this point. This is partly as a result of the turn at altitude, not providing a guaranteed turn point. The proposed centreline is 1.7nm from the gliding area measured at the first turn at altitude waypoint) then remaining 1.6nm thereafter until vertical separation provided. New safety assurances will therefore be required but an acceptable safety argument is envisaged to be achievable. Proximity of Luton's routes to those of adjacent routes from FASI airports will all require safety assurances subject to their final locations.
All	Interdependencies, conflicts and tradeoffs	Moving the MATCH SID to the North of BPK will keep aircraft further away from Northolt, London City and Heathrow. Until the shortlisted options from those airports are available, the exact interdependencies are not known. However, the interdependencies with other airspace changes identified in Iteration 2 of ACOG's Airspace Change Masterplan show that any SIDs to the South of Luton are likely to interact with Northolt, London City and Heathrow. *Table 28 Westerly SID Group 5 and areas of interdependencies. Heathrow (purple) Northolt (red) Stansted (blue) London City (green)*  As set out in our Stage 2A documentation, achieving procedural climb in SIDs to the South of Luton to higher than 5000ft will be extremely challenging. The Transition Altitude remaining at 6,000ft does not help this situation. For example, if Heathrow's northbound SIDs were to remain in their existing vicinity, we would need climb rates in excess of 8% to at least FL90 on those Heathrow departures to enable Luton's SIDs to climb to even 6,000ft. Positioning Luton's SIDs further north than today would help to enable Continuous Climb and reduce interdependencies on other airports, but there are significant population densities that would be newly overflown below 4,000ft as a result.
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* This option would support the modernisation of the airspace. Luton already have a PBN MATCH SID from runway 25 but the re-positioning to the North of BPK can be expected to improve efficiencies within the LTMA and enable more frequent, tactical CCO. Ideally, Luton's SIDs will be able to climb procedurally above 5000ft, but this will be extremely challenging as described above. Upgrading the CPT and OLY SIDs to PBN would be aligned with the AMS as would the reduction in noise impacts, if they were to be assessed as such. However, as mentioned in the Noise impact on health and quality of life section above, it is currently questionable as to whether the realignment of the CPT and OLY SID track would result in noise improvements. It is possible that to avoid increasing the numbers of people adversely affected by aircraft noise, delaying the turns until after Markyate could be the required outcome. This option could be expected to result in reductions in the volume of Luton's CAS if procedural CCO is enabled.

Westerly SID Group 6

Westerly SID Group 6	
 Period 1 (above) Period 2 (below) 	This option has two sets of SIDs (Period 1 and Period 2) which would alternate at a set time. For this IOA, we have assumed they alternative each day, therefore each set of SIDs is in operation an equal amount of time over a year. **This option is dependent on the integration with other FASI-S airports and the upper airspace design.**

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option is similar to Westerly SID Option 4, however some parts are now dependent on the FASI-S programme and resolving interdependencies with other airports. This option is based on two sets of SIDs that would alternate; for this IOA we have assumed that they will alternate on a daily basis and will be operated equally over a year. **Period 1:** This part of the option sees a change in the initial departure SID tracks from the baseline so that they split earlier than today. The MATCH SID illustrated provides the earliest and tightest turn possible using RNP+RF within PANS OPS. This would result in some overflight of Harpenden, although as the procedures are developed and refined, there may be the opportunity to minimise this whilst balancing the separation required to achieve respite with the period 2 MATCH SID. There is also a change to the latter part of the MATCH SID to keep to the north of Brookmans Park, away from existing Heathrow and Northolt SIDs to enable more CCO. The change in the MATCH SID is expected to reduce the overflight from multiple routes (Heathrow, Northolt and Luton) between Hatfield and Harlow; further quantitative analysis of cumulative overflight will be undertaken as part of the Full Options Appraisal at Stage 3. The move of the OLY and CPT routes would result in communities under the baseline CPT, MATCH and OLY routes not being overflown to the same extent by the CPT and OLY departures however this change will result in overflight closer to Markyate and Cheverell's Green.  *Figure 12 Westerly SID Group 6 overflight (centreline), with population density and baseline (black outline).* **Period 2:** The period 2 CPT and OLY SIDs are positioned further south than Westerly SID Option 4 to achieve a greater level of lateral separation from the period 1 SIDs for longer, to enable a greater level of respite. This would result in some overflight of parts of Berhamstead. As the tracks are further south, they are closer to Heathrow and Northolt and therefore these could only be implemented with coordination of the interdependencies between Heathrow, Northolt and Luton. We would expect the wider LTMA re-design to have procedurally deconflicted routes to/from adjacent airports and therefore the cumulative impacts from other neighbouring airports to be reduced. The opportunity to avoid cumulative impacts from Luton's routes depends on the arrival configuration; we will explore this in future detail as part of the Full Options Appraisal at Stage 3. We have assumed all the SIDs in Westerly Option 6 operate guaranteed climb to at least 6000ft although this will be extremely challenging for the same reasons as articulated in Westerly Option 5. This is because we assume Heathrow, Northolt and London City departures are deconflicted in the new FASI design. This means that there is a lower requirement for routine tactical intervention from air traffic controllers and aircraft are expected to follow the SID centrelines more frequently. **L_{Aeq}** The changes to the CPT, OLY and MATCH SIDs during period 1 and period 2 are anticipated to result in changes to the shape of the LOAEL day and night contour. During the day we expect to see some small changes to the contour shape to the south west area of the current contour (due to the changes to the OLY and CPT SIDs) and changes to the shape to the south (due to the changes to the MATCH SIDs). Review of population density maps suggests that this may result in slightly less total population within the LOAEL due to the change in contour shape, although would result in new communities falling within the LOAEL. This would require further exploration as part of the FOA at Stage 3. With regards to LLAOL's L_{Aeq} contours that form part of the planning condition, although this option is likely to result in a change to shape of the contours, we do not expect it to significantly impact the size of the 57dB(A) Leq16hr and 48dB(A) L_{eq8hr} contours.

The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal if this option is progressed.

Overflight

The overflight diagrams shown in technical appendix A demonstrate the changes in overflight from the relocation of the MATCH, CPT and OLY SIDs. The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline):

Table 29 Westerly Departure Option 6 Overflight Data

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
DAY	Baseline Westerly Dep Option 1 (Vector)	614324.0	79163.0	5722.0	1447.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	153814.2	86233.8	14940.9	2535.9	0.0
	Westerly Dep Option 6	173323.1	92101.3	19089.5	572.6	0.0
NGT	Baseline Westerly Dep Option 1 (Vector)	98936.0	6666.0	0.0	0.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	93645.0	14597.6	0.0	0.0	0.0
	Westerly Dep Option 6	125262.1	11349.3	0.0	0.0	0.0

The table shows that there is an increase in the number of people overflown at 0-7000ft 1, 10 and 50 times a day, and there is a reduction in the number of people overflown 100 times per day compared to the baseline. At night the number of people overflown on average once per night increases and overflown 10 times decreases. These outcomes reflect the nature of respite routes whereby a greater number of people overall are overflown the numbers overflown at a higher frequency drops because of the periods of respite and sharing of noise.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows an increase in the number of sites overflown between 0-7000ft; this again can be attributed to the respite periods whereby there is a greater area of overflight however the frequency of overflight would be lower. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

NPR

The changes to the CPT, OLY and MATCH SIDs between 0-4000ft will result in a requirement to adjustment the baseline Noise Preferred Routes. There would be different NPRs for each period.

Respite

This option offers respite via two sets of SIDs which could be alternated. For this IOA we have assumed the period of alternation as daily, however this can be explored in greater detail with stakeholders as part of the Stage 3 consultation.

As outlined in our overflight analysis, there is an increase in the overall population and noise sensitive sites overflown, however the impacts of noise are now shared and so there are decreases in the frequency of overflight. This is something that was requested by stakeholders and formed part of the design principles although the specifics require careful analysis to ensure that the sharing of noise at low altitudes does not increase adverse effects from aviation noise. The benefits and impacts of this would require further quantitative analysis as part of the Stage 3 Full Options Appraisal.

	Air Quality	The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.
Wider Society	Greenhouse gas impact	We estimate that there will be an improvement in track mileage for the period 1 SIDs with the MATCH c.4nm shorter than the baseline, and the CPT and OLY SIDs c.1nm shorter. The period 2 MATCH and CPT SIDs remain the same as today, but the OLY SID is expected to be c.2nm longer than the baseline. For the period 1 CPT and OLY, this equates to around 7.4kg of fuel difference per flight which is a CO_2 equivalent of 0.023mt. The period 1 MATCH saving equates to around 29.6kg of fuel difference per flight which is a CO_2 equivalent of 0.094mt. The period 2 OLY difference equates to around an extra 14.8kg of fuel difference per flight which is a CO_2 equivalent of 0.047mt. Although there is an increase in Period 2 track mileage of c.2nm, the savings in period 1 of c.6nm mean that overall this option is expected to have a track milage saving compared to the baseline. When considered against the total movements operated across an average year, this amounts

to overall CO_2 savings for this option. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 30 Westerly SID Group 6 Track Mileage, Fuel Burn and CO_2

	MATCH	OLY	HEN (CPT SID)	MATCH		OLY		HEN (CPT SID)	
	NM diff to/abeam			A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)
W SID Grp 1 (Baseline)	0	0	0	0	0.000	0	0.000	0	0.000
W SID Grp 6 Period 1	-4	-1	-1	-29.6	-0.094	-7.4	-0.023	-7.4	-0.023
W SID Grp 6 Period 2	0	2	0	0	0.000	14.8	0.047	0	0.000

Capacity / resilience

This option is dependent on the FASI-S programme and the modernisation of the LTMA, therefore assuming that in this scenario Luton departures will be able to continuously climb to above 6000ft, we anticipate that there will be an improvement to capacity because of the changes to the LTMA. In addition to this, the divergence between the CPT/OLY and MATCH SIDs may provide an opportunity to reduce the departure separations to less than 2 mins between successive MATCH + OLY/CPT departures, although it is important to note that these do not currently meet ICAO regulation around 45˚ departure divergence, and therefore a safety case would be required.

Tranquility

Aircraft today overfly the Chilterns AONB. The table below provides a comparison of the AONB overflown data. In the baseline, aircraft are vectored from 3/4000ft creating dispersion across the AONB whereas Westerly SID group 6 uses 2 sets of PBN SIDs. This results in a bigger spread of noise compared to other PBN options that do not offer respite however overall, it increases the area of AONB overflown.

Table 31 Westerly SID Group 6 AONB overflown

		Area (Km2) of AONB overflown. 0-7000ft
DAY	Baseline Westerly Dep Option 1 (Vector)*	130.9
	Baseline Westerly Dep Option 1 (centreline)	95.9
	Westerly Dep Option 6 (centreline)	145.2
NGT	Baseline Westerly Dep Option 1 (Vector)*	89.4
	Baseline Westerly Dep Option 1 (centreline)	87.2
	Westerly Dep Option 6 (centreline)	132.6

Biodiversity

On departure all flights will be over 1,000ft after each aircraft has covered 3km. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 6km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown.

General Aviation

Access

This option could be expected to require less CAS owing to CCO above 5000ft enabled by the wider LTMA FASI design. It also offers the potential to simplify airspace boundaries owing to CCO and the assumption of wider FASI change. This option would not change the existing FUA airspace sharing arrangement with Dunstable

Economic impact from increased effective capacity

We expect the potential increased effective capacity detailed in the section above will result in a positive economic impact on commercial air traffic compared with the baseline do nothing westerly SID group 1.

General Aviation / Commercial airlines

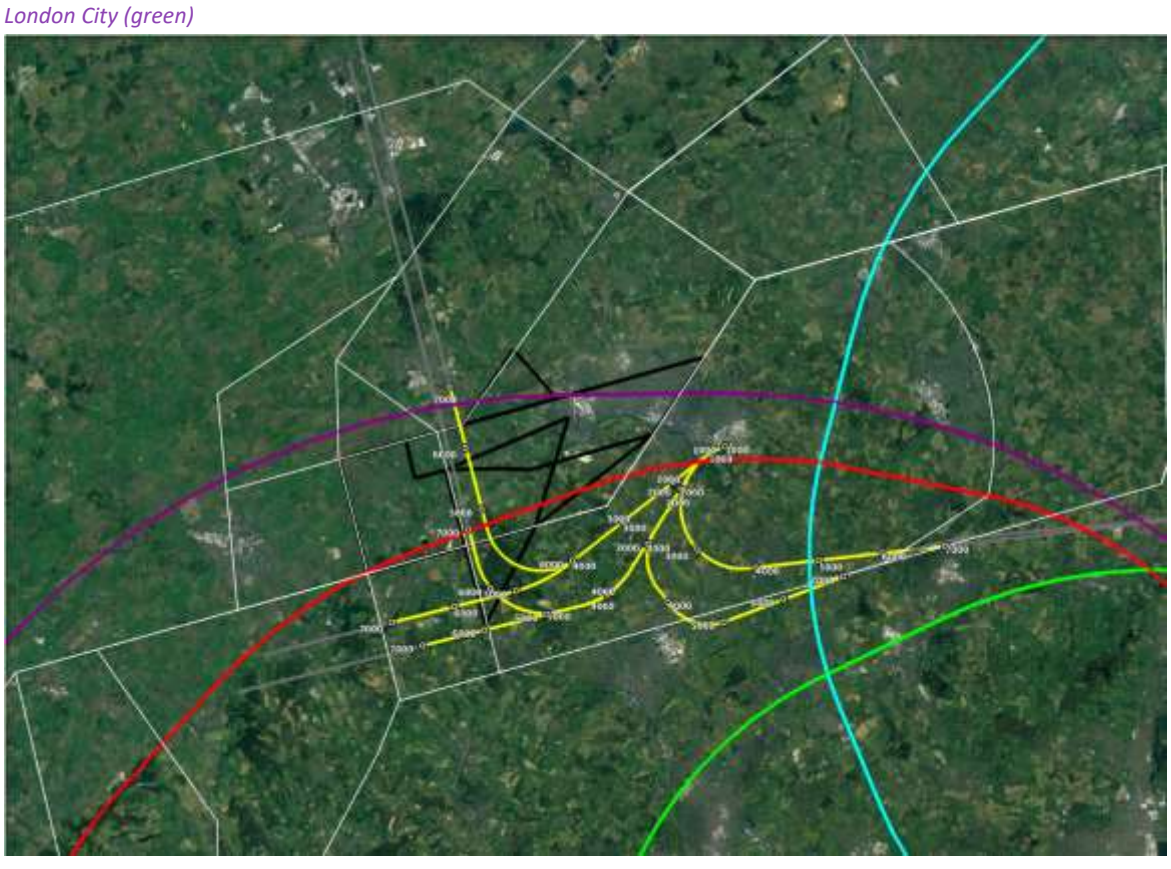
Fuel burn

We estimate that there will be an improvement in track mileage for the period 1 SIDs with the MATCH c.4nm shorter than the baseline, and the CPT and OLY SIDs c.1nm shorter. The period 2 MATCH and CPT SIDs remain the same as today, but the OLY SID is expected to be c.2nm longer than the baseline.

For the period 1 CPT and OLY, this equates to around 7.4kg of fuel difference per flight. The period 1 MATCH saving equates to around 29.6kg of fuel difference per flight. The period 2 OLY difference equates to around an extra 14.8kg of fuel difference per flight. Although there is an increase in period 2 track mileage of c.2nm, the savings in period 1 of c.6nm mean that overall this option is expected to have a track milage saving compared to the baseline. When considered against the total movements operated across an average year, this amounts to overall fuel burn savings for this option. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 32 Westerly SID Group 6 Track Mileage and Fuel Burn

	MATCH	OLY	HEN (CPT SID)	MATCH	OLY	HEN (CPT SID)
	NM diff to/abeam			A320 fuel difference at FL160 (kg)	A320 fuel difference at FL160 (kg)	A320 fuel difference at FL160 (kg)
W SID Grp 1 (Baseline)	0	0	0	0	0	0

		W SID Grp 6 Period 1: -4 / -1 / -1 / -29.6 / -7.4 / -7.4 W SID Grp 6 Period 2: 0 / 2 / 0 / 0 / 14.8 / 0
Commercial airlines	Training costs	Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This westerly SID option is not anticipated to require any additional training costs for airlines.
	Other costs	No other airline costs are foreseen.
Airport / Air navigation service provider	Infrastructure costs	The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.
	Operational costs	This airspace change proposal is not anticipated to change airport or ANSP operational costs. The implementation of PBN SIDs removes LLAOL's dependency on conventional ground based navigation equipment (VORs), which contributes to a reduction in NERL's operational costs as it enables VOR rationalisation[11]
	Deployment costs	This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options. Owing to the use of the respite periods and the changes to the OLY, CPT and MATCH SIDs, we anticipate that it will require slightly more training that some of the other options.
All	Safety	All SIDs: Climb above 5000ft will require additional safety assurances to assure LTMA separations in all pressures. CPT+OLY: This route requires the 'Period 1' SID centreline to be closer to Dunstable Gliding Area. There are no prescribed separations from the area at present, controllers can vector 'right to the line'. The existing centreline is 1.7nm from the gliding area (measured at the first turn at altitude waypoint) with aircraft tracks seen to be regularly 1.3nm from the gliding area at this point. This is partly as a result of the turn at altitude, not providing a guaranteed turn point. The proposed centreline is 1.7nm from the gliding area measured at the first turn at altitude waypoint) then remaining 1.6nm thereafter until vertical separation provided. The Period 1 MATCH SID relies on RF, so procedures may be required to cater for non-RF aircraft. New safety assurances will therefore be required but an acceptable safety argument is envisaged to be achievable. The Period 2 OLY/CPT routes are further south than today and therefore closer to Northolt and Heathrow. This means the option could not be implemented ahead of changes at those airports. SID Switching: Would be new to Luton and the LTMA. The risk of an aircraft selecting the incorrect SID needs to be managed carefully. For example, if the first MATCH departure was issued and the aircraft flew the longer SID and then the subsequent MATCH departure was issued the longer SID but the aircraft incorrectly flew the shorter SID, there would be a catch up situation. Alternating between each set of SIDs may need to take place overnight to help mitigate the chances of pilot and ATC error so to avoid changing during busy periods. Proximity of Luton's routes to those of adjacent routes from FASI airports will all require safety assurances subject to their final locations.
All	Interdependencies, conflicts and tradeoffs	Moving the MATCH SID to the North of BPK will keep aircraft further away from Northolt, London City and Heathrow which will help to reduce conflicts. The Period 2 CPT/OLY SIDs however are closer to Northolt and Heathrow which may reduce chances of procedural CCO. Until the shortlisted options from those airports are available, the exact interdependencies are not known. However, the interdependencies with other airspace changes identified in Iteration 2 of ACOG's Airspace Change Masterplan show that any SIDs to the South of Luton are likely to interact with Northolt, London City and Heathrow. *Table 33 Westerly SID Group 6 and areas of interdependencies. Heathrow (purple) Northolt (red) Stansted (blue) London City (green)*  As set out in our Stage 2A documentation, achieving procedural climb in SIDs to the South of Luton to higher than 5000ft will be extremely challenging. The Transition Altitude remaining at 6,000ft does not help this situation. For example, if Heathrow's

[11] LLAOL is currently investigating RNAV Substitution to mitigate VOR rationalisation however this is a temporary solution for the interim period before the deployment of the FASI-S

		northbound SIDs were to remain in their existing vicinity, we would need climb rates in excess of 8% to at least FL90 on those Heathrow departures to enable Luton's SIDs to climb to even 6,000ft. Positioning Luton's SIDs further north than today would help to enable Continuous Climb and reduce interdependencies on other airports but there are significant population densities that would be newly overflown below 4,000ft as a result.
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* This option would support the modernisation of the airspace. Luton already have a PBN MATCH SID from runway 25 but the re-positioning to the North of BPK can be expected to improve efficiencies within the LTMA and enable more frequent, tactical CCO. Ideally, Luton's SIDs will be able to climb procedurally above 5000ft but this will be extremely challenging as described above. Upgrading the CPT and OLY SIDs to PBN would be aligned with the AMS and use of multiple SIDs to provide sharing of noise and provision of respite would support the reduction in noise impacts, if they were to be assessed as such. However, as mentioned in the Noise impact on health and quality of life section above, it is currently questionable as to whether the realignment of the CPT and OLY SID track at very low altitude would result in noise improvements. It is possible that to avoid increasing the numbers of people adversely affected by aircraft noise, delaying the turns until after Markyate could be the required outcome. This option could be expected to result in reductions in the volume of Luton's CAS if procedural CCO is enabled although the presence of Multiple Routes is likely to reduce the amount of CAS that could be released.

LLAOL FASI-S Initial Options Appraisal

Westerly SID Group 7

Westerly SID Group 7	
 Period 1 (above) Period 2 (below) 	This option has two sets of SIDs (Period 1 and Period 2) which would alternate at a set time based around the interaction with Dunstable gliding area. The period 2 SIDs are very different from current day. **This option is dependent on the integration with other FASI-S airports and the upper airspace design.**

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option is based on two sets of SIDs that would alternate, however due to the interaction with the gliding airspace the period 2 SIDs could only be operated outside of gliding operating hours (during the late evening/night time period). For the purposes of this IOA we assumed a standard operating time of 21:00 – 07:00 local for period 2. Recent engagement with the Gliding Club have suggested a timing of 22:00 – 08:00 local would be more suitable, although in the winter hours availability could be increased. We will explore timings in more detail as part of Stage 3 of this ACP if this option is progressed. **Period 1:** This option is laterally identical to Westerly SID Group 2, however this option assumes all departures are able to continuously climb to at least 6,000ft. This part of the option would see a replication of the existing OLY and CPT SIDs and a change to the latter part of the MATCH SID, to keep to the north of Brookmans Park. This could take the MATCH SID slightly closer to Hemel Hempstead however it might be possible to refine that in Stage 3, to minimise any impacts, particularly if RNP+RF specification is considered.  *Figure 14 Westerly SID Group 7 overflight day (centreline), with population density and baseline (black outline).*  *Figure 13 Westerly SID Group 7 overflight night (centreline), with population density and baseline (black outline).* **Period 2:** The period 2 group of SIDs is very different from current day to offer an alternative respite opportunity. Today the CPT SID turns to the south before routing west whereas in this configuration, the SID turns slightly north to avoid overflight of the runway 07 final approach before routing west. Today's MATCH SID turns to the south before routing east whereas in this respite configuration, it turns north over Luton and Dunstable before turning to the south-east. Finally, the OLY SID today turns to the south before turning and routing towards the north; in this respite configuration the OLY SID turns immediately to the north and aims to follow the M1 motorway as closely as possible. This was suggested by community stakeholders as part of our stakeholder engagement. We expect all the SIDs in Westerly Option 7 operate guaranteed climb to above 6000ft. This is because we assume Heathrow, Northolt and London City departures are deconflicted in the new FASI design. This means that there is a lower requirement for routine tactical intervention from air traffic controllers and aircraft are expected to follow the SID centrelines. We would expect the wider LTMA re-design to have procedurally deconflicted routes to/from adjacent airports and therefore the cumulative impacts from other neighbouring airports to be reduced. The opportunity to avoid cumulative impacts from Luton's arrivals depends on guaranteed CCO above 6,000ft to enable the Period

2 MATCH SIDs to outclimb arrivals to RWY 25. The period 2 CPT SID will overfly those communities also under the base-leg of arrivals to runway 07 and also under the period 1 OLY SID. In addition to this, the period 2 OLY SID, and to a slightly lesser extent the MATCH SID, could overfly areas also under the arrivals downwind to runway 07.

Whether or not the same communities are not overflown by Luton's own routes depends on the Easterly SID configuration taken forward to partner this westerly configuration for example, if used with East SID Group 4, communities to the North of Luton would be overflown more frequently. However, departure routes to the North of Luton are likely to reduce the interactions with Heathrow, Northolt and London City traffic below 7000ft.

This option is dependent on guaranteed CCO above 6,000ft to enable the Period 2 MATCH SIDs to outclimb arrivals to RWY 25 and therefore dependent on changes to adjacent airports.

L_{Aeq}

The L_{Aeq} contours are split into the 16hr day, and 8hr nighttime period. The day period is calculated between 07:00-23:00 and the night between 23:00 – 07:00, which is different to the times used for the SIDs for our assessments (07:00-21:00 and 21:00 – 07:00). Given the complexity in noise contour calculations and the qualitative nature of this appraisal, for the purposes of this IOA we have described how we anticipate the period 1 SIDs will impact the daytime L_{Aeq} contour, and the period 2 SIDs will impact the day and nighttime contours. As part of the full options appraisal at Stage 3 we will fully quantify the LAeq metrics taking into account the anticipated operating hours of the SIDs if this option is progressed.

The period 1 CPT and OLY SIDs do not change laterally from today and therefore we do not expect to see any significant change to the L_{Aeq} contours in those areas as a result of these. The change in the MATCH SID may result in a small change to the shape of LOAEL day and night contour, with the contour shifting slightly to the west and south to reflect the change to the MATCH SID. Review of population density maps suggests that this may result in slightly less population within the LOAEL however this would require further exploration as part of the FOA at Stage 3.

The period 2 SIDs are a significant change compared to the SIDs flown today and therefore are expected to result in a significant change to the shape of the nighttime LOAEL contours. Today the contours turn to the south, whereas with this SID configuration they would turn to the north. This results in the contours overflying the highly populated areas of Luton and Dunstable and therefore we expect this option to lead to a significant increase in population within the nighttime LOAEL. In addition, the Period 2 SIDs fly straight ahead on departure before turning and we anticipate that this will result in an increase in the size of the LOAEL owing to the cumulative effect of overflight of departures over final approach.

With regards to LLAOL's LAeq contours that form part of the planning condition we do expect it to significantly impact the size of the 57dB(A) Leq16hr and 48dB(A) Leq8hr contours due to the cumulative effect of the Period 2 SIDs overflying RWY07 final approach.

Overflight

The overflight diagrams shown in technical appendix A demonstrate the changes in overflight as a result of the changes to the MATCH, CPT and OLY SIDs. The contour calculations take into account the assumed standard operating time of 21:00 – 07:00 for period 2. The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline):

Table 34 Westerly Departure Option 7 Overflight Data

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
DAY	Baseline Westerly Dep Option 1 (Vector)	614324.0	79163.0	5722.0	1447.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	153814.2	86233.8	14940.9	2535.9	0.0
	Westerly Dep Option 7	184070.8	65680.5	14394.9	986.1	0.0
NGT	Baseline Westerly Dep Option 1 (Vector)	98936.0	6666.0	0.0	0.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	93645.0	14597.6	0.0	0.0	0.0
	Westerly Dep Option 7	119601.6	39888.2	0.0	0.0	0.0

The daytime overflight data shows an increase in the number of people overflown once per day, and a decrease in the number of people overflown 10, 50 and 100 times per day. These outcomes reflect the nature of respite routes whereby a greater number of people overall are overflown, however it is on a lower frequency basis because of the periods of respite.

The nighttime overflight data show significant increases in the number of people overflown 1 and 10 times per day; this can be

attributed to the Period 2 SIDs which overfly the populated areas of Luton and Dunstable.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) largely shows an increase in the number of sites overflown between 0-7000ft; this again can be attributed to the respite periods whereby there is a greater area of overflight however the frequency of overflight would be lower. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

Respite
This option makes use of multiple routes for the same departures to share the noise more equitably although due to the availability of the gliding airspace, the period 2 SIDs have assumed to only be operated between 21:00 – 07:00 for this appraisal.

Wider Society

Air Quality

The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.

Greenhouse gas impact

We estimate that there will be an improvement in track mileage for the period 2 OLY SID of c.7nm and there will be an increase in track mileage to the MATCH SID of c.2nm. The period 1 SIDs and the period 2 CPT SID will remain the same as the baseline.

For the period 2 OLY, this equates to around 51.8kg of fuel difference per flight which is a CO_2 equivalent of 0.164mt. The period 2 MATCH SID results in an extra 14.8kg of fuel burn per flight which is a CO_2 equivalent of 0.047mt.

With Westerly SID group 7, the period 2 SIDs are only anticipated to be available between the hours of 21:00 – 07:00 and there are lower traffic levels at this time of day. The MATCH SID is operated at night more frequently than the OLY therefore this option may result in small overall CO_2 impacts; this will be appraised in further detail as part of the FOA at Stage 3 should this option progress.

Table 35 Westerly SID Group 7 Track Mileage, Fuel Burn and CO_2

	MATCH	OLY	HEN (CPT SID)	MATCH		OLY		HEN (CPT SID)	
	NM diff to/abeam			A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)
W SID Grp 1 (Baseline)	0	0	0	0	0.000	0	0.000	0	0.000
W SID Grp 7 Period 1	0	0	0	0	0.000	0	0.000	0	0.000
W SID Grp 7 Period 2	2	-7	0	14.8	0.047	-51.8	-0.164	0	0.000

Capacity / resilience

This option is dependent on the FASI-S programme and the modernisation of the LTMA, therefore assuming that in this scenario Luton departures will be able to continuously climb to above 6000ft, we anticipate that there will be an improvement to capacity because of the changes to the LTMA.

Tranquility

Aircraft today overfly the Chilterns AONB. The table below provides a comparison of the AONB overflown data. In the baseline, aircraft are vectored from 3/4000ft creating dispersion across the AONB whereas Westerly SID group 7 uses 2 sets of PBN SIDs. Effects to AONB are slightly mitigated by more flights banking north soon after takeoff however, these are likely to overfly the part of the Chilterns AONB which is located to the north of Luton albeit at high altitude and therefore with lower noise effects. Overall, the data shows that there would be a decrease in area of AONB overflown compared to the baseline vectored data.

Table 36 Westerly SID Group 7 AONB overflown

		Area (Km2) of AONB overflown. 0-7000ft
DAY	Baseline Westerly Dep Option 1 (Vector)*	130.9
	Baseline Westerly Dep Option 1 (centreline)	95.9
	Westerly Dep Option 7 (centreline)	118.7
NGT	Baseline Westerly Dep Option 1 (Vector)*	89.4
	Baseline Westerly Dep Option 1 (centreline)	87.2
	Westerly Dep Option 7 (centreline)	55.3

Biodiversity

On departure all flights will be over 1,000ft after each aircraft has covered 3km. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 6km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown.

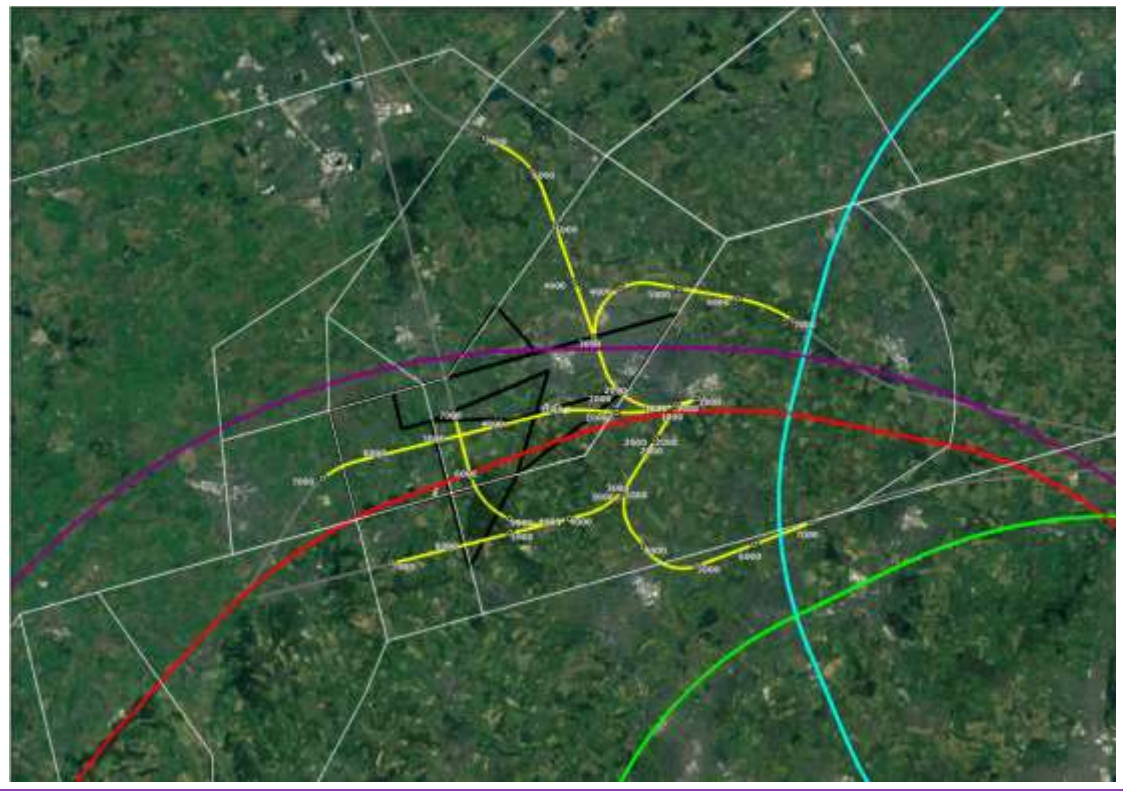
<table>
<tr><td>General Aviation</td><td>Access</td><td>The Period 2 SID could require more CAS with a lowering of CTA5 if we can't guarantee CAS containment for the MATCH/OLY SIDs. These would require a very high rate of climb to make 4000ft in time.</td></tr>
<tr><td rowspan="2">General Aviation / Commercial airlines</td><td>Economic impact from increased effective capacity</td><td>We expect the increased effective capacity detailed in the section above will result in a positive economic impact on commercial air traffic compared with the baseline do nothing westerly SID group 1.</td></tr>
<tr><td>Fuel burn</td><td>We estimate that there will be an improvement in track mileage for the period 2 OLY SID of c.7nm and there will be an increase in track mileage to the MATCH SID of c.2nm. The period 1 SIDs and the period 2 CPT SID will remain the same as the baseline.

For the period 2 OLY, this equates to around 51.8kg of fuel difference per flight and the change to the period 2 MATCH SID results in an extra 14.8kg of fuel burn per flight.

With Westerly SID group 7, the period 2 SIDs are only anticipated to be available between the hours of 21:00 – 07:00 and there are lower traffic levels at this time of day. The MATCH SID is operated at night more frequently than the OLY therefore this option may result in additional fuel burn costs; this will be appraised in further detail as part of the FOA at Stage 3 should this option progress.

Table 37 Westerly SID Group 7 Track Mileage and Fuel Burn
<table>
<tr><th></th><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th></tr>
<tr><th></th><th colspan="3">NM diff to/abeam</th><th>A320 fuel difference at FL160 (kg)</th><th>A320 fuel difference at FL160 (kg)</th><th>A320 fuel difference at FL160 (kg)</th></tr>
<tr><td>W SID Grp 1 (Baseline)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>W SID Grp 7 Period 1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>W SID Grp 7 Period 2</td><td>2</td><td>-7</td><td>0</td><td>14.8</td><td>-51.8</td><td>0</td></tr>
</table></td></tr>
<tr><td rowspan="2">Commercial airlines</td><td>Training costs</td><td>Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This westerly SID option is not anticipated to require any additional training costs for airlines.</td></tr>
<tr><td>Other costs</td><td>No other airline costs are foreseen.</td></tr>
<tr><td rowspan="3">Airport / Air navigation service provider</td><td>Infrastructure costs</td><td>The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.</td></tr>
<tr><td>Operational costs</td><td>This airspace change proposal is not anticipated to change airport or ANSP operational costs.
The implementation of PBN SIDs removes LLAOL's dependency on conventional ground based navigation equipment (VORs), which contributes to a reduction in NERL's operational costs as it enables VOR rationalisation[12]</td></tr>
<tr><td>Deployment costs</td><td>This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options. Owing to the use of the respite periods and the changes to the OLY, CPT and MATCH SIDs, we anticipate that it will require slightly more training that some of the other options.</td></tr>
<tr><td>All</td><td>Safety</td><td>SID Switching: Would be new to Luton and the LTMA. The risk of an aircraft selecting the incorrect SID needs to be managed. For example, if an aircraft was to inadvertently fly a Period 2 SID during times of Gliding Activity. In addition, SIDs going substantially different ways, with differing track miles between them albeit connecting to the network at the same point is a new concept of operation within the LTMA and could generate flight planning and fueling issues.</td></tr>
<tr><td>All</td><td>Interdependencies, conflicts and tradeoffs</td><td>Moving the Period 1 MATCH SID to the North of BPK will keep aircraft further away from Northolt, London City and Heathrow which will help to reduce conflicts. The Period 2 SIDs however are further from Northolt and Heathrow which should increase chances of procedural CCO and reduce conflict. Until the shortlisted options from those airports are available, the exact interdependencies are not known. However, the interdependencies with other airspace changes identified in Iteration 2 of ACOG's Airspace Change Masterplan show that any SIDs to the North of Luton are less likely to interact with Northolt, London City and Heathrow.</td></tr>
</table>

[12] LLAOL is currently investigating RNAV Substitution to mitigate VOR rationalisation however this is a temporary solution for the interim period before the deployment of the FASI-S

		Positioning Luton's SIDs further north than today would help to enable Continuous Climb and reduce interdependencies on other airports but there are significant population densities that would be newly overflown below 4,000ft as a result. *Table 38 Westerly SID Group 7 and areas of interdependencies. Heathrow (purple) Northolt (red) Stansted (blue) London City (green)* 
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* This option would support the modernisation of the airspace. Luton already have a PBN MATCH SID from runway 25 but the re-positioning to the North of BPK can be expected to improve efficiencies within the LTMA and enable more frequent, tactical CCO. Ideally, Luton's SIDs will be able to climb procedurally above 5000ft but this will be extremely challenging for the Period 1 SIDs as described above. The Period 2 SIDs would enable better CCO opportunities together with a significant sharing of noise impacts and in the case of OLY SIDs, much shorter track miles. However, there are very few OLY departures at night. Unfortunately having SIDs turning North of Luton will result is very high numbers of newly overflown population within the night time LOAEL and increase adverse effects for many. This option would require more CAS and without significant other benefits.

LLAOL FASI-S Initial Options Appraisal

Westerly SID Group 8

Westerly SID Group 8

Period 1 (above) Period 2 (below)

This option has two sets of SIDs (Period 1 and Period 2) which would alternate at a set time based around the interaction with Dunstable gliding area. The period 2 SIDs are very different from current day and aim to avoid the populated areas of Luton and Dunstable.

This option is dependent on the integration with other FASI-S airports and the upper airspace design.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option is based on two sets of SIDs that would alternate however due to the interaction with the gliding airspace the period 2 SIDs could only be operated outside of gliding operating hours (during the late evening/night time period). For the purposes of this IOA we have assumed a standard operating time of 21:00 – 07:00 for period 2. Recent engagement with the Gliding Club have suggested a timing of 22:00 – 08:00 local would be more suitable although in the winter hours of availability could be increased. We will explore timings in more detail as part of Stage 3 of this ACP if this option is progressed. This option is similar to Westerly SID Group 7, however the period 2 SIDs in this option aim to avoid Luton and Dunstable which results in more track miles. **Period 1:** This option is laterally identical to Westerly SID Group 2 however this option assumes all departures can continuously climb to at least 6,000ft. This part of the option would see a replication of the existing OLY and CPT SIDs and a change to the latter part of the MATCH SID to keep to the north of Brookmans Park. This could take the MATCH SID slightly closer to Hemel Hempstead however it might be possible to refine that in Stage 3, to minimise any impacts, particularly if RNP+RF specification is considered. **Period 2:** The period 2 group of SIDs is very different from current day to offer an alternative respite opportunity. Today the CPT SID turns to the south before routing west whereas in this configuration, the SID turns slightly north to avoid overflight of the runway 07 final approach before routing west (this is the same as the CPT SID for westerly group 7). Today's MATCH SID turns to the south before routing east whereas in this respite configuration, it routes straight ahead, making a small adjustment to avoid the runway 07 final approach, before turning north after avoiding the main areas of Luton and routing around the outskirts of Dunstable. It then turns again to the east, avoiding areas of dense population. Finally, the OLY SID today turns to the south before turning and routing towards the north; in this respite configuration the OLY SID would route straight ahead, adjusting north to avoid final approach, before turning to the north. This aims to avoid the highly populated areas of Luton and Dunstable. We expect all the SIDs in Westerly Option 8 to operate guaranteed climb to above 6000ft. This is because we assume Heathrow, Northolt and London City departures are deconflicted in the new FASI design. This means that there is a lower requirement for routine tactical intervention from air traffic controllers and aircraft are expected to follow the SID centrelines. We would expect the wider LTMA re-design to have procedurally deconflicted routes to/from adjacent airports and therefore the cumulative impacts from other neighbouring airports to be reduced.

Figure 15 Westerly SID Group 8 overflight day (centreline), with population density and baseline (black outline).

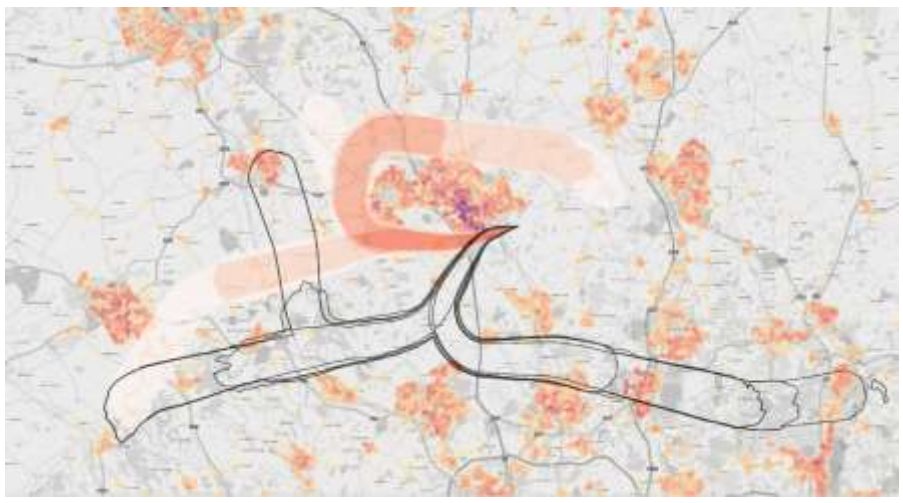


Figure 16 Westerly SID Group 8 overflight night (centreline), with population density and baseline (black outline).

The CPT route for Period 2 will overfly those communities also under arrivals on base-leg to RWY07 and also under the Period 1 OLY route. The OLY and MATCH SIDs for Period 2 would overfly those communities under arrivals downwind to RWY07. We would expect the wider LTMA re-design to have procedurally deconflicted routes to/from adjacent airports and therefore reduce the overflight of the same communities by multiple routes from different airports. Whether or not the same communities are not overflown by Luton's own routes depends on the Easterly SID configuration taken forward to partner this westerly configuration for example, if used with East SID Group 4, communities to the North of Luton would be overflown more frequently. However departure routes to the North of Luton are likely to reduce the interactions with Heathrow, Northolt and London City traffic below 7000ft.

This option is dependent on guaranteed CCO above 6,000ft to enable the Period 2 MATCH SIDs to outclimb arrivals to RWY 25 and therefore dependent on changes to adjacent airports.

L_{Aeq}

The L_{Aeq} contours are split into the 16hr day, and 8hr nighttime period. The day period is calculated between 07:00-23:00 and the night between 23:00 – 07:00, which is different to the times used for the SIDs for our assessments (07:00-21:00 and 21:00 – 07:00). Given the complexity of noise contour calculations and the qualitative nature of this appraisal, for the purposes of this IOA we have described how we anticipate the period 1 SIDs will impact the daytime L_{Aeq} contour, and the period 2 SIDs will impact the nighttime contours. As part of the full options appraisal at Stage 3 we will fully quantify the L_{Aeq} metrics taking into account the anticipated operating hours of the SIDs if this option is progressed.

The period 1 CPT and OLY SIDs do not change laterally from today and therefore we do not expect to see any significant change to the L_{Aeq} contours in those areas as a result of these. The change in the MATCH SID may result in a small change to the shape of LOAEL day and night contour, with the contour shifting slightly to the west and south to reflect the change to the MATCH SID. Review of population density maps suggests that this may result in slightly less population within the LOAEL however this would require further exploration as part of the FOA at Stage 3.

The period 2 SIDs are a significant change compared to the SIDs flown today and are expected to result in a significant change to the shape of the nighttime LOAEL contours. Today the contours turn to the south, whereas with this SID configuration we expect that they would expand to the west before turning slightly north. Review of population density maps suggests that this may result in more population within the nighttime LOAEL due to the change in contour shape, however this would require further exploration as part of the FOA at Stage 3. In addition, the Period 2 SIDs fly straight ahead on departure before turning and we anticipate that this will result in an increase in the size of the SOEAL owing to the cumulative effect of overflight of departures over final approach.

With regards to LLAOL's L_{Aeq} contours that form part of the planning condition we do expect it to significantly impact the size of the 57dB(A) Leq16hr and 48dB(A) Leq8hr contours due to the cumulative effect of the Period 2 SIDs overflying RWY07 final approach.

Overflight

The overflight diagrams shown in technical appendix A demonstrate the changes in overflight as a result of the changes to the MATCH, CPT and OLY SIDs. The contour calculations consider the assumed standard operating time of 21:00 – 07:00 for period 2. The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline):

Table 39 Westerly Departure Option 8 Overflight Data

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
DAY	Baseline Westerly Dep Option 1 (Vector)	614324.0	79163.0	5722.0	1447.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	153814.2	86233.8	14940.9	2535.9	0.0
	Westerly Dep Option 8	163516.8	65680.5	14394.9	986.1	0.0
NGT	Baseline Westerly Dep Option 1 (Vector)	98936.0	6666.0	0.0	0.0	0.0
	Baseline Westerly Dep Option 1 (centreline)	93645.0	14597.6	0.0	0.0	0.0
	Westerly Dep Option 8	73587.3	22475.8	0.0	0.0	0.0

The daytime overflight data shows an increase in the number of people overflown once per day, and a decrease in the number of people overflown 10, 50 and 100 times per day. These outcomes reflect the nature of respite routes whereby a greater number of people overall are overflown however it is on a lower frequency basis because of the periods of respite.

The nighttime overflight data show significant increases in the number of people overflown 10 times per day however a decrease in the number of people overflown once per day.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) largely shows an increase in the number of sites overflown between 0-7000ft during the day; this again can be attributed to the respite periods whereby there is a greater area of overflight however the frequency of overflight would be lower. Data on the number of noise sensitive sites (schools, hospitals and places of worship) overflown at night largely shows a decreased in the number of sites overflown between 0-7000ft.

The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

Respite
This option makes use of multiple routes for the same departures to share the noise more equitably although due to the availability of the gliding airspace, the period 2 SIDs have assumed to only be operated between 21:00 – 07:00 for this appraisal.

Air Quality

The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.

Wider Society

Greenhouse gas impact

We estimate that there will be an improvement in track mileage for the period 2 OLY SID of c.6nm and there will be an increase in track mileage to the MATCH SID of c.8nm. The period 1 SIDs and the period 2 CPT SID will remain the same as the baseline.

For the period 2 OLY, this equates to around 44.4kg of fuel saving per flight which is a CO_2 equivalent of 0.140mt. The period 2 MATCH SID results in an extra 59.2kg of fuel burn per flight which is a CO_2 equivalent of 0.187mt.

With Westerly SID group 8, the period 2 SIDs are only anticipated to be available between the hours of 21:00 – 07:00 and there are lower traffic levels at this time of day. The MATCH SID is operated at night more frequently than the OLY therefore this option may result in small overall CO_2 impacts; this will be appraised in further detail as part of the FOA at Stage 3 should this option progress.

Table 40 Westerly SID Group 8 Track Mileage, Fuel Burn and CO_2

	MATCH	OLY	HEN (CPT SID)	MATCH		OLY		HEN (CPT SID)	
	NM diff to/abeam			A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)
W SID Grp 1 (Baseline)	0	0	0	0	0.000	0	0.000	0	0.000
W SID Grp 8 Period 1	0	0	0	0	0.000	0	0.000	0	0.000
W SID Grp 8 Period 2	8	-6	0	59.2	0.187	-44.4	-0.140	0	0.000

Capacity / resilience

This option is dependent on the FASI-S programme and the modernization of the LTMA, therefore assuming that in this scenario Luton departures will be able to continuously climb to above 6000ft, we anticipate that there will be an improvement to capacity because of the changes to the LTMA.

Tranquility

Aircraft today overfly the Chilterns AONB. The table below provides a comparison of the AONB overflown data. In the baseline, aircraft are vectored from 3/4000ft creating dispersion across the AONB whereas Westerly SID group 8 uses 2 sets of PBN SIDs. Effects to AONB are slightly mitigated by more flights banking north soon after takeoff however, these are likely to overfly the part of the Chilterns AONB which is located to the north of Luton albeit at high altitude and therefore with lower noise effects. Overall, the data shows that there would be a decrease in area of AONB overflown compared to the baseline vectored data.

Table 41 Westerly SID Group 8 AONB overflown

		Area (Km2) of AONB overflown. 0-7000ft
DAY	Baseline Westerly Dep Option 1 (Vector)*	130.9
	Baseline Westerly Dep Option 1 (centreline)	95.9
	Westerly Dep Option 8 (centreline)	128.3
NGT	Baseline Westerly Dep Option 1 (Vector)*	89.4
	Baseline Westerly Dep Option 1 (centreline)	87.2
	Westerly Dep Option 8 (centreline)	53.2

Biodiversity

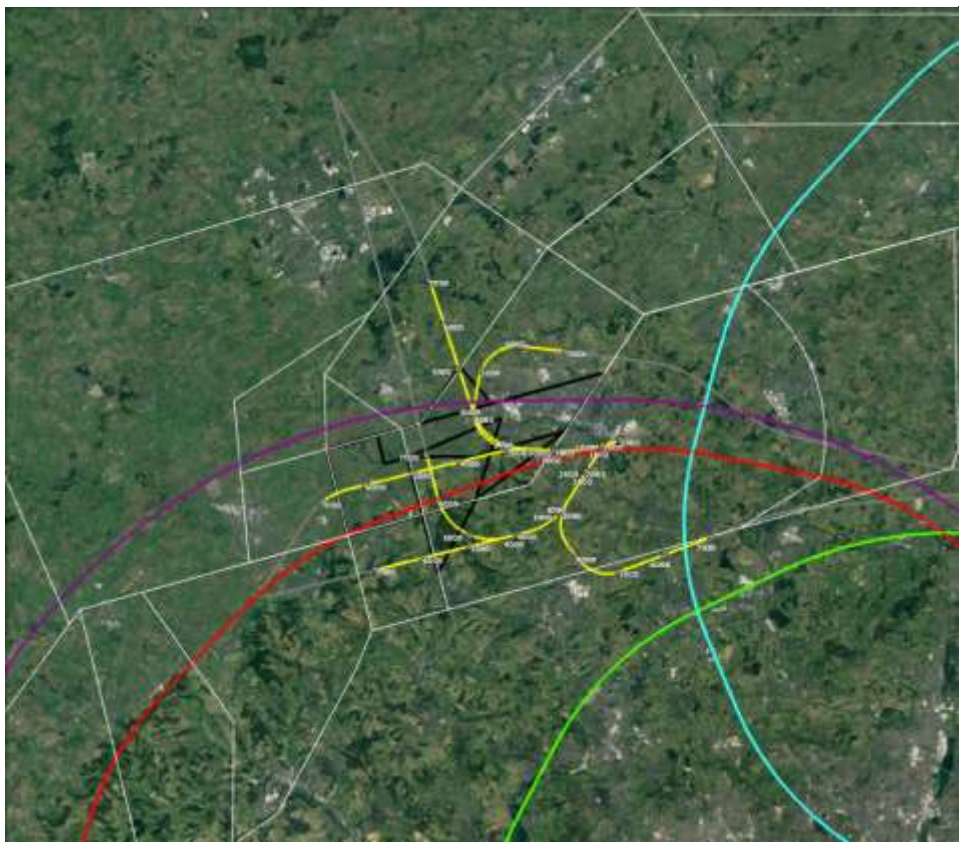
On departure all flights will be over 1,000ft after each aircraft has covered 3km. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 6km is

<table>
<tr><td></td><td></td><td>covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown.</td></tr>
<tr><td>General Aviation</td><td>Access</td><td>The Period 2 SID is unlikely to require more CAS, as there are more track miles (compared to W SID Group 7) to reach 4000ft by CTA5. CCO is generally more likely to enable a reduction on CAS boundaries however the lower track miles on the Period 2 OLY SIDs is less likely to enable a raising of CTA6.</td></tr>
<tr><td rowspan="3">General Aviation / Commercial airlines</td><td>Economic impact from increased effective capacity</td><td>We expect the increased effective capacity detailed in the section above will result in a positive economic impact on commercial air traffic compared with the baseline do nothing westerly SID group 1.</td></tr>
<tr><td>Fuel burn</td><td>We estimate that there will be an improvement in track mileage for the period 2 OLY SID of c.6nm and there will be an increase in track mileage to the MATCH SID of c.8nm. The period 1 SIDs and the period 2 CPT SID will remain the same as the baseline.

For the period 2 OLY, this equates to around 44.4kg of fuel saving per flight and the period 2 MATCH SID results in an extra 59.2kg of fuel burn per flight.
With Westerly SID group 8, the period 2 SIDs are only anticipated to be available between the hours of 21:00 – 07:00 and there are lower traffic levels at this time of day. The MATCH SID is operated at night more frequently than the OLY therefore this option may result in small overall fuel burn impacts; this will be appraised in further detail as part of the FOA at Stage 3 should this option progress.

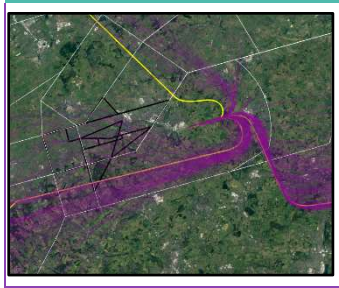
Table 42 Westerly SID Group 8 Track Mileage and Fuel Burn
<table>
<tr><th></th><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th><th colspan="2">MATCH</th><th colspan="2">OLY</th><th colspan="2">HEN (CPT SID)</th></tr>
<tr><th></th><th colspan="3">NM diff to/abeam</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th></tr>
<tr><td>W SID Grp 1 (Baseline)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0.000</td><td>0</td><td>0.000</td><td>0</td><td>0.000</td></tr>
<tr><td>W SID Grp 8 Period 1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0.000</td><td>0</td><td>0.000</td><td>0</td><td>0.000</td></tr>
<tr><td>W SID Grp 8 Period 2</td><td>8</td><td>-6</td><td>0</td><td>59.2</td><td>0.187</td><td>-44.4</td><td>-0.140</td><td>0</td><td>0.000</td></tr>
</table></td></tr>
<tr><td rowspan="2">Commercial airlines</td><td>Training costs</td><td>Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This westerly SID option is not anticipated to require any additional training costs for airlines.</td></tr>
<tr><td>Other costs</td><td>No other airline costs are foreseen.</td></tr>
<tr><td rowspan="3">Airport / Air navigation service provider</td><td>Infrastructure costs</td><td>The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.</td></tr>
<tr><td>Operational costs</td><td>This airspace change proposal is not anticipated to change airport or ANSP operational costs.
The implementation of PBN SIDs removes LLAOL’s dependency on conventional ground based navigation equipment (VORs), which contributes to a reduction in NERL’s operational costs as it enables VOR rationalisation[13]</td></tr>
<tr><td>Deployment costs</td><td>This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options. Owing to the use of the respite periods and the changes to the OLY, CPT and MATCH SIDs, we anticipate that it will require slightly more training that some of the other options.</td></tr>
<tr><td>All</td><td>Safety</td><td>SID Switching: Would be new to Luton and the LTMA. The risk of an aircraft selecting the incorrect SID needs to be managed. For example, if an aircraft was to inadvertently fly a Period 2 SID during times of Gliding Activity. In addition, SIDs going substantially different ways, with differing track miles between them albeit connecting to the network at the same point is a new concept of operation within the LTMA and could generate flight planning and fueling issues.</td></tr>
</table>

[13] LLAOL is currently investigating RNAV Substitution to mitigate VOR rationalisation however this is a temporary solution for the interim period before the deployment of the FASI-S

All	Interdependencies, conflicts and tradeoffs	Moving the Period 1 MATCH SID to the North of BPK will keep aircraft further away from Northolt, London City and Heathrow which will help to reduce conflicts. The Period 2 SIDs are further from Northolt and Heathrow which should increase chances of procedural CCO and reduce conflict. Until the shortlisted options from those airports are available, the exact interdependencies are not known. However, the interdependencies with other airspace changes identified in Iteration 2 of ACOG's Airspace Change Masterplan show that any SIDs to the North of Luton are less likely to interact with Northolt, London City and Heathrow. *Table 43 Westerly SID Group 8 and areas of interdependencies. Heathrow (purple) Northolt (red) Stansted (blue) London City (green)*  Positioning Luton's SIDs further north than today would help to enable Continuous Climb and reduce interdependencies on other airports but there are significant population densities that would be newly overflown below 4,000ft as a result.
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* This option would support the modernisation of the airspace. Luton already have a PBN MATCH SID from runway 25 but the re-positioning to the North of BPK can be expected to improve efficiencies within the LTMA and enable more frequent, tactical CCO. Ideally, Luton's SIDs will be able to climb procedurally above 5000ft but this will be extremely challenging for the Period 1 SIDs as described above. The Period 2 SIDs would enable better CCO opportunities together with a significant sharing of noise impacts and in the case of OLY SIDs, much shorter track miles. However, there are very few OLY departures at night. There Period 2 MATCH SIDs would significantly increase CO2 emissions. Having SIDs turning North of Luton will result is very high numbers of newly overflown population within the night time LOAEL and increase adverse effects for many. This option would require not require more CAS but would restrict the ability to release CAS to the north of Luton.

Easterly SID Group 1 (Do Nothing)

Easterly SID Group 1 (Do Nothing Baseline)

Group	Impact	Qualitative Assessment
		This option represents the do nothing scenario for Luton Easterly SIDs. With the exception of OLY departures where the SID centreline cannot be flown accurately, aircraft departing Luton largely keep to the SID centrelines up to 4000ft. Beyond 4000ft, some concentration can still be seen along the centrelines however aircraft are routinely vectored. Further details around our do nothing scenario can be found within our Step 2A submission document on the CAA's Airspace Change Portal.
Communities	Noise impact on health and quality of life	Due to wind direction, easterly operations on runway 07 occur approximately 30% of the year. The noise data shown in technical appendix A and this qualitative assessment has considered this modal split. Aircraft departing Luton on easterlies follow the MATCH, OLY and CPT standard instrument departures (SIDs) shown in yellow on the image. The obligations of Noise Preferential Routings for SIDs cease when a height of 4000ft[14] has been reached. Aircraft typically keep to the SID centerlines up to around 3/4000ft before they are vectored by ATC which aligns with the obligations of the NPRs. This vectoring creates some dispersion although the noise track keeping (NTK) data shown in purple shows that there is still some concentration along the SID centrelines, particularly with the MATCH and CPT SIDs.

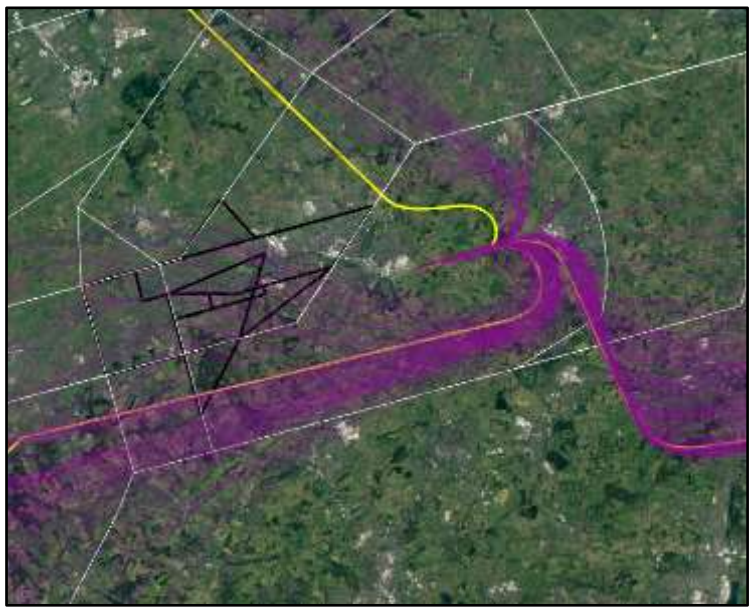


Figure 17 Current Easterly SID centrelines (Yellow) and NTK data (purple)

The technical appendix to this document includes images and maps showing the current areas of overflight. The overflight data, generated from actual radar tracks and using the CAA's definition of overflight gives us information about this baseline scenario. To aid comparison, we have included the overflight data for the actual dispersion of the vectored tracks, and data for if all aircraft were to follow the centerline of the current published SID. The data from this tables will be used to compare the easterly departure options against the 'do nothing' baseline:

Table 44 Easterly departures baseline overflight data

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
Day	**Baseline Easterly Dep Option 1 (Vector)**	255436.0	22277.0	0.0	0.0	0.0
	Baseline Easterly Dep Option 1 (Centreline)	201573.7	30483.5	0.0	0.0	0.0
Night	**Baseline Easterly Dep Option 1 (Vector)**	40990.0	0.0	0.0	0.0	0.0
	Baseline Easterly Dep Option 1 (centreline)	119466.6	0.0	0.0	0.0	0.0

As the noise modelling has taken into account the average modal split at Luton, there is no population that fall within the 50 flights per day overflight contour. In reality, we know that when we are operating on easterlies, there may be occasions when some areas are overflown greater than 10 times per day. As part of the Stage 3 Full Options Appraisal, to help further understand and articulate the proposals impacts for noise, contours representing 100% easterly and 100% easterly operations will also be produced.

In addition to population overflown, we also have data on the overflight of noise sensitive buildings such as schools, hospitals and places of worship; the full data around these is shown in technical appendix a, and as part of this IOA we will provide a qualitative statement around this data.

[14] Conventional: 3000 FT QNH (between 0700-2300 (0600-2200)) and 4000 FT QNH (during night time, 2300-0700 (2200-0600)). RNAV1 SIDs cease when a height of 4000ft has been reached.

<table>
<tr><td></td><td></td><td>L_{Aeq}
The easterly departures make up a component of the overall LAeq day time and night time contours. We have used the overall contours from 2019, as an indicative contour for 2028 as it is expected that contours will be a similar size or smaller in 2028 as Luton has a planning condition to reduce the size. The AD6 airspace change Final Options Appraisal model predicted a very small change to these contours which was put down to the modelling, rather than expecting a change in real life. We have also taken this into account when qualitatively describing the baseline and comparing it to our other airspace change options (see arrivals baseline for further details).

Noise Preferred Routes
As this baseline reflects current day, there would be no changes to NPRs as a result of this option.</td></tr>
<tr><td></td><td>Air Quality</td><td>Impacts to air quality are considered for changes below around 650ft (200m). Aircraft flying above this are unlikely to have a significant impact on local ground air quality.

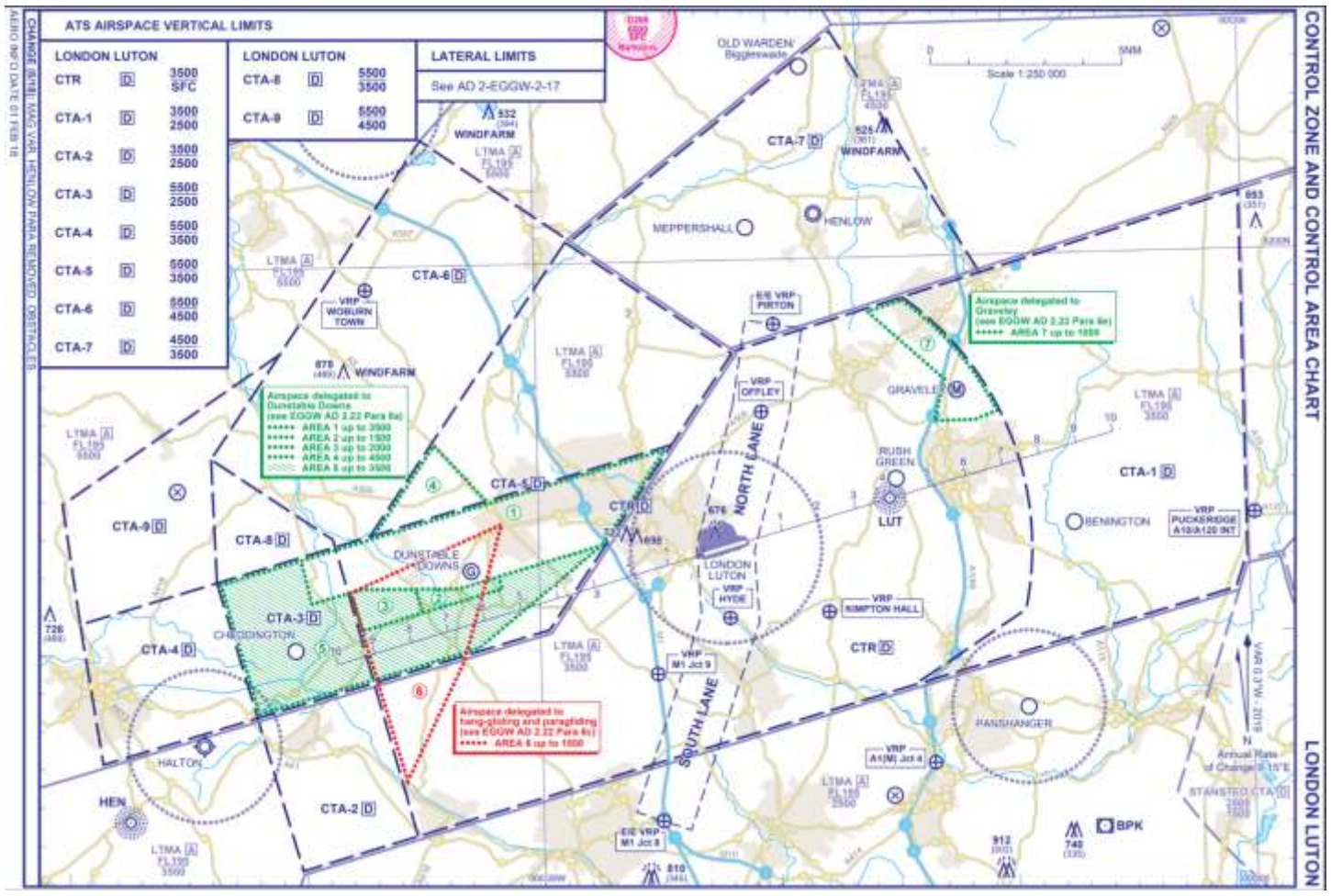
Owing to high climb performance, aircraft departing from Luton are typically already above 650ft when reaching the departure end runway (DER). This means that our options are unlikely to have a significant impact on ground-level air quality however as part of our IOA we will review each option to understand any changes against this baseline.</td></tr>
<tr><td rowspan="4">Wider Society</td><td>Greenhouse gas impact</td><td>Emissions of greenhouse gases arise from the combustion of aviation fuel, and as the combustion of aviation fuel is linked to track length, we have initially looked at the track length for the baseline easterly SIDs.

When departing from Luton, some aircraft are vectored after 3/4000ft, which means that the track length varies from flight to flight. For the purposes of comparing our westerly SID options against the baseline scenario, we have taken the track length of the SID centerlines as an initial indication of ‘do nothing’ track length. We know that although vectoring does occur above 3/4000ft, there is concentration along the centerline and therefore at this stage, it is a proportionate approach; at the Stage 3 full options appraisal track length will be modelled in further detail.

Table 45 Easterly SID Baseline Track Mileage
<table>
<tr><th rowspan="2">Option</th><th colspan="3">Indicative track miles (nautical miles) to/abeam</th></tr>
<tr><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th></tr>
<tr><td>Baseline Easterly Dep (centreline)
Option 1</td><td>28</td><td>28</td><td>28</td></tr>
</table>
We will estimate the differences between this baseline and the option, to understand if there are any anticipated advantages/disadvantages of the option against current day. This estimation will consider whether the aircraft tracks will be longer or shorter than a typical flight today. As CO_2 emissions are linked to the difference in aviation fuel burnt, this will allow us to calculate a high level estimation of the greenhouse gas impacts as a result of the option. Full details are shown in technical appendix A.</td></tr>
<tr><td>Capacity / resilience</td><td>Although Luton has recently undertaken a separate ACP to remove interdependencies between Luton and Stansted arrivals, in future, increased forecast movement levels are anticipated to result in capacity and resilience disbenefits. As traffic increases, the extra complexity and workload for air traffic controllers and pilots would likely result in the use of flow regulations. Flow regulations stabilise the number of movements until the peak in traffic subsides, however in doing so they do not allow Luton to optimise capacity.

It is anticipated that, with forecast increases in traffic, in future this baseline scenario would result in a potential reduction in the departure capacity at the airport. In addition to this, no change to the airspace around Luton may also inhibit the wider FASI programme of change and AMS benefits associated with the programme.</td></tr>
<tr><td>Tranquility</td><td>Aircraft today overfly the Chilterns AONB. The table below provides data on the area of AONB overflown:
Table 46 Easterly SID Baseline AONB Overflown
<table>
<tr><th></th><th>Option</th><th>Area (Km2) of AONB overflown 0-7000ft</th></tr>
<tr><td rowspan="2">Day</td><td>Baseline Easterly Dep Option 1 (Vector)*</td><td>22.8</td></tr>
<tr><td>Baseline Easterly Dep Option 1 (centreline)</td><td>11.3</td></tr>
<tr><td rowspan="2">Night</td><td>Baseline Easterly Dep Option 1 (Vector)*</td><td>0.0</td></tr>
<tr><td>Baseline Easterly Dep Option 1 (centreline)</td><td>4.2</td></tr>
</table></td></tr>
<tr><td>Biodiversity</td><td>On departure all flights will be over 1,000ft after each aircraft has covered 3km. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 6km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown.</td></tr>
<tr><td>General Aviation</td><td>Access</td><td>This baseline scenario would not offer any change from the existing Controlled Airspace (CAS) arrangements in place today. The options will be qualitatively compared against this existing scenario.

Today, Luton’s instrument flight procedures are contained within Class D controlled airspace. The base of this airspace varies and is shown on the chart below (for the current published chart, please see the UK eAIP):</td></tr>
</table>



Within the Luton TMA, there are areas of airspace delegated to gliding activities. The Gliding areas are used differently depending on whether Luton are on easterly or westerly operations. Use of the portions of gliding areas within Controlled Airspace is strictly controlled by a Letter of Agreement between various parties. Luton Approach controllers ensure that all Luton arriving and departing commercial traffic stays within controlled airspace and remain clear of the airspace delegated to gliding activities. There would be no change to these arrangements or letters of agreement as a result of this baseline option.

Although the existing baseline scenario will not result in the requirement for more airspace, this option offers no opportunity to simplify the airspace boundaries.

General Aviation / Commercial airlines	Economic impact from increased effective capacity	There will be no change from today as a result of this option; later in this IOA we will qualitatively estimate the differences between this and the airspace change options.
	Fuel burn	As the combustion of aviation fuel is linked to track length, we have initially looked at the track length for the baseline easterly SIDs. When departing from Luton, some aircraft are vectored after around 4000ft, which means that the track length varies from flight to flight. For the purposes of comparing our easterly SID options against the baseline scenario, we have taken the track length of the SID centerlines as an initial indication of 'do nothing' track length. We know that although vectoring does occur above 4000ft, there is concentration along the centerline and therefore at this stage, it is a proportionate approach; at the Stage 3 full options appraisal track length will be modelled in further detail.

Table 47 Easterly Baseline Track Mileage

Option	Indicative track miles (nautical miles) to/abeam		
	MATCH	OLY	HEN (CPT SID)
Baseline Easterly Dep (centreline) Option 1	28	28	28

Aircraft departing from Luton are often prevented from continuously climbing to above 7000ft due to the tactical coordination with other traffic within the airspace.

We will qualitatively estimate the differences between this baseline and the option, to understand if there are any anticipated advantages/disadvantages of the option against current day. This estimation will consider whether the aircraft tracks will be longer or shorter than a typical flight today and will also consider the opportunity for continuous climb.

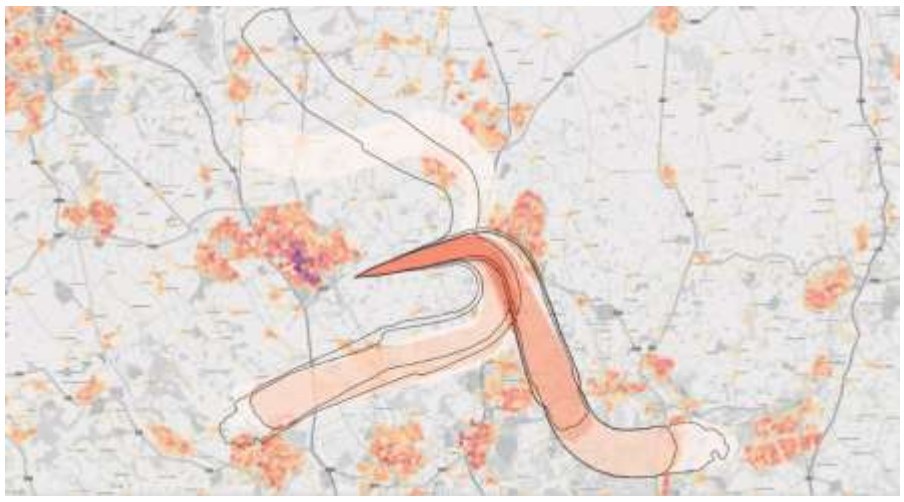
Commercial airlines	Training costs	As this option is already in operation, there are no training costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
	Other costs	As this option is already in operation, there are no other costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
Airport / Air navigation service provider	Infrastructure costs	As this option is already in operation, there are no infrastructure costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
	Operational costs	As this option is already in operation, there are no operational costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
	Deployment costs	As this option is already in operation, there are no deployment costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.

LLAOL FASI-S Initial Options Appraisal

All	Safety	At current traffic levels, there are no safety concerns with the current arrangements at Luton. Future traffic growth could however result in increased complexity and workload for Air Traffic Controllers and pilots, which may lead to traffic within the LTMA being capped to maintain safety.
All	Interdependencies, conflicts and tradeoffs	The ability for Luton easterly departures to continuously climb is currently constrained by movements within the LTMA from neighbouring airport's such as Heathrow, Stansted, London City and Northolt. This is described in more detail in our Stage2A documentation. Doing nothing with Easterly departures will not enable a reduction in the interdependencies, conflicts and tradeoffs between Luton and Heathrow, Stansted, London City and Northolt. In addition, Luton will likely be required to do something in order to enable NERL to make efficiencies within the LTMA.
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* Doing nothing with Easterly departures will not align with the AMS. It will not enable any environmental benefits or help to reduce the interdependencies and constraints within the LTMA. No improvements to vertical profiles from Luton will not enable any reduction in the volume of controlled airspace.

Easterly SID Group 2

Easterly SID Group 2	
	This option aims to replicate current day with the exception of the OLY SID which can't be replicated closely with PBN. The OLY SID in this option aims to route between Hitchin and Letchworth Garden City. The CPT SID would be refined slightly to remain south of runway 07 final approach because the existing centreline does not do this. **This option is not expected to be dependent on changes at neighbouring airports.**

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option aims to replicate the existing MATCH SID, refine the CPT SID and redesign the OLY SID. The MATCH SID would largely be the same as current day and therefore we would expect to see a very minimal change to the vectoring swathe of the MATCH Departures. The CPT SID would also be kept largely as it is today, however there is some refinement to keep the route laterally separated from final approach. Should this option progress, this will be explored in more detail as part of our Stage 3 FOA. Finally, the OLY SID cannot be replicated using PBN design criteria and therefore it has been redesigned; as part of this process the route has been refined to fly between the highly populated areas of Hitchin and Letchworth Garden City.  *Figure 18 Easterly SID Group 2 overflight (centreline), with population density and baseline (black outline). Note this option would retain some vectoring which is not shown in these centreline contours.* The lateral dispersion of the MATCH SID is expected to be similar to today, however we expect the CPT SID to see a higher concentration of aircraft on the centreline as controllers would not need to rely on vectoring to the south of the SID centreline. The changes to the OLY SID will result in a change in concentration around the initial part of the first turn however we wouldn't expect aircraft to routinely fly the route centreline beyond this first turn, as controllers will still need to manage the conflict with arrivals to runway 07. This means that we still expect there to be a vectoring swathe for OLY departures, however this will change from current day owing to the change in the first turn. This swathe is likely to occur over Hitchin and Letchworth Garden City. At this stage, quantifying the dispersion of a vectoring swathe that is not currently in operation is a challenging task owing to the unpredictable nature of vectoring; subject to this option progressing, we will explore this in further detail as part of the Full Options Appraisal at stage 3. Subject to safety assurances, it is expected this option could be implemented within the current airspace, without affecting adjacent airports as the published vertical profile of the SIDs would be the same as today. It is not expected to result in overflight of the same communities with multiple routes to/from Luton or other airports below 7000ft with the one exception of the OLY SID, if used in combination with the RNP-AR PBN route that forms part of westerly arrival option 4. **L_{Aeq}** Easterly operations occur approximately 30% of the year and this has been considered when appraising the potential impacts to the L_{Aeq} average daytime and nighttime contours. Owing to % split between easterly and westerly operations, changes to the easterly departures have a lower overall impact on the L_{Aeq} contours compared to the westerly options. Although there are small changes to SIDs in Easterly SID Group 2 compared to current day, when comparing the scale of the changes against the scope of the L_{Aeq} contour area and taking into account percentage of overall operations that would fly these SIDs, there is expected to be a very small, almost imperceptible differences to the L_{Aeq} daytime and night LOAEL and SOAEL contours. With regards to LLAOL's L_{Aeq} contours that form part of the planning condition do not expect this option to impact the size of the 57dB(A) Leq16hr and 48dB(A) Leq8hr contours. The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal if this option is progressed. **Overflight** The overflight diagrams shown in technical appendix A demonstrate the changes in overflight from the relocation of the MATCH, CPT and OLY SIDs. We have shown the 0-4000ft data below as it represents the sections of the SIDs where there is the greatest level of change from the baseline, however it is important to note that there are changes beyond 4000ft as well. At this stage in the process, owing to the nature of the vectoring that will occur beyond 4000ft and the complexity to model this with regards to noise, we have

not quantitatively articulated the benefits and impacts. We have, however, some data for if these routes were to follow the SID centrelines fully up to 7000ft; this information is included in table 47 below.

Table 48 Easterly Departure Option 2 Overflight Data 0-4000ft

		Population over flown 0-4000ft (1 times per day)	Population over flown 0-4000ft (10 times per day)	Population over flown 0-4000ft (50 times per day)	Population over flown 0-4000ft (100 times per day)	Population over flown 0-4000ft (150 times per day)
Day	Baseline Easterly Dep Option 1 (Centreline)	17616.5	7510.6	0.0	0.0	0.0
	Easterly Dep Option 2	13806.0	2459.3	0.0	0.0	0.0
Night	Baseline Easterly Dep Option 1 (centreline)	14574.9	0.0	0.0	0.0	0.0
	Easterly Dep Option 2	7454.9	0.0	0.0	0.0	0.0

The data for between 0-4000ft shows that the changes to the CPT and OLY SIDs result in reduction in the population overflown 1 or 10 times per day, although it's important to note that this data is based on centrelines and we still expect some dispersion to occur between 0-4000ft.

Table 49 Easterly Departure Option 2 Overflight Data 0-7000ft

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
Day	Baseline Easterly Dep Option 1 (Vector)	255436.0	22277.0	0.0	0.0	0.0
	Baseline Easterly Dep Option 1 (Centreline)	201573.7	30483.5	0.0	0.0	0.0
	Easterly Dep Option 2	154991.1	19852.4	0.0	0.0	0.0
Night	Baseline Easterly Dep Option 1 (Vector)*	40990.0	0.0	0.0	0.0	0.0
	Baseline Easterly Dep Option 1 (centreline)	119466.6	0.0	0.0	0.0	0.0
	Easterly Dep Option 2	104732.9	0.0	0.0	0.0	0.0

The data for between 0-7000ft shows that the changes to the CPT and OLY SIDs result in reduction in the population overflown 1 or 10 times per day. This data is based on all aircraft following the SID centrelines, whereas we anticipate that aircraft will continue to be vectored as they are today, therefore this data isn't representative of the overall vectoring swathes that would occur with this option. Particularly with the OLY SID, although the centreline aims to route between Letchworth Garden City and Hitchin, vectoring of flights is expected to occur over these highly populated areas.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows an overall reduction in the number of sites overflown between 0-7000ft however there are increases places of worship overflown between 4-7000ft. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

NPR
The changes to the CPT and OLY SIDs between 0-4000ft will result in a requirement to adjustment the baseline Noise Preferred Routes.

Respite
This option does not offer any respite.

	Air Quality	The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.
Wider Society	Greenhouse gas impact	We estimate that there will be increases in track milage of c.3nm and c.2nm for the OLY and CPT SIDs. The MATCH will remain the same as today.

For the OLY SID the equates to around 22.2kg of additional fuel per flight which is a CO_2 equivalent of 0.070mt. The CPT SID results in an estimated 14.8kg of extra fuel per flight which is a CO_2 equivalent of 0.047mt.

When considered against the total movements operated across an average year, this amounts to an anticipated impact to greenhouse gas and CO_2 emissions. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 50 Easterly SID Group 3 Track Mileage, Fuel Burn and CO_2

	MATCH	OLY	HEN (CPT SID)	MATCH		OLY		HEN (CPT SID)	
	NM diff to/abeam			A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)
E SID Group 1 (Baseline)	0	0	0	0	0.000	0	0.000	0	0.000
E SID Group 2	0	3	2	0	0.000	22.2	0.070	14.8	0.047

Capacity / resilience

The changes to easterly SID group 2, compared to the baseline, are a result of PBN design criteria requirements and the aim to minimise the adverse impacts of noise; these changes are not expected to enhance or degrade Luton's operational capacity.

Tranquility

Aircraft today overfly the Chilterns AONB. Easterly SID group 2 results in overflying of Chilterns AONB north of Luton but only infrequently and at low levels of average noise. Transatlantic routes that fly south of Airport overfly AONB to west but when average noise is low. The table below provides a comparison of the AONB overflown data however it's important to note that this option will continue to see aircraft vectored above 3/4000ft; this will be investigated in further detail with regards to AONB overflight should this option be progressed into Stage 3.

Table 51 Easterly SID Group 2 AONB overflown

	Option	Area (Km2) of AONB overflown 0-7000ft
Day	Baseline Easterly Dep Option 1 (Vector)*	22.8
	Baseline Easterly Dep Option 1 (centreline)	11.3
	Easterly Dep Option 2 (centreline)	33.8
Night	Baseline Easterly Dep Option 1 (Vector)*	0.0
	Baseline Easterly Dep Option 1 (centreline)	4.2
	Easterly Dep Option 2 (centreline)	5.1

Biodiversity

On departure all flights will be over 1,000ft after each aircraft has covered 3km. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 6km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown.

General Aviation

Access

Owing to the vertical profile remaining as today, we would not expect this change to enable a reduction on the volume of CAS or simplification of CAS boundaries

Economic impact from increased effective capacity

As we do not expect any increased effective capacity as a result of this option (see section above), we anticipate that this option would not result in any economic impact either positive or negative on commercial air traffic compared with the baseline do nothing easterly SID group 1.

General Aviation / Commercial airlines

Fuel burn

We estimate that there will be increases in track milage of c.3nm and c.2nm for the OLY and CPT SIDs. The MATCH will remain the same as today. For the OLY SID the equates to around 22.2kg of additional fuel per flight and the CPT SID results in an estimated 14.8kg of extra fuel per flight.

When considered against the total movements operated across an average year, this amounts to an anticipated impact to fuel burn costs. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 52 Easterly SID Group 3 Track Mileage and Fuel Burn

	MATCH	OLY	HEN (CPT SID)	MATCH	OLY	HEN (CPT SID)
	NM diff to/abeam			A320 fuel difference at FL160 (kg)	A320 fuel difference at FL160 (kg)	A320 fuel difference at FL160 (kg)
E SID Group 1 (Baseline)	0	0	0	0	0	0
E SID Group 2	0	3	2	0	22.2	14.8

Commercial airlines	Training costs	Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This easterly SID option is not anticipated to require any additional training costs for airlines.
	Other costs	No other airline costs are foreseen.
Airport / Air navigation service provider	Infrastructure costs	The initial deployment phase of the ACP may require some ATC system engineering amendments, however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.
	Operational costs	This airspace change proposal is not anticipated to change airport or ANSP operational costs. The implementation of PBN SIDs removes LLAOL's dependency on conventional ground based navigation equipment (VORs), which contributes to a reduction in NERL's operational costs as it enables VOR rationalisation[15]
	Deployment costs	This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options. As this option is close to current day and is independent of other neighbouring airports, we anticipate that it will require less training that some of the other options however training still will be required.
All	Safety	As the vertical profile and published centrelines of the SIDs would be the similar as today there are no significant safety concerns at this stage.
All	Interdependencies, conflicts and tradeoffs	This option is not expected to reduce any interdependencies with adjacent airports and the move will not enable improvements to the vertical published profiles of the SIDs without wider changes within the LTMA. Luton and NERL have assessed this option as having no negative impact or dependencies on other airports. The change is not expected to constrain the options associated with the core LTMA deployments later because the published SID levels would remain as today, with the SID tracks very similar to today.
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* This option would see PBN SIDs introduced for easterly operations which would support the AMS objectives however the option would not be expected to deliver any significant capacity benefits or environmental improvements, especially when progressed ahead of a Core LTMA deployment. The option would not enable any reductions in CAS.

[15] LLAOL is currently investigating RNAV Substitution to mitigate VOR rationalisation however this is a temporary solution for the interim period before the deployment of the FASI-S ACPs

Easterly SID Group 3

Easterly SID Group 3	
	This MATCH and OLY SIDs in this option are the same as Easterly Departure Group 2 except with the assumption of improved CCO. The CPT departure now avoids Harpenden which relies on guaranteed CCO. **This option is dependent on the integration with other FASI-S airports and the upper airspace design.**

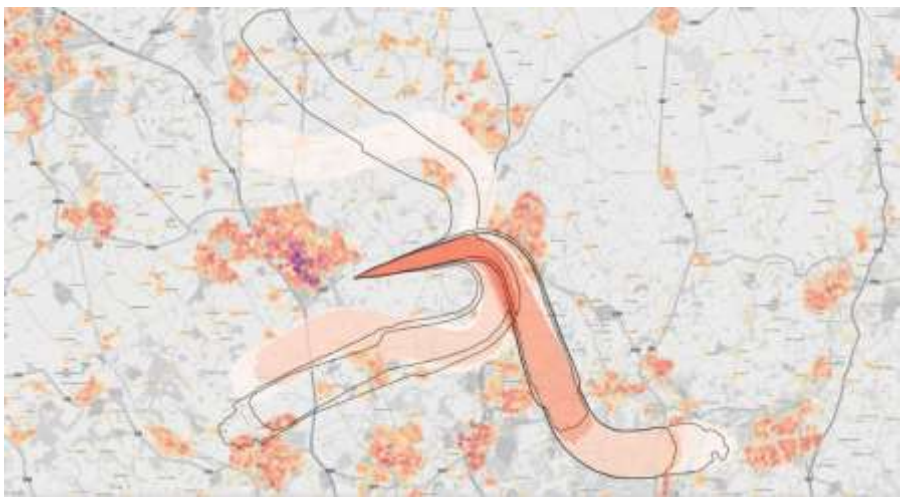
Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option is the same as Easterly SID Group 2 but with a CPT departure to the south of the aerodrome that avoids Harpenden. This is only possible with guaranteed CCO to above 5,000ft because the route bends back towards final approach and would not be safe against a Missed Approach, Final Approach or subsequent departures without guaranteed climb. For this reason such an option is dependent on changes at other airports. As a result, we would expect the OLY and MATCH routes would experience more concentration but also improved CCO as a result of the wider FASI deployment.  *Figure 19 Easterly SID Group 3 overflight (centreline), with population density and baseline (black outline).* As this option is dependent on changes at other airports and within the upper airspace we expect all the SIDs to operate with continuous climb to above 6000ft. This is because we assume Heathrow, Northolt and London City departures are deconflicted in the new FASI design. This means that there is a lower requirement for routine tactical intervention from air traffic controllers and aircraft are expected to follow the SID centrelines. However as described previously, delivering procedural climb above 5000ft will be extremely challenging for SIDs routing to the south of Luton. We would expect the wider LTMA re-design to have procedurally deconflicted routes to/from adjacent airports and therefore the cumulative impacts from other neighbouring airports to be reduced. The opportunity to avoid cumulative impacts from Luton's routes depends on the arrival configuration; we will explore this in future detail as part of the Full Options Appraisal at Stage 3. **L_{Aeq}** Easterly operations occur approximately 30% of the year and this has been considered when appraising the potential impacts to the L_{Aeq} average daytime and nighttime contours. Owing to % split between easterly and westerly operations, changes to the easterly departures have a lower overall impact on the L_{Aeq} contours compared to the westerly options. Although there are small changes to SIDs in Easterly SID Group 3 compared to current day, when comparing the scale of the changes against the scope of the L_{Aeq} contour area and taking into account percentage of overall operations that would fly these SIDs, there is expected to be very small, almost imperceptible differences to the L_{Aeq} daytime and night LOAEL and SOAEL contours. With regards to LLAOL's L_{Aeq} contours that form part of the planning condition do not expect this option to impact the size of the 57dB(A) Leq16hr and 48dB(A) Leq8hr contours. The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal if this option is progressed. **Overflight** The overflight diagrams shown in technical appendix A demonstrate the changes in overflight from the relocation of the MATCH, CPT and OLY SIDs and the changes to the airspace to reduce vectoring. The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline):

Table 53 Easterly Departure Option 3 Overflight Data 0-7000ft

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
Day	Baseline Easterly Dep Option 1 (Vector)	255436.0	22277.0	0.0	0.0	0.0
	Baseline Easterly Dep Option 1 (Centreline)	201573.7	30483.5	0.0	0.0	0.0
	Easterly Dep Option 3	122694.9	19852.4	0.0	0.0	0.0
Night	Baseline Easterly Dep Option 1 (Vector)*	40990.0	0.0	0.0	0.0	0.0
	Baseline Easterly Dep Option 1 (centreline)	119466.6	0.0	0.0	0.0	0.0
	Easterly Dep Option 3	74473.0	0.0	0.0	0.0	0.0

The data shows that there are decreases in the population overflown 1 and 10 times per day which can be attributed to the SIDs aiming to avoid the overflight of highly populated areas.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows an overall reduction in the number of sites overflown between 0-7000ft. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

NPR

The changes to the CPT and OLY SIDs between 0-4000ft will result in a requirement to adjustment the baseline Noise Preferred Routes.

Respite

This option does not offer any respite.

	Air Quality	The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.
Wider Society	Greenhouse gas impact	We estimate that there will be increases in track milage of c.3nm and c.2nm for the OLY and CPT SIDs. The MATCH will remain the same as today. For the OLY SID the equates to around 22.2kg of additional fuel per flight which is a CO_2 equivalent of 0.070mt. The CPT SID results in an estimated 14.8kg of extra fuel per flight which is a CO_2 equivalent of 0.047mt. When considered against the total movements operated across an average year, this amounts to an anticipated impact to greenhouse gas and CO_2 emissions. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.
	Capacity / resilience	The changes to the SIDs within this option are not expected to enhance or degrade Luton's operational capacity. There is however a safety risk with the CPT departure turning back towards final approach and climb out that requires resolution through more detailed design work at Stage 3. Without this design resolution, greater departure time separation may be required after a CPT departure to maintain safety. As part of this IOA, we have assumed that it is possible for this to be resolved as part of the design and further details around this will be explored should this option be progressed into Stage 3. This option is dependent on the FASI-S programme and the modernisation of the LTMA, therefore assuming that in this scenario Luton departures will be able to continuously climb to above 5000ft, we anticipate that there will be an improvement to capacity because of the changes to the LTMA.
	Tranquility	Aircraft today overfly the Chilterns AONB. Easterly SID group 3 results in overflying of Chilterns AONB north of Luton but only

Table 54 Easterly SID Group 3 Track Mileage, Fuel Burn and CO_2

	MATCH	OLY	HEN (CPT SID)	MATCH		OLY		HEN (CPT SID)	
	NM diff to/abeam			A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)
E SID Group 1 (Baseline)	0	0	0	0	0.000	0	0.000	0	0.000
E SID Group 3	0	3	2	0	0.000	22.2	0.070	14.8	0.047

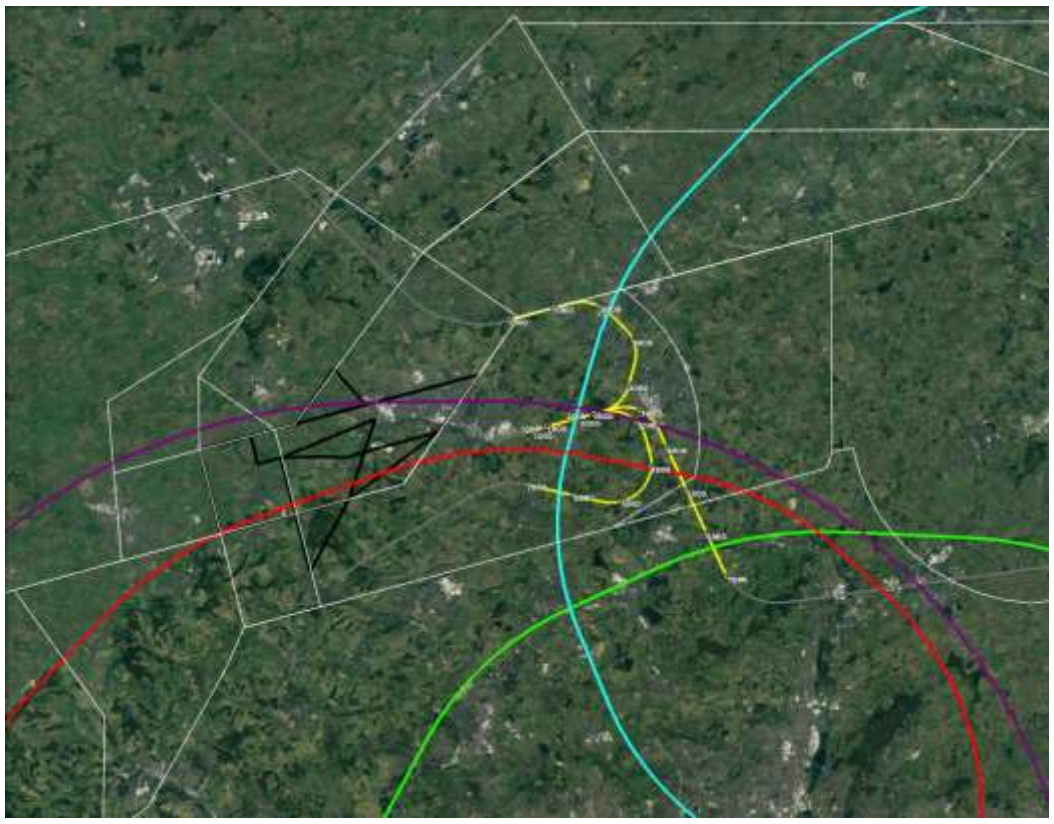
<table>
<tr><td></td><td></td><td>infrequently and at low levels of average noise. Transatlantic routes that fly south of Airport overfly AONB to west but when average noise is low. In the baseline, aircraft are vectored from 3/4000ft creating dispersion across the AONB whereas easterly SID group 3 uses PBN which will result in a smaller area overflown, however the frequency will increase.

Table 55 Easterly SID Group 3 AONB overflown
<table><tr><th></th><th>Option</th><th>Area (Km2) of AONB overflown 0-7000ft</th></tr><tr><td rowspan="3">Day</td><td>Baseline Easterly Dep Option 1 (Vector)*</td><td>22.8</td></tr><tr><td>Baseline Easterly Dep Option 1 (centreline)</td><td>11.3</td></tr><tr><td>Easterly Dep Option 3</td><td>41.3</td></tr><tr><td rowspan="3">Night</td><td>Baseline Easterly Dep Option 1 (Vector)*</td><td>0.0</td></tr><tr><td>Baseline Easterly Dep Option 1 (centreline)</td><td>4.2</td></tr><tr><td>Easterly Dep Option 3</td><td>7.4</td></tr></table></td></tr>
<tr><td></td><td>Biodiversity</td><td>On departure all flights will be over 1,000ft after each aircraft has covered 3km. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 6km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown.</td></tr>
<tr><td>General Aviation</td><td>Access</td><td>This option could be expected to require less CAS owing to CCO above 5000ft enabled by the wider LTMA FASI design.</td></tr>
<tr><td rowspan="2">General Aviation / Commercial airlines</td><td>Economic impact from increased effective capacity</td><td>We expect the increased effective capacity detailed in the section above will result in a positive economic impact on commercial air traffic compared with the baseline do nothing easterly SID group 1.</td></tr>
<tr><td>Fuel burn</td><td>We estimate that there will be increases in track milage of c.3nm and c.2nm for the OLY and CPT SIDs. The MATCH will remain the same as today. For the OLY SID the equates to around 22.2kg of additional fuel per flight and the CPT SID results in an estimated 14.8kg of extra fuel per flight.

When considered against the total movements operated across an average year, this amounts to an anticipated impact to fuel burn costs. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 56 Easterly SID Group 3 Track Mileage and Fuel Burn
<table><tr><th></th><th colspan="3">NM diff to/abeam</th><th>A320 fuel difference at FL160 (kg)</th><th>A320 fuel difference at FL160 (kg)</th><th>A320 fuel difference at FL160 (kg)</th></tr><tr><th></th><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th></tr><tr><td>E SID Group 1 (Baseline)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>E SID Group 2</td><td>0</td><td>3</td><td>2</td><td>0</td><td>22.2</td><td>14.8</td></tr></table></td></tr>
<tr><td>Commercial airlines</td><td>Training costs</td><td>Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This westerly SID option is not anticipated to require any additional training costs for airlines.</td></tr>
<tr><td></td><td>Other costs</td><td>No other airline costs are foreseen.</td></tr>
<tr><td rowspan="3">Airport / Air navigation service provider</td><td>Infrastructure costs</td><td>The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.</td></tr>
<tr><td>Operational costs</td><td>This airspace change proposal is not anticipated to change airport or ANSP operational costs. The implementation of PBN SIDs removes LLAOL's dependency on conventional ground based navigation equipment (VORs), which contributes to a reduction in NERL's operational costs as it enables VOR rationalisation[16]</td></tr>
<tr><td>Deployment costs</td><td>This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options.
Although this option is relatively similar to current day, as it is to be integrated into the wider FASI airspace we anticipate that it will require slightly more training that some of the other options.</td></tr>
<tr><td>All</td><td>Safety</td><td>There are no safety concerns identified with the MATCH and OLY SIDs, however the CPT departure turning back towards final approach and climb out will require additional safety assurances although they are not considered insurmountable at this stage, providing CCO to at least 6000ft can be delivered.</td></tr>
</table>

[16] LLAOL is currently investigating RNAV Substitution to mitigate VOR rationalisation however this is a temporary solution for the interim period before the deployment of the FASI-S ACPs

All	Interdependencies, conflicts and tradeoffs	Keeping a MATCH SID routing towards BPK is unlikely to help reduce dependencies and/or enable CCO. Stakeholders requested that the CPT SID avoids Harpenden - it can't currently go South of Harpenden as it will be closer to Heathrow and Northolt and increase dependencies and routing north of Harpenden generates dependencies on Heathrow, Northolt and London City as it requires CCO. If this option is progressed, it is likely the MATCH SID would be routed more closely as in Easterly SID Group 5. We will also investigate whether a CPT SID to the South of Harpenden is possible once the Heathrow, Northolt and London City shortlisted options are available.  *Figure 20 Easterly SID Group 3 and areas of interdependencies. Heathrow (purple) Northolt (red) Stansted (blue) London City (green)*
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* This option would support the AMS objectives through improved CCO, implementation of PBN and, subject to CCO, reduced CAS. This option would not deliver significant CO2 reductions although the options could be refined in Stage 3 (particularly MATCH) to enable a more direct route.

Easterly SID Group 4

Easterly SID Group 4	
	This option has a track adjustment on departure to the right (south) of runway 25 final approach to help avoid Breachwood Green and Hitchin and to provide some respite to those under RWY25 final approach. The CPT departure turns back west earlier than today, to reduce track miles/CO_2 which would also enable improved departure separations. **This option is not expected to be dependent on changes at neighbouring airports.**

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option is a fundamental change from today as all departures are offset to the right (south) of final approach to help avoid Breachwood Green, as requested by stakeholders. This provides respite to some areas under the runway 25 final approach, however OLY departures would be required to cross back over final approach when turning north. The figure opposite shows the offset departure tracks compared to today. Compared to today, the CPT departure SID turns to the south earlier to enable CO_2 and capacity benefits (see sections below) however this results in overflight of Harpenden at lower altitudes than today. The change in the OLY SID would result in the OLY departures remaining west of Hitchin, and the turn could be closer to the existing OLY tracks flown today (compared to Group 2 and Group 3). After the initial offset, the MATCH SID joins the existing MATCH route. However, engagement with NERL since performing the DPE has suggested a more direct MATCH route might be possible without having dependencies on other airports. Subject to safety assurances, it is expected this option could be implemented within the current airspace, without affecting adjacent airports as the published vertical profile of the SIDs would be the same as today and the lateral tracks not significantly further south. We expect that the climb performance/vertical profile of the SIDs would be the same as today and these routes would still operate with a similar amount of tactical intervention compared to the baseline to enable the option to be implemented ahead of the LTMA FASI deployments. This means that above the NPRs, we would expect routine vectoring. **L_{Aeq}** Easterly operations occur approximately 30% of the year and this has been considered when appraising the potential impacts to the L_{Aeq} average daytime and nighttime contours. Owing to % split between easterly and westerly operations, changes to the easterly departures have a lower overall impact on the L_{Aeq} contours compared to the westerly options. The changes to the SIDs will result in changes to the shape of the easterly component of the L_{Aeq} contour, with the contour moving further to the south to reflect the offset departures. This is anticipated to reduce the population within the daytime LOAEL as it avoids Breachwood Green and reduces the cumulative effect from the departures routing over the same areas as final approach. The impact that this has on the overall L_{Aeq} contours will be explored as part of our Full Options Appraisal at Stage 3 if this option is progressed. With regards to the nighttime LOAEL, the contours are also expected to move south to reflect the offset departures. This has the potential to move the nighttime contour over Whitwell, and has the potential to change the overall L_{Aeq} contour which extends to capture the outskirts of Stevenage; this too will be explored as part of our Full Options Appraisal at Stage 3. The avoidance of final approach may reduce adverse effects from aircraft noise as it reduces the cumulative impacts of arrivals and departures overflying the same area, however this would require further exploration as part of our Full Options Appraisal given the percentage of departures that would operate these SIDs. With regards to LLAOL's L_{Aeq} contours that form part of the planning condition, although this option is likely to result in a change to

Figure 21 Easterly SID Group 4 Offset Departures (Yellow) Existing SIDs (Green)

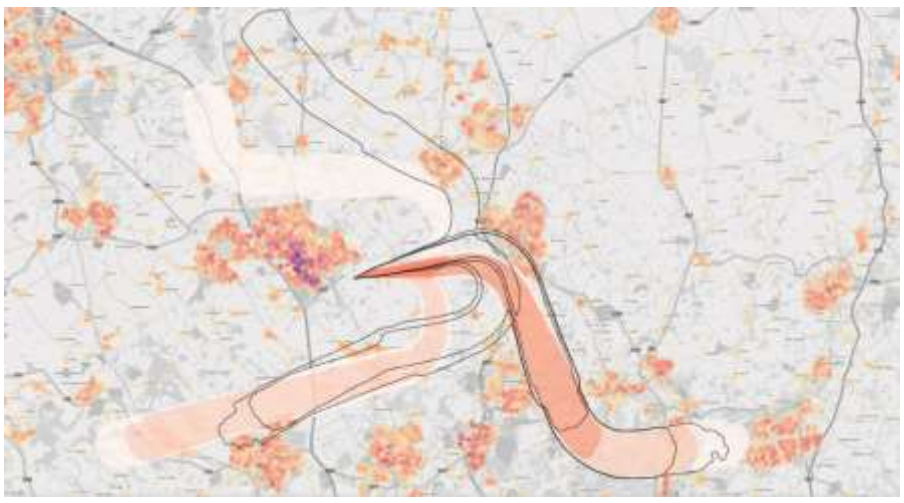


Figure 22 Easterly SID Group 4 overflight (centreline), with population density and baseline (black outline). Note this option would retain some vectoring which is not shown in these centreline contours.

shape of the contours, we do not expect it to significantly impact the size of the 57dB(A) L_{eq}16hr and 48dB(A) L_{eq}8hr contours.

The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal if this option is progressed.

Overflight

The overflight diagrams shown in technical appendix A demonstrate the changes in overflight from the relocation of the MATCH, CPT and OLY SIDs. We have shown the 0-4000ft data below as it represents the sections of the SIDs where there is the greatest level of change from the baseline however it is important to note that there are changes beyond 4000ft too. At this stage in the process, owing to the nature of the vectoring that will occur beyond 4000-5000ft and the complexity to model this with regards to noise, we have not quantitatively articulated the benefits and impacts. We have however some data for if these routes were to follow the SID centrelines fully up to 7000ft; this information is included in table 58 below.

Table 57 Easterly Departure Option 4 Overflight Data 0-4000ft

		Population over flown 0-4000ft (1 times per day)	Population over flown 0-4000ft (10 times per day)	Population over flown 0-4000ft (50 times per day)	Population over flown 0-4000ft (100 times per day)	Population over flown 0-4000ft (150 times per day)
	Baseline Easterly Dep Option 1 (Centreline)	17616.5	7510.6	0.0	0.0	0.0
	Easterly Dep Option 4	13799.9	4570.3	0.0	0.0	0.0
	Baseline Easterly Dep Option 1 (centreline)	14574.9	0.0	0.0	0.0	0.0
	Easterly Dep Option 4	9436.3	0.0	0.0	0.0	0.0

The overflight data shows that the offsets and changes to the SIDs below 4000ft would result in reduction in the number of people overflown 1 and 10 times per day.

Table 58 Easterly Departure Option 4 Overflight Data 0-7000ft

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
Day	Baseline Easterly Dep Option 1 (Vector)	255436.0	22277.0	0.0	0.0	0.0
	Baseline Easterly Dep Option 1 (Centreline)	201573.7	30483.5	0.0	0.0	0.0
	Easterly Dep Option 4	130883.1	16257.3	0.0	0.0	0.0
Night	Baseline Easterly Dep Option 1 (Vector)*	40990.0	0.0	0.0	0.0	0.0
	Baseline Easterly Dep Option 1 (centreline)	119466.6	0.0	0.0	0.0	0.0
	Easterly Dep Option 4	109614.4	0.0	0.0	0.0	0.0

The data for between 0-7000ft shows that there is a reduction in the population overflown 1 and 10 times per day. This data is based on all aircraft following the SID centrelines, whereas aircraft will continue to be vectored as they are today, therefore this data isn't representative of the overall vectoring swathes that would occur with this option. We anticipate that the vectoring swathes beyond 4000ft will not be fundamentally different from today and therefore, based on the 0-4000ft data, this option may result in a reduction in population overflown.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows an overall reduction in the number of sites overflown between 0-7000ft. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

NPR

The changes to SIDs will result in a requirement to adjustment the baseline Noise Preferred Routes.

Respite

The offset departures element of this option offers some respite for some communities currently overflown by rwy 25 final approach. This option does not offer alternative respite departure configurations.

<table>
<tr><td></td><td>Air Quality</td><td>The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than around 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. This is because although there are offset departures as part of this option, aircraft do not make the track adjustment (offset) until the departure end of runway (DER) and most aircraft are already above 200m by this point.
Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.</td></tr>
<tr><td rowspan="4">Wider Society</td><td>Greenhouse gas impact</td><td>We estimate that there will be decreases in track mileage of c.1nm and c.3nm for the MATCH and CPT SIDs. The OLY will remain the same as today. For the MATCH SID this equates to around 7.4kg of fuel savings per flight which is a CO_2 equivalent of 0.023mt. The CPT SID results in an estimated 22.2kg of savings per flight which is a CO_2 equivalent of 0.070mt.

When considered against the total movements operated across an average year, this amounts to an anticipated benefit to greenhouse gas and CO_2 emissions. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 59 Easterly SID Group 4 Track Mileage, Fuel Burn and CO_2
<table>
<tr><th></th><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th><th colspan="2">MATCH</th><th colspan="2">OLY</th><th colspan="2">HEN (CPT SID)</th></tr>
<tr><th></th><th colspan="3">NM diff to/abeam</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th></tr>
<tr><td>E SID Group 1 (Baseline)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0.000</td><td>0</td><td>0.000</td><td>0</td><td>0.000</td></tr>
<tr><td>E SID Group 4</td><td>-1</td><td>0</td><td>-3</td><td>-7.4</td><td>-0.023</td><td>0</td><td>0.000</td><td>-22.2</td><td>-0.070</td></tr>
</table></td></tr>
<tr><td>Capacity / resilience</td><td>The change in the CPT departure to turn earlier than today means that there could be a smaller departure separation between the CPT and MATCH/OLY SIDs, that could enhance departure capacity at Luton.</td></tr>
<tr><td>Tranquility</td><td>Aircraft today overfly the Chilterns AONB. Easterly SID group 4 results in overflying of Chilterns AONB north of Luton but only infrequently and at low levels of average noise. Transatlantic routes that fly south of Airport overfly AONB to the west but when average noise is low. The table below provides a comparison of the AONB overflown data however it's important to note that this option will continue to see aircraft vectored above 3/4000ft rather than stay on the centrelines; this will be investigated in further detail with regards to AONB overflight should this option be progressed into Stage 3.
Table 60 Easterly SID Group 4 AONB overflown
<table>
<tr><th></th><th>Option</th><th>Area (Km2) of AONB overflown 0-7000ft</th></tr>
<tr><td rowspan="3">Day</td><td>Baseline Easterly Dep Option 1 (Vector)*</td><td>22.8</td></tr>
<tr><td>Baseline Easterly Dep Option 1 (centreline)</td><td>11.3</td></tr>
<tr><td>Easterly Dep Option 4 (centreline)</td><td>69.7</td></tr>
<tr><td rowspan="3">Night</td><td>Baseline Easterly Dep Option 1 (Vector)*</td><td>0.0</td></tr>
<tr><td>Baseline Easterly Dep Option 1 (centreline)</td><td>4.2</td></tr>
<tr><td>Easterly Dep Option 4 (centreline)</td><td>24.0</td></tr>
</table></td></tr>
<tr><td>Biodiversity</td><td>On departure all flights will be over 1,000ft after each aircraft has covered 3km. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 6km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown.</td></tr>
<tr><td>General Aviation</td><td>Access</td><td>Owing to the vertical profile remaining as today as this could be implemented ahead of the Core LTMA deployment, we would not expect this change to enable a reduction in the volume of CAS.</td></tr>
<tr><td rowspan="2">General Aviation / Commercial airlines</td><td>Economic impact from increased effective capacity</td><td>We expect the increased effective capacity detailed in the section above will result in a positive economic impact on commercial air traffic compared with the baseline do nothing easterly SID group 1.</td></tr>
<tr><td>Fuel burn</td><td>We estimate that there will be decreases in track mileage of c.1nm and c.3nm for the MATCH and CPT SIDs. The OLY will remain the same as today. For the MATCH SID this equates to around 7.4kg of fuel savings per flight and the CPT SID results in an estimated 22.2kg of savings per flight.

When considered against the total movements operated across an average year, this amounts to an anticipated benefit to greenhouse gas and CO_2 emissions. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.</td></tr>
</table>

Table 61 Easterly SID Group 4 Track Mileage and Fuel Burn

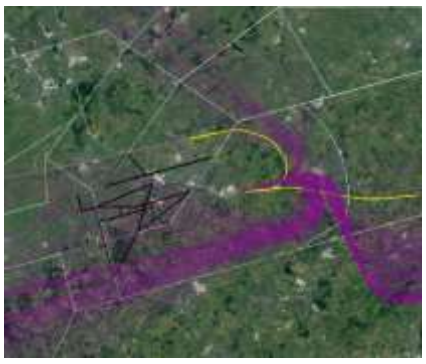
	MATCH	OLY	HEN (CPT SID)	MATCH	OLY	HEN (CPT SID)
	NM diff to/abeam			A320 fuel difference at FL160 (kg)	A320 fuel difference at FL160 (kg)	A320 fuel difference at FL160 (kg)
E SID Group 1 (Baseline)	0	0	0	0	0	0
E SID Group 2	-1	0	-3	-7.4	0	-22.2

Commercial airlines	Training costs	Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This westerly SID option is not anticipated to require any additional training costs for airlines.
	Other costs	No other airline costs are foreseen.
Airport / Air navigation service provider	Infrastructure costs	The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.
	Operational costs	This airspace change proposal is not anticipated to change airport or ANSP operational costs. The implementation of PBN SIDs removes LLAOL's dependency on conventional ground based navigation equipment (VORs), which contributes to a reduction in NERL's operational costs as it enables VOR rationalisation[17]
	Deployment costs	This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. As it is to be integrated into the wider FASI airspace we anticipate that it will require slightly more training that some of the other options. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options.
All	Safety	Offset departures (known as track adjustments) are available within PANS OPS but would require additional safety assurances compared to day. Other than this, there are no safety concerns at this time.
All	Interdependencies, conflicts and tradeoffs	This option is not expected to reduce any interdependencies with adjacent airports and the move will not enable improvements to the vertical published profiles of the SIDs without wider changes within the LTMA. Luton and NERL have assessed this option as having no negative impact or dependencies on other airports. Furthermore NERL have suggested that the MATCH SID could potentially be routed more direct than today which would help to reduce conflicts with London City departures via BPK. The change is not expected to constrain the options associated with the core LTMA deployments later because the published SID levels would remain as today, with the SID tracks very similar to today.
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* This option would support AMS objectives through the implementation of PBN, a reduction in noise impacts close in to the airport and reduction in CO2. Without guaranteed overflight enabled by a wider Core LTMA deployment, the CPT route could however increase overflight of Harpenden below 7000ft. We would not expect this change to enable a reduction in the volume of CAS.

[17] LLAOL is currently investigating RNAV Substitution to mitigate VOR rationalisation however this is a temporary solution for the interim period before the deployment of the FASI-S ACPs

Easterly SID Group 5

Easterly SID Group 5



This departure option also has a track adjustment to the right (south) but compared to Easterly SID Group 3, this option has CPT SIDs turning left to track north of Luton to increase opportunities for continuous climb operations and provide some respite for those communities south of Luton, who are overflown by Westerly MATCH departures. The CPT departures follow the same route below 7000ft as the OLY SID. The MATCH SID takes a more direct route to the upper airspace.

The option can only be operated in combination with either Easterly Arrival Option 3 or Option 4 due to the interaction between the CPT/OLY departures and arrival routes.

This option is dependent on the integration with other FASI-S airports and the upper airspace design.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option is a fundamental change from today as all departures are offset to the right (south) of final approach to help avoid Breachwood Green. This provides respite to some areas under the runway 25 final approach however the CPT and OLY departures would be required to cross back over final approach when turning north. The figure opposite shows the offset departure tracks compared to today. The CPT departure SID turns to the north to provide greater opportunity for continuous climb, as aircraft will be further away from Heathrow, London City and Northolt northbound departures. Today the CPT departure turns to the south but by turning it to the north it also offers the opportunity to provide some respite for those communities to the south of Luton who currently experience the cumulative impacts of easterly and westerly departure operations. The change in the OLY SID would result in the OLY departures turning north, as they do today however remaining west of Hitchin. The OLY SID would then turn west and continue west for further than today before reaching c.5-6000ft and turning north. Both the CPT and OLY SIDs wrap around the north of Luton, avoiding the areas of high population density. The MATCH SID takes a more direct routing than today, rather than turning towards Brookmans Parks, however it turns slightly south to avoid large parts of Stevenage. As this option is dependent on changes at other airports and within the upper airspace we expect all the SIDs to operate with continuous climb to above 5000ft. This is because we assume Heathrow, Stansted Northolt and London City movements are deconflicted in the new FASI design. This means that there is a lower requirement for routine tactical intervention from air traffic controllers and aircraft are expected to follow the SID centrelines. We would expect the wider LTMA re-design to have procedurally deconflicted routes to/from adjacent airports and therefore the cumulative impacts from other neighbouring airports to be reduced. The opportunity to avoid cumulative impacts from Luton's routes depends on the arrival configuration; we will explore this in future detail as part of the Full Options Appraisal at Stage 3. **L_{Aeq}** Easterly operations occur approximately 30% of the year and this has been considered when appraising the potential impacts to the L_{Aeq} average daytime and nighttime contours. Owing to % split between easterly and westerly operations, changes to the easterly departures have a lower overall impact on the L_{Aeq} contours compared to the westerly options. The changes to the SIDs will result in changes to the shape of the easterly component of the L_{Aeq} contour, with the contour moving further to the south to reflect the offset departures. This is anticipated to reduce the population within the daytime LOAEL as it avoids Breachwood Green and reduces the cumulative effect from the departures routing over the same areas as final approach. The impact that this has on the overall L_{Aeq} contours will be explored as part of our Full Options Appraisal at Stage 3, if this option is progressed.

Figure 23 Easterly SID Group 5 Offset Departures (Yellow) Existing SIDs (Green)

Figure 24 Easterly SID Group 5 overflight (centreline), with population density and baseline (black outline).

With regards to the nighttime LOAEL, the contours are also expected to move south to reflect the offset departures. This has the potential to move the nighttime contour over Whitwell, and has the potential to change the overall L_{Aeq} contour which extends to capture the outskirts of Stevenage; this too will be explored as part of our Full Options Appraisal at Stage 3. The avoidance of final approach may have a positive impact on the number of people adversely affected by aircraft noise as it reduces the cumulative impacts of arrivals and departures overflying the same area however this would require further exploration as part of our Full Options Appraisal given the percentage of departures that would operate these SIDs.
With regards to LLAOL's L_{Aeq} contours that form part of the planning condition, although this option is likely to result in a change to shape of the contours, we do not expect it to significantly impact the size of the 57dB(A) L_{eq}16hr and 48dB(A) L_{eq}8hr contours.

The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal if this option is progressed.

Overflight
The overflight diagrams shown in technical appendix A demonstrate the changes in overflight from the relocation of the MATCH, CPT and OLY SIDs and the changes to the airspace to reduce vectoring.

The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline):

Table 62 Easterly Departure Option 5 Overflight Data 0-7000ft

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
Day	Baseline Easterly Dep Option 1 (Vector)	255436.0	22277.0	0.0	0.0	0.0
	Baseline Easterly Dep Option 1 (Centreline)	201573.7	30483.5	0.0	0.0	0.0
	Easterly Dep Option 5	61816.7	19951.2	0.0	0.0	0.0
Night	Baseline Easterly Dep Option 1 (Vector)*	40990.0	0.0	0.0	0.0	0.0
	Baseline Easterly Dep Option 1 (centreline)	119466.6	0.0	0.0	0.0	0.0
	Easterly Dep Option 5	58119.7	0.0	0.0	0.0	0.0

The data shows that there are decreases in the population overflown 1 and 10 times per day which can be attributed to the SIDs aiming to avoid the overflight of densely populated areas.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows an overall reduction in the number of sites overflown between 0-7000ft. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

NPR
The changes to SIDs will result in an adjustment to the baseline Noise Preferred Routes.

Respite
The offset departures element of this option offers some respite for some communities overflown by final approach. This option does not offer alternative respite departure configurations, although the CPT departures now turn to the north offering some respite for communities to the south of Luton who currently experience the cumulative impacts of easterly and westerly departure operations.

	Air Quality	The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than around 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. This is because although there are offset departures as part of this option, aircraft do not make the track adjustment (offset) until the departure end of runway (DER) and most aircraft are already above 200m by this point. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.
Wider Society	Greenhouse gas impact	We estimate that there will be increases in track milage of c.3nm to the OLY and CPT SIDs. We also estimate that there will be a decrease in track mileage of c.6nm to the MATCH SID. For the MATCH SID this equates to around 44.4kg of fuel savings per flight which is a CO_2 equivalent of 0.140mt. The OLY and CPT SID results in an estimated 22.2kg of fuel costs per flight which is a CO_2 equivalent of 0.070mt. When considered against the total movements operated across an average year, today easterly CPT departures make up around

10.5% of departures, easterly OLY departures make up around 3.3%, and easterly MATCH departures make up 15.3% of all movements. When we consider this within the context of greenhouse gas impact and weighing up the track length differences between the SIDs, we expect there to be an overall benefit to greenhouse gas emissions with this option given the MATCH makes up a larger percentage of overall flights. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 63 Easterly SID Group 5 Track Mileage, Fuel Burn and CO_2

	MATCH	OLY	HEN (CPT SID)	MATCH		OLY		HEN (CPT SID)	
	NM diff to/abeam			A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)
E SID Group 1 (Baseline)	0	0	0	0	0.000	0	0.000	0	0.000
E SID Group 5	-6	3	3	-44.4	-0.140	22.2	0.070	22.2	0.070

Capacity / resilience

As a result of the CPT SID turning north and splitting earlier from the MATCH SID than the baseline, this option might enable reduced departure separation which enhances Luton's departure throughput. We therefore expect this option to lead to an increase in capacity.

In addition to this, this option is dependent on the FASI-S programme and the modernisation of the LTMA, therefore assuming that in this scenario Luton departures will be able to continuously climb to above 6000ft, we anticipate that there will be an improvement to capacity because of the changes to the LTMA.

Tranquility

Aircraft today overfly the Chilterns AONB. Easterly SID group 5 results in concentrating all transatlantic traffic to the north of the Airport which has the effect of higher noise occurring over that part of the Chilterns AONB that occurs to the north of Luton. Improved CCO means however that aircraft will be higher over some areas compared to today. The table below provides a comparison of the AONB overflown data.

Table 64 Easterly SID Group 5 AONB overflown

	Option	Area (Km2) of AONB overflown 0-7000ft
Day	Baseline Easterly Dep Option 1 (Vector)*	22.8
	Baseline Easterly Dep Option 1 (centreline)	11.3
	Easterly Dep Option 5	36.0
Night	Baseline Easterly Dep Option 1 (Vector)*	0.0
	Baseline Easterly Dep Option 1 (centreline)	4.2
	Easterly Dep Option 5	34.3

Biodiversity

On departure all flights will be over 1,000ft after each aircraft has covered 3km. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 6km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown.

General Aviation

Access

The CCO and the lack of a CPT departure route to the south of the airport may offer opportunity to reduce the volume of Luton's CAS, particularly to the South of Luton.

General Aviation / Commercial airlines

Economic impact from increased effective capacity

We expect the increased effective capacity detailed in the section above will result in a positive economic impact on commercial air traffic compared with the baseline do nothing easterly SID group 1.

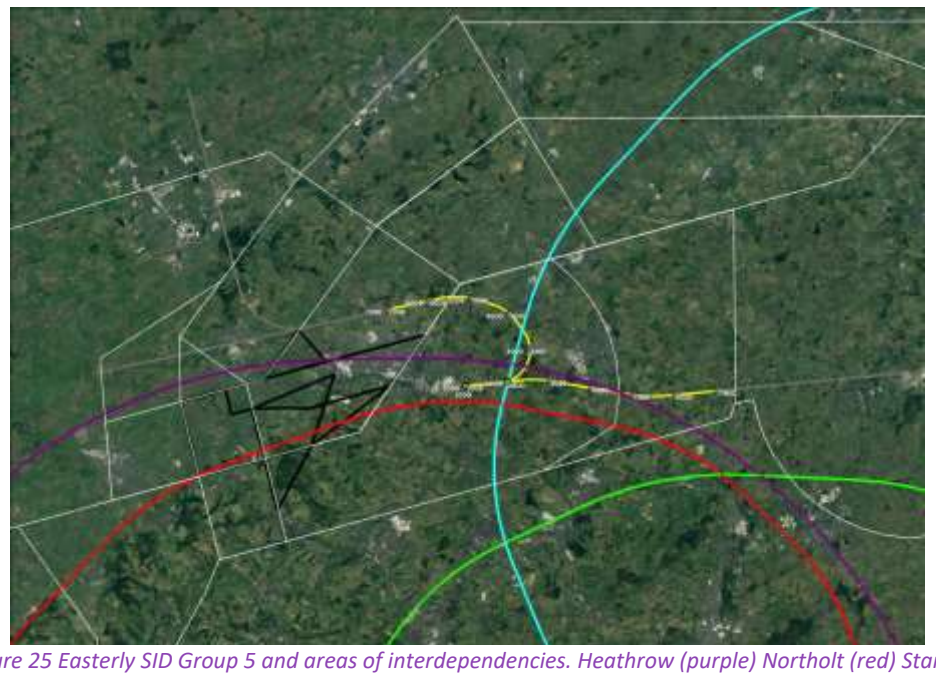
Fuel burn

We estimate that there will be increases in track milage of c.3nm to the OLY and CPT SIDs. We also estimate that there will be a decrease in track mileage of c.6nm to the MATCH SID. For the MATCH SID this equates to around 44.4kg of fuel savings per flight. The OLY and CPT SID results in an estimated 22.2kg of fuel costs per flight.

When considered against the total movements operated across an average year, today easterly CPT departures make up around 10.5% of departures, easterly OLY departures make up around 3.3%, and easterly MATCH departures make up 15.3% of all movements. When we consider this within the context of fuel burn and weighing up the track length differences between the SIDs, we expect there to be an overall benefit to fuel burn with this option given the MATCH makes up a larger percentage of overall flights. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 65 Easterly SID Group 5 Track Mileage and Fuel Burn

	MATCH	OLY	HEN (CPT SID)	MATCH	OLY	HEN (CPT SID)
	NM diff to/abeam			A320 fuel difference at FL160 (kg)	A320 fuel difference at FL160 (kg)	A320 fuel difference at FL160 (kg)
E SID Group 1 (Baseline)	0	0	0	0	0	0
E SID Group 2	-6	3	3	-44.4	22.2	22.2

Commercial airlines	Training costs	Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This westerly SID option is not anticipated to require any additional training costs for airlines.
	Other costs	No other airline costs are foreseen.
Airport / Air navigation service provider	Infrastructure costs	The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.
	Operational costs	This airspace change proposal is not anticipated to change airport or ANSP operational costs. The implementation of PBN SIDs removes LLAOL's dependency on conventional ground based navigation equipment (VORs), which contributes to a reduction in NERL's operational costs as it enables VOR rationalisation[18]
	Deployment costs	This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. As it is to be integrated into the wider FASI airspace we anticipate that it will require slightly more training that some of the other options. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options.
All	Safety	Offset departures (known as track adjustments) are available within PANS OPS but would require additional safety assurances compared to today. All the SIDs are dependent on CCO above 5000ft which we assume is enabled due to deconfliction from adjacent airport' flight paths. Climb above 5000ft will require additional safety assurances to assure LTMA separations. We have not identified any other safety concerns.
All	Interdependencies, conflicts and tradeoffs	This option is the best Easterly SID option for reducing interdependencies with adjacent airports due to the CPT SID routing to the North of Luton and the MATCH SID routing more direct. This keeps the SIDs further from Heathrow, Northolt and London City and enhances the chances of CCO. The MATCH SID does route closer to Stansted's FASI Options for Runway 22 departures but it is expected that we will be able to deconflict laterally and/or vertically. This MATCH route would be able to outclimb Stansted's arrival options to Runway 04.  *Figure 25 Easterly SID Group 5 and areas of interdependencies. Heathrow (purple) Northolt (red) Stansted (blue) London City (green)* However, guaranteed CCO is required for all the SIDs; this is so the MATCH departures outclimb Stansted Airspace and the CPT and OLY departures outclimb Luton arrivals onto runway 07. Due to this interaction between Luton arrivals and departures and with neighbouring airports, this option would only be viable with changes to other airports' routes to guarantee CCO above 5,000ft.
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* This option will support AMS Objectives through improved CCO, reduced CO_2 emissions for MATCH SIDs and expected reductions to CAS volumes. The SIDs are expected to be more easily deconflicted from routes to/from adjacent airports thereby enhancing capacity in the LTMA and reducing complexity. However, the CPT SID turning to the North of Luton may generate increased emissions for those departures, therefore it is not yet clear whether this option would generate an overall CO_2 reductions until the finer details of the wider Core LTMA and Network designs are known.

[18] LLAOL is currently investigating RNAV Substitution to mitigate VOR rationalisation however this is a temporary solution for the interim period before the deployment of the FASI-S ACPs

Easterly SID Group 6

Westerly SID Group 6

Period 1 (above) Period 2 (below)

This is similar to Easterly SID Group 5 but with a pair of MATCH SIDs and a pair of CPY/OLY SIDs which could be switched on/off for respite purposes.

This option is dependent on the integration with other FASI-S airports and the upper airspace design.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option is similar to Easterly SID Group 5 but it offers 2 sets of SIDs that would alternate to offer respite. For this IOA, we have assumed they alternate each day, therefore each set of SIDs is in operation an equal amount of time over a year. **Period 1:** This option is a fundamental change from today as all departures are offset to the right (south) of final approach to help avoid Breachwood Green. This provides respite to some areas under the runway 25 final approach however the CPT and OLY departures would be required to cross back over final approach when turning north.  *Figure 26 Easterly SID Group 6 overflight (centreline), with population density and baseline (black outline).* The CPT departure SID turns to the north to provide greater opportunity for continuous climb, as aircraft will be further away from Heathrow, London City and Northolt northbound departures. Today the CPT departure turns to the south and by turning it to the north it also offers the opportunity to provide some respite for those communities to the south of Luton who currently experience the cumulative impacts of easterly and westerly departure operations. The change in the OLY SID would result in the OLY departures turning north as they do today, however remaining west of Hitchin. The OLY SID would then turn west and continue west for further than today before reaching 5-6000ft and turning north. Both the CPT and OLY SIDs wrap around the north of Luton, avoiding the areas of high population density. The MATCH SID takes a more direct routing than today, rather than turning towards Brookmans Park, however it turns slightly south to avoid large parts of Stevenage. The latter part of the SID overflies Bishop Stortford. **Period 2:** The period 2 CPT and OLY SID turns north earlier than the period 1 SID before turning again to the west. This brings it closer to the north of Luton and results in some overflight of Leighton Buzzard. The MATCH departure routes further south before turning east compared to period 1, this avoids Stevenage and Welwyn Garden City, however overflies parts of Oaklands and Bishop Stortford. As this option is dependent on changes at other airports and within the upper airspace we expect all of the SIDs to operate with continuous climb to above 5000ft. This is because we assume Heathrow, Stansted Northolt and London City movements are deconflicted in the new FASI design. This means that there is a lower requirement for routine tactical intervention from air traffic controllers and aircraft are expected to follow the SID centrelines. We would expect the wider LTMA re-design to have procedurally deconflicted routes to/from adjacent airports and therefore the cumulative impacts from other neighbouring airports to be reduced. The opportunity to avoid cumulative impacts from Luton's routes depends on the arrival configuration; we will explore this in future detail as part of the Full Options Appraisal at Stage 3. **L_{Aeq}** Easterly operations occur approximately 30% of the year and this has been considered when appraising the potential impacts to the L_{Aeq} average daytime and nighttime contours. Owing to % split between easterly and westerly operations, changes to the easterly departures have a lower overall impact on the L_{Aeq} contours compared to the westerly options.

The changes to the SIDs will result in changes to the shape of the easterly component of the L_{Aeq} contour, with the contour moving further to the south to reflect the offset departures. This is anticipated to reduce the population within the daytime LOAEL as it avoids Breachwood Green and reduces the cumulative effect from the departures routing over the same areas as final approach. The impact this has on the overall L_{Aeq} contours will be explored as part of our Full Options Appraisal at Stage 3 if this option is progressed. With regards to the nighttime LOAEL, the contours are also expected to move south to reflect the offset departures. This has the potential to move the nighttime contour over Whitwell and has the potential to change the overall L_{Aeq} contour which extends to capture the outskirts of Stevenage; this too will be explored as part of our Full Options Appraisal at Stage 3. The avoidance of final approach may have a positive impact on the number of people adversely affected by aircraft noise as it reduces the cumulative impacts of arrivals and departures overflying the same area, however this would require further exploration as part of our Full Options Appraisal given the percentage of departures that would operate these SIDs.

With regards to LLAOL's L_{Aeq} contours that form part of the planning condition, although this option is likely to result in a change to shape of the contours, we do not expect it to significantly impact the size of the 57dB(A) Leq16hr and 48dB(A) Leq8hr contours.

The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal.

Overflight

The overflight diagrams shown in technical appendix A demonstrate the changes in overflight from the relocation of the MATCH, CPT and OLY SIDs and the changes to the airspace to reduce vectoring.

The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline):

Table 66 Easterly Departure Option 6 Overflight Data 0-7000ft

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
Day	Baseline Easterly Dep Option 1 (Vector)	255436.0	22277.0	0.0	0.0	0.0
	Baseline Easterly Dep Option 1 (Centreline)	201573.7	30483.5	0.0	0.0	0.0
	Easterly Dep Option 6	152384.2	5086.2	0.0	0.0	0.0
Night	Baseline Easterly Dep Option 1 (Vector)*	40990.0	0.0	0.0	0.0	0.0
	Baseline Easterly Dep Option 1 (centreline)	119466.6	0.0	0.0	0.0	0.0
	Easterly Dep Option 6	56481.5	0.0	0.0	0.0	0.0

The data shows that there are decreases in the population overflown 1 and 10 times per day which can be attributed to the SIDs aiming to avoid the overflight of densely populated areas and the use of respite routes.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows an overall reduction in the number of sites overflown between 0-7000ft. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

NPR

The changes to SIDs will result in an adjustment to the baseline Noise Preferred Routes and would need 2 sets of NPRs.

Respite

This option offers respite via two sets of SIDs which could be alternated to share the noise more equitably. For this IOA we have assumed the period of alternation as daily, however this will be explored in greater detail with stakeholders as part of the Stage 3 consultation should this option progress.

Air Quality	The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than around 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. This is because although there are offset departures as part of this option, aircraft do not make the track adjustment (offset) until the departure end of runway (DER) and most aircraft are already above 200m by this point. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.

<table>
<tr><td></td><td>Greenhouse gas impact</td><td>For the period 1 SIDs we estimate that there will be a decrease in track mileage of c.6nm for the MATCH SID and an increase in track miles for the OLY of c.3nm. The CPT SID will remain the same as today. For the MATCH SID this equates to around 44.4kg of fuel savings per flight which is a CO_2 equivalent of 0.140mt. The OLY SID results in an estimated 22.2kg of fuel costs per flight which is a CO_2 equivalent of 0.070mt.

For the period 2 SIDs we estimate that there will be a decrease in track mileage of c.6nm for the MATCH SID and an increase in track miles for the OLY and CPT of c.3nm. For the MATCH SID this equates to around 44.4kg of fuel savings per flight which is a CO_2 equivalent of 0.140mt. The OLY and CPT SID result in an estimated 22.2kg of fuel costs per flight which is a CO_2 equivalent of 0.070mt.

When considered against the total movements operated across an average year, today easterly CPT departures make up around 10.5% of departures, easterly OLY departures make up around 3.3%, and easterly MATCH departures make up 15.3% of all movements. When we consider this within the context of greenhouse gas impact and weighing up the track length differences between the SIDs, we expect there to be a small overall benefit to greenhouse gas emissions with this option given the MATCH makes up a larger percentage of overall flights. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 67 Easterly SID Group 6 Track Mileage, Fuel Burn and CO_2
<table>
<tr><th colspan="3">NM diff to/abeam</th><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th></tr>
<tr><th>MATCH</th><th>OLY</th><th>HEN (CPT SID)</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th></tr>
<tr><td>E SID Group 1 (Baseline)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0.000</td><td>0</td><td>0.000</td><td>0</td><td>0.000</td></tr>
<tr><td>E SID Group 6 Period 1</td><td>-6</td><td>3</td><td>0</td><td>-44.4</td><td>-0.140</td><td>22.2</td><td>0.070</td><td>0</td><td>0.000</td></tr>
<tr><td>E SID Group 6 Period 2</td><td>-6</td><td>3</td><td>3</td><td>-44.4</td><td>-0.140</td><td>22.2</td><td>0.070</td><td>22.2</td><td>0.070</td></tr>
</table></td></tr>
<tr><td rowspan="3">Wider Society</td><td>Capacity / resilience</td><td>As a result of the CPT SID turning north and splitting earlier from the MATCH SID than the baseline, this option could enable reduced departure separation which enhances Luton’s departure throughput. We therefore expect this option to lead to an increase in capacity.

In addition to this, this option is dependent on the FASI-S programme and the modernisation of the LTMA, therefore assuming that in this scenario Luton departures will be able to continuously climb to above 5000ft, we anticipate that there will be an improvement to capacity because of the changes to the LTMA.</td></tr>
<tr><td>Tranquility</td><td>Aircraft today overfly the Chilterns AONB. Easterly SID group 6 results in concentrating all transatlantic traffic to the north of the Airport which has the effect of higher noise occurring over the area of the Chilterns AONB to the north of Luton. Group 6 also includes 2 sets of respite SIDs, increasing the area of AONB overflown but reducing the frequency compared to some other PBN based options. Improved CCO means however, that aircraft will be higher over some areas compared to today. The table below provides a comparison of the AONB overflown data.

Table 68 Easterly SID Group 6 AONB overflown
<table>
<tr><th></th><th>Option</th><th>Area (Km2) of AONB overflown 0-7000ft</th></tr>
<tr><td rowspan="3">Day</td><td>Baseline Easterly Dep Option 1 (Vector)*</td><td>22.8</td></tr>
<tr><td>Baseline Easterly Dep Option 1 (centreline)</td><td>11.3</td></tr>
<tr><td>Easterly Dep Option 6</td><td>40.7</td></tr>
<tr><td rowspan="3">Night</td><td>Baseline Easterly Dep Option 1 (Vector)*</td><td>0.0</td></tr>
<tr><td>Baseline Easterly Dep Option 1 (centreline)</td><td>4.2</td></tr>
<tr><td>Easterly Dep Option 6</td><td>33.9</td></tr>
</table></td></tr>
<tr><td>Biodiversity</td><td>On departure all flights will be over 1,000ft after each aircraft has covered 3km. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 6km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown.</td></tr>
<tr><td>General Aviation</td><td>Access</td><td>The CCO and the lack of a CPT departure route to the south of the airport may offer opportunity to reduce the volume of Luton's CAS. However multiple routes could result in less CAS being released compared to options with single routes.</td></tr>
<tr><td rowspan="2">General Aviation / Commercial airlines</td><td>Economic impact from increased effective capacity</td><td>We expect the increased effective capacity detailed in the section above will result in a positive economic impact on commercial air traffic compared with the baseline do nothing easterly SID group 1.</td></tr>
<tr><td>Fuel burn</td><td>For the period 1 SIDs we estimate that there will be a decrease in track mileage of c.6nm for the MATCH SID and an increase in track miles for the OLY of c.3nm. The CPT SID will remain the same as today. For the MATCH SID this equates to around 44.4kg of fuel savings per flight and the OLY SID results in an estimated 22.2kg of fuel costs per flight which is a CO_2 equivalent of 0.070mt.</td></tr>
</table>

For the period 2 SIDs we estimate that there will be a decrease in track mileage of c.6nm for the MATCH SID and an increase in track miles for the OLY and CPT of c.3nm. For the MATCH SID this equates to around 44.4kg of fuel savings per flight. The OLY and CPT SID result in an estimated 22.2kg of fuel costs per flight.

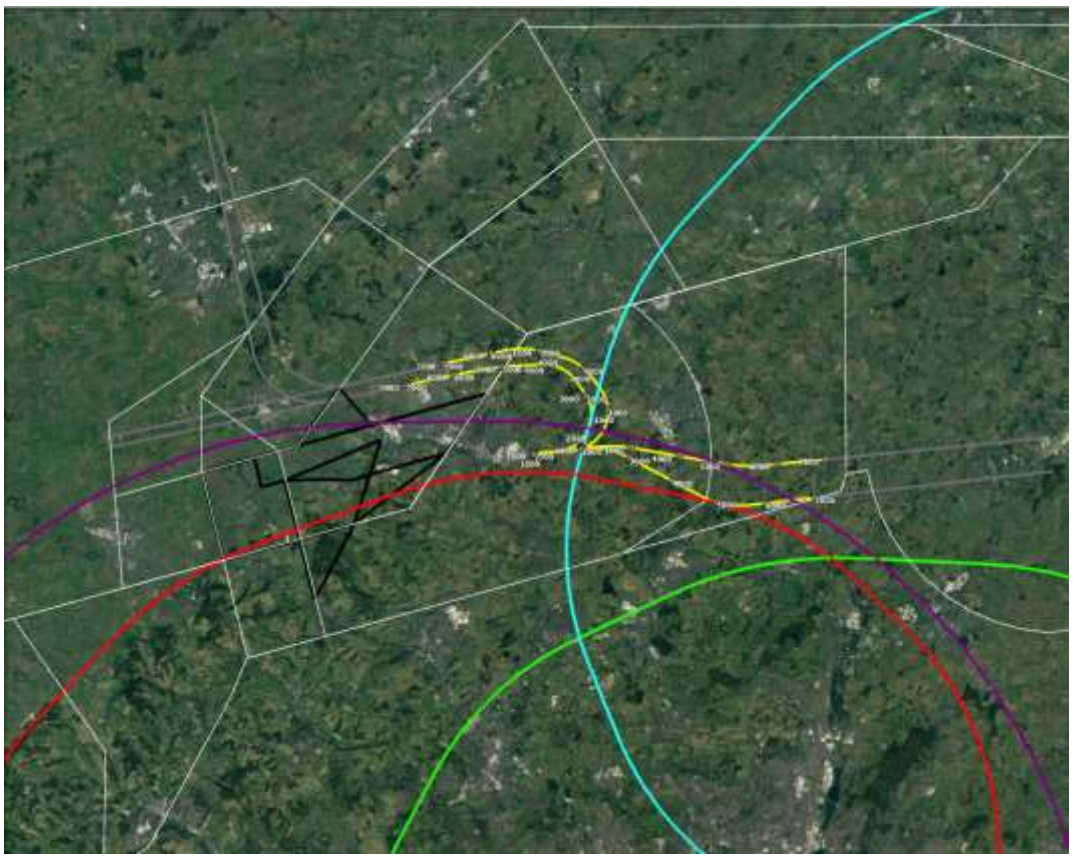
When considered against the total movements operated across an average year, today easterly CPT departures make up around 10.5% of departures, easterly OLY departures make up around 3.3%, and easterly MATCH departures make up 15.3% of all movements. When we consider this within the context of fuel burn and weighing up the track length differences between the SIDs, we expect there to be a small overall benefit to greenhouse gas emissions with this option given the MATCH makes up a larger percentage of overall flights. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 69 Easterly SID Group 6 Track Mileage and Fuel Burn

	MATCH	OLY	HEN (CPT SID)	MATCH	OLY	HEN (CPT SID)
	NM diff to/abeam			A320 fuel difference at FL160 (kg)	A320 fuel difference at FL160 (kg)	A320 fuel difference at FL160 (kg)
E SID Group 1 (Baseline)	0	0	0	0	0	0
E SID Group 6 Period 1	-6	3	0	-44.4	22.2	0
E SID Group 6 Period 2	-6	3	3	-44.4	22.2	22.2

Commercial airlines	Training costs	Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. This westerly SID option is not anticipated to require any additional training costs for airlines.
	Other costs	No other airline costs are foreseen.
Airport / Air navigation service provider	Infrastructure costs	The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.
	Operational costs	This airspace change proposal is not anticipated to change airport or ANSP operational costs. The implementation of PBN SIDs removes LLAOL's dependency on conventional ground based navigation equipment (VORs), which contributes to a reduction in NERL's operational costs as it enables VOR rationalisation[19]
	Deployment costs	This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. As it is to be integrated into the wider FASI airspace we anticipate that it will require slightly more training that some of the other options. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options.
All	Safety	All SIDs: Offset departures (known as track adjustments) are available within PANS OPS but would require additional safety assurances compared to today. Climb above 5000ft will require additional safety assurances to assure LTMA separations. SID switching would be new to Luton and the LTMA. The risk of an aircraft selecting the incorrect SID needs to be managed. For example, if an aircraft was to inadvertently fly a Period 1 CPT following a previous Period 2 CPT there would be a catch-up situation
All	Interdependencies, conflicts and tradeoffs	This option is good for reducing interdependencies with adjacent airports due to the CPT SID routing to the North of Luton and the MATCH SID routing more direct. This keeps the SIDs further from Heathrow, Northolt and London City and enhances the chances of CCO. The MATCH SID does route closer to Stansted's FASI Options for Runway 22 departures, but it is expected that we will be able to deconflict laterally and/or vertically. This MATCH route would be able to outclimb Stansted's arrival options to Runway 04. However, guaranteed CCO is required for all the SIDs; this is so the MATCH departures outclimb Stansted Airspace and the CPT and OLY departures outclimb Luton arrivals onto runway 07. Due to this interaction between Luton arrivals and departures and with neighbouring airports, this option would only be viable with changes to other airports' routes to guarantee CCO above 5,000ft.

[19] LLAOL is currently investigating RNAV Substitution to mitigate VOR rationalisation however this is a temporary solution for the interim period before the deployment of the FASI-S ACPs

		The presence of multiple routes for respite means that there is a greater chance of interdependencies with other airports' routes.  *Figure 27 Easterly SID Group 6 and areas of interdependencies. Heathrow (purple) Northolt (red) Stansted (blue) London City (green)*
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* This option will support AMS Objectives through improved CCO, reduced CO_2 emissions for MATCH SIDs and expected reductions to CAS volumes. The SIDs are expected to be more easily deconflicted from routes to/from adjacent airports thereby enhancing capacity in the LTMA and reducing complexity. However, the CPT SID turning to the North of Luton may generate increased emissions for those departures, therefore it is not yet clear whether this option would generate an overall CO_2 reductions until the finer details of the wider Core LTMA and Network designs are known. It should be noted that the presence of 2 sets of SIDs means that the optimal solutions from a CO_2 and wider efficiency perspective is reduced.

Westerly Arrivals Option 1 (Do Nothing)

Westerly Arrival Option 1 (Do Nothing Baseline)		
		This option would see all arrivals vectored from ZAGZO exactly as per SAIP AD6, with the same vertical profiles. This is a Do Nothing Scenario for RWY25 arrivals and therefore not dependent on changes to other airports routes. At the time of generating this list of options, the AD6 airspace has not been implemented and therefore the illustration cannot be generated using noise track keeping data (NTK). **This option is not dependent on changes at neighbouring airports.**
Group	**Impact**	**Qualitative Assessment**
Communities	Noise impact on health and quality of life	Due to wind direction, westerly operations on runway 25 occur approximately 70% of the year. The noise data and qualitative assessment has considered this modal split. From 7000ft, aircraft arriving at Luton on westerlies are vectored from ZAGZO onto final approach. In November 2021 ACP-2018-65 (known as SAIP AD6) was approved; this was an ACP co-sponsored between LLAOL and NATS which made improvements to arrivals to address a latent risk identified. At the year of implementation of this FASI-S ACP (c.2028), AD6 will be implemented and therefore this Westerly Arrival option 1 baseline scenario will take into account the Luton AD6 airspace change. The following image shows the expected main AD6 vectoring swathe in purple:  *Figure 28 Baseline Westerly arrival swathe following SAIP AD6 implementation* The AD6 Airspace Change describes the vectoring swathe as: *Controllers would take most of the LLA arrivals at 8,000ft and vector them within the swathes depicted. Arrival traffic to runway 25 would fly south of Grafham Water past St Neots, to the east of the A1 main road and roughly parallel with it, some traffic heading further east, so the 8,000ft arrivals may be spread between the east of Sandy and the west of Bourn. The controllers would then descend the traffic to 5,000ft in this same spread, between Biggleswade and Royston, where it would likely stay level at 5,000ft for about 10-15km. The controllers would turn the traffic to the south, either in an S-shape, or straight. As the traffic reaches the Letchworth-Baldock-Wallington area the controller turns the aircraft roughly perpendicular to the extended runway centreline, and descends it to 4,000ft, then turns right and descends once more to establish on final approach typically around Buntingford from 4,000ft to 3,000ft and Stevenage 3,000ft and below. The swathe narrows until it aligns with the runway on final approach. The final approach path to Runway 25 always overflies Ardeley, Walkern, Stevenage and St Paul's Walden in a very narrow path. Vectoring naturally causes some dispersion, and our controllers expect the areas described here to be the most commonly overflown below 7,000ft. Some could be vectored from the east to shortcut aircraft to the runway if the opportunity exists, similar to today.* The technical appendix to this document includes images and maps showing areas of overflight. The overflight data, generated using the CAA's definition of overflight, gives us information about this baseline scenario. The table below shows the overflight data for the baseline westerly arrival option 1 scenario:

Table 70 Westerly arrivals baseline overflight data

	Option	Population overflown 0-7000ft (1 times per day)	Population overflown 0-7000ft (10 times per day)	Population overflown 0-7000ft (50 times per day)	Population overflown 0-7000ft (100 times per day)	Population overflown 0-7000ft (150 times per day)
Day	Baseline Westerly Option 1 ARR	215537.6	131310.1	35272.3	25610.5	0.0
Night	Baseline Westerly Option 1 ARR	201700.2	35182.6	0.0	0.0	0.0

The data from this table will be used to compare the westerly arrival options against the 'do nothing' baseline.

In addition to population overflown, we also have data on the overflight of noise sensitive buildings such as schools, hospitals and places of worship; the full data around these is shown in technical appendix a, and as part of this IOA we will provide a qualitative statement around this data.

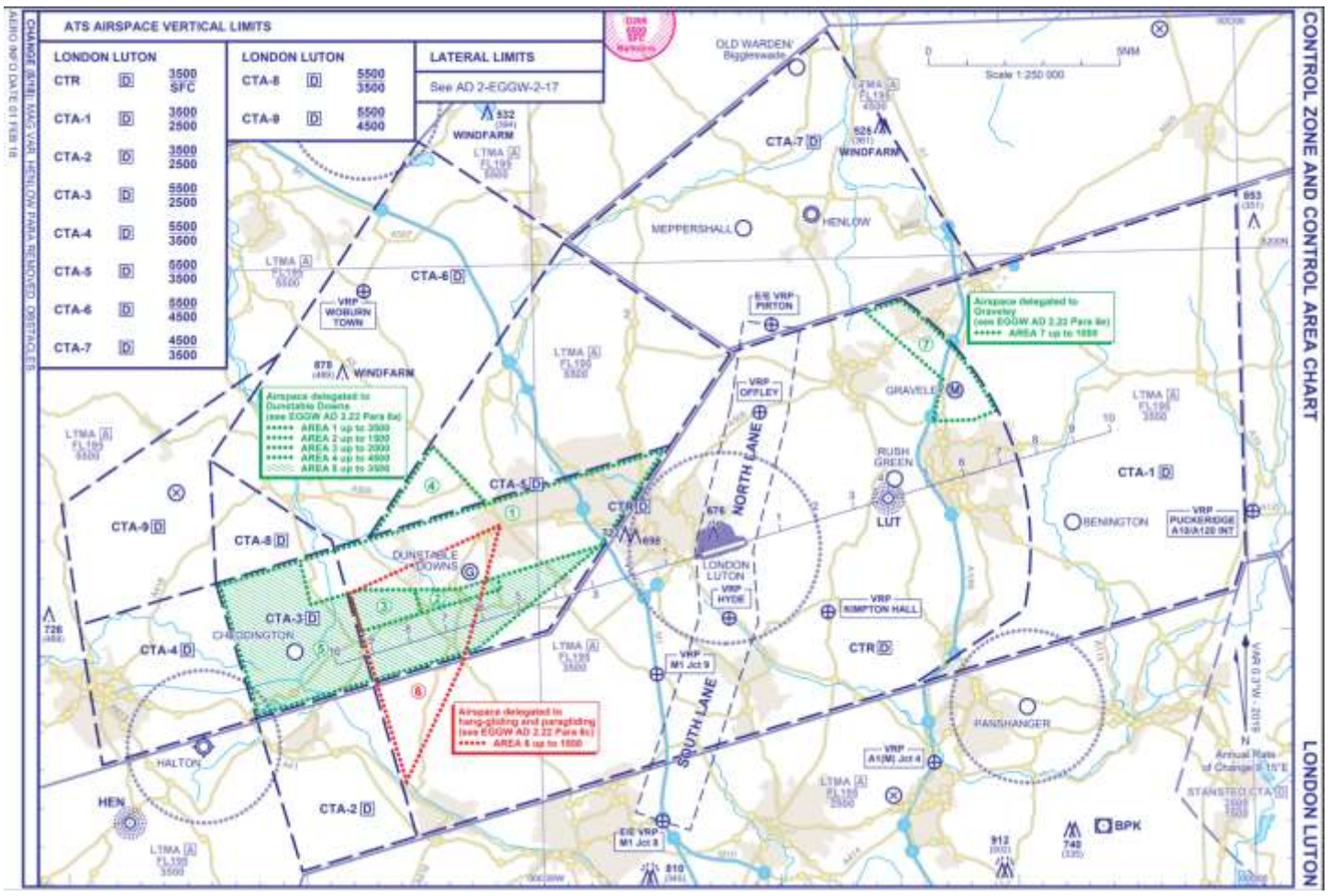
L_{Aeq}

The westerly arrivals make up a component of the overall L_{Aeq} day time and night time contours. We have used the overall contours from 2019, as an indicative contour for 2028 as it is expected that contours will be a similar size or smaller in 2028 as Luton has a planning condition to reduce the size. The AD6 airspace change Full Options Appraisal model predicted a very small change to these contours which was put down to the modelling rather than expecting a change in real life. We have also taken this into account when qualitatively describing the baseline and comparing it to our other airspace change options.

Respite

Although this baseline option does not have specific respite routes that can be predictably alternated, tactical vectoring does provide a distribution of traffic that the AD6 consultation feedback demonstrated was preferrable to concentration.

	Air Quality	Impacts to air quality are considered for changes below around 650ft (200m). Aircraft flying above this are unlikely to have a significant impact on local ground air quality. **Assessment of Arrivals Options** Aircraft arriving at Luton fly a standard 3-degree angle of approach and descend through 650ft whilst aligned with the extended runway centreline. This is in the last stages of the final approach. It's therefore very unlikely that any arrivals options will offer any significant impact air quality however we will review each option for changes against this baseline.
Wider Society	Greenhouse gas impact	Emissions of greenhouse gases arise from the combustion of aviation fuel, and as the combustion of aviation fuel is linked to track length, we have initially looked at the track length for the baseline westerly arrivals options. For the purposes of this Initial Options Appraisal, we have taken the track mileage information generated for the AD6 ACP and used this as our 'do nothing' track length. *Table 71 Westerly Arrival Baseline Track Mileage* Option: W Arriv Option 1 AV from ZAGZO Baseline — NM from ZAZGO to THR: 37 We will estimate the differences between this baseline and the option, to understand if there are any anticipated advantages/disadvantages of the option against current day. This estimation will consider whether the aircraft tracks will be longer or shorter than a typical flight today. As CO_2 emissions are linked to the difference in aviation fuel burnt, this will allow us to calculate a high level estimation of the greenhouse gas impacts as a result of the option. Full details are shown in technical appendix a.
	Capacity / resilience	Although Luton has recently undertaken a separate ACP to remove interdependencies between Luton and Stansted arrivals, in future, increased forecast movement levels across the LTMA are anticipated to result in capacity and resilience disbenefits. As traffic increases, the extra complexity and workload for air traffic controllers and pilots would likely result in the use of flow regulations at all LTMA airports including Luton. Flow regulations stabilise the number of movements until the peak in traffic subsides, however in doing so they generate delay.
	Tranquility	No effect as no AONB overflown.
	Biodiversity	On arrival all flights will be over 1,000ft when each aircraft is more than 6km from the airfield. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 18km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. Although no designated sites are crossed within this distance, Knebworth Woods SSSI lies immediately adjacent to the contours. However, as the designated features of this site are not prone to disturbance and therefore it can be discounted.
General Aviation	Access	This baseline scenario would not offer any change from the existing Controlled Airspace (CAS) arrangements in place today. The options will be qualitatively compared against this existing scenario.

		Today, Luton's instrument flight procedures are contained within Class D controlled airspace. The base of this airspace varies and is shown on the chart below (for the current published chart, please see the UK eAIP):  Within the Luton TMA, there are areas of airspace delegated to gliding activities. The Gliding areas are used differently depending on whether Luton are on easterly or westerly operations. Use of the portions of gliding areas within Controlled Airspace is strictly controlled by a Letter of Agreement between various parties. Luton Approach controllers ensure that all Luton arriving and departing commercial traffic stays within controlled airspace and remain clear of the airspace delegated to gliding activities. There would be no change to these arrangements or letters of agreement as a result of this baseline option. Although the existing baseline scenario will not result in the requirement for more airspace, this option offers no opportunity to simplify the airspace boundaries.
General Aviation / Commercial airlines	Economic impact from increased effective capacity	There will be no change from today as a result of this option; later in this IOA we will qualitatively estimate the differences between this and the airspace change options.
	Fuel burn	As the combustion of aviation fuel is linked to track length, we have initially looked at the track length for the baseline westerly arrivals. For the purposes of this Initial Options Appraisal, we have taken the track mileage information generated for the AD6 ACP and used this as our 'do nothing' track length. *Table 72 Westerly Arrival Baseline Track Mileage* **Option** | **NM from ZAZGO to THR** **W Arriv Option 1 AV from ZAGZO Baseline** | 37 We will estimate the differences between this baseline and the option, to understand if there are any anticipated advantages/disadvantages of the option against current day. This estimation will consider whether the aircraft tracks will be longer or shorter than a typical flight today. As track length is linked to the difference in aviation fuel burnt, this will allow us to calculate a high level estimation of fuel burn impacts as a result of the option. Full details are shown in technical appendix a.
Commercial airlines	Training costs	As this option will already be in operation, there are no training costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
	Other costs	As this option will already be in operation, there are no other costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
Airport / Air navigation service provider	Infrastructure costs	As this option will already be in operation, there are no infrastructure costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
	Operational costs	As this option will already be in operation, there are no operational costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
	Deployment costs	As this option will already be in operation, there are no deployment costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
All	Safety	At current traffic levels, there are no safety concerns with the current arrangements at Luton. Future traffic growth across the LTMA

		could however result in increased complexity and workload for Air Traffic Controllers and pilots, which may lead to traffic within the LTMA being capped to maintain safety, leading to delays.
All	Interdependencies, conflicts and tradeoffs	As described on our Stage 2A documentation, Luton's arrivals are currently forced to be lower than optimal to manage the existing interdependencies within the LTMA. The result is that Luton's arrivals are required to be down at 5000ft early, with CDA only guaranteed from that altitude. It is not expected that changes to Luton's arrivals below 7000ft will be required to manage new interdependencies that arise from changes to traffic flows to/from adjacent airports. On the contrary, it is expected that improvements to Luton's arrivals can be made in the form of CDA from above 5000ft as a result of changes to traffic flows to/from adjacent airports.
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* Whilst it is not expected that changes to Luton's Westerly Arrival flows will be required to enable wider LTMA improvements, doing nothing with Westerly arrivals will not align with the AMS. It will not enable any environmental benefits through improvements to vertical profiles into Luton and will not enable any reduction in the volume of controlled airspace which may be possible with CDA from above 5000ft.

Westerly Arrivals Option 2

Westerly SID Group 1 (Do Nothing Baseline)		
	This option would see the majority of arrivals vectored from ZAGZO as per Westerly Arrivals Group 1 but we also introduce a PBN (RNP-AR) arrival route which some arrivals could use during periods of low traffic. **This option is not dependent on changes at neighbouring airports.**	
Group	**Impact**	**Qualitative Assessment**
Communities	Noise impact on health and quality of life	This option would see the majority of all arrivals vectored from ZAGZO as described in the Westerly Arrival Option 1 baseline with the same profiles, but we also introduce a PBN (RNP-AR) arrival route which some arrivals could use during periods of low traffic. The RNP-AR route as illustrated meets the existing final approach path at around 3nm (around 5.6km) before landing, which is far earlier than the baseline vectoring swathe which joins the final approach at c.8 – 11nm from landing (15-20.5km). This means that implementation of an RNP-AR route would offer a reduction in the frequency of overflight for those under final approach outside of c5-6nm particularly over the densely populated area of Stevenage. Such a route would require a change to Luton's Nighttime noise abatement rules for establishing on final approach. Aircraft using the RNP-AR route would be concentrated on the centreline with no vectoring and therefore the route is currently designed to avoid, where possible, Hitchin and Letchworth Garden City, and routes to the south of Biggleswade and to the east of Potton. The profile of the RNP-AR route would be contained within the existing (AD6) Luton radar maneuvering area (RMA) and is therefore not expected to have a dependency on other airports. Operator approvals are required for an RNP-AR route therefore not all operators would be able to use it. Unlike with SIDs which have to be managed on a more scheduled basis, this arrival could be made available by Luton ATC ad hoc and/or at relatively short notice. However, doing so during core arrival hours is unlikely because it would be very difficult to mix RNP-AR arrivals in with the main vectored swathe whilst delivering the required arrival spacing to the runway. Therefore, we assume that use of this route would be in the shoulder periods. The RNP-AR route would overfly some communities already overflown by RWY07 easterly OLY departures whereas those communities experience no overflight during westerly operations as part of the baseline. **L_{Aeq}** The arrivals component of the L_{Aeq} contours is mainly based along the extended runway centreline as arrivals are aligned with this when on final approach. The introduction of an RNP-AR route has the potential to make a very small adjustment to the daytime L_{Aeq} contour, as some aircraft will now join final approach closer than they do today, however owing to relatively low numbers of aircraft that are anticipated to operate this route, we do not expect this to fundamentally change the shape or size of the LOAEL day contours. At night when there are lower traffic periods, there is an opportunity to utilise the RNP-AR route and in doing so the overall population overflown is minimised. We expect this to have an impact on the shape of the night time L_{Aeq} contour, with the contour reducing in area to the east, and instead extending further north. This has the potential to reduce the contour area over the densely populated area of Stevenage. Further exploration as part of the FOA at Stage 3 would be required to confirm together with a more details assessment on the number of RNP-AR movements this should this option progress. With regards to LLAOL's L_{Aeq} contours that form part of the planning condition, we do not expect it to impact the size of the 57dB(A) Leq16hr daytime contour however there may be a small reduction in size to the night-time 48dB(A) Leq8hr contours; this will require further investigation as part of our full options appraisal at Stage 3.

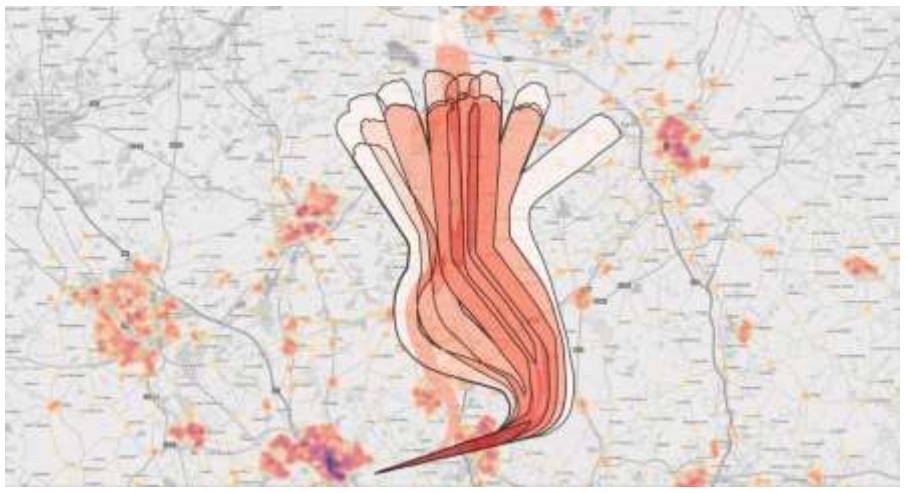


Figure 29 Westerly Arrivals Option 2 overflight day, with population density and baseline (black outline).

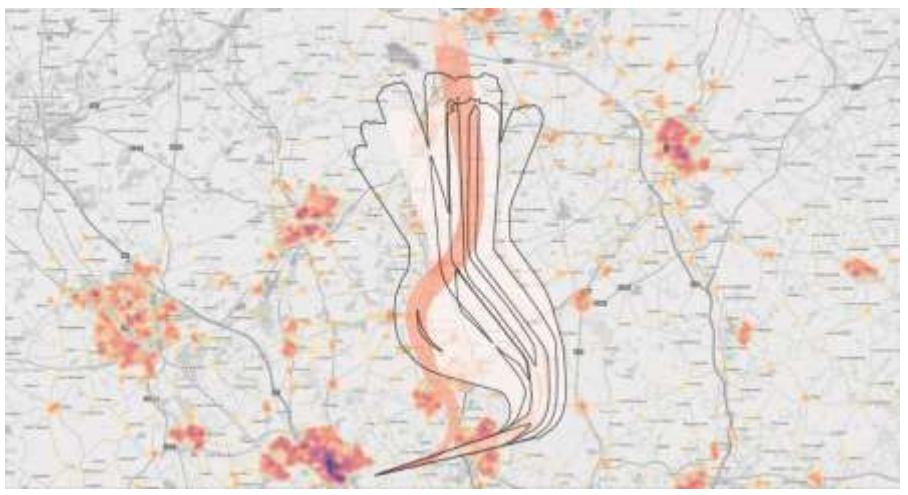


Figure 30 Westerly Arrivals Option 2 overflight night, with population density and baseline (black outline).

The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal if this option is progressed.

Overflight

The overflight diagrams shown in technical appendix A demonstrate the change in overflight contours as a result of some aircraft now using the RNP-AR route. This is particularly evident during the nighttime period. The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline).

Table 73 Westerly Arrivals Option 2 Overflight Data 0-7000ft

	Option	Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
Day	Baseline Westerly Option 1 ARR	215537.6	131310.1	35272.3	25610.5	0.0
	Westerly Arrival Option 2	230911.8	134536.6	36513.0	25513.2	0.0
Night	Baseline Westerly Option 1 ARR	201700.2	35182.6	0.0	0.0	0.0
	Westerly Arrival Option 2	138088.4	44221.0	0.0	0.0	0.0

The data shows an increase in the number of population overflown 1, 10 and 50 times per day during the day, and a decrease in the number of people overflown 100 times per day. The decrease in 100 times per day can be attributed to the introduction of the RNP-AR route, which joins final approach later than today and therefore offers a reduction in frequency of overflight for those under final approach outside of c.5-6nm. The increases in population overflown can also be attributed to the RNP-AR route, and the contours shown in the technical appendix show the areas where the contours are extended as a result of the route.

During the nighttime, there is a decrease in the number of people overflown once, as there is less vectoring and instead some aircraft operate the RNP-AR route and there is an increase in the population overflown 10 times per night, as now there is some concentration because of this route.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows overall increases in the number of sites overflown between 0-7000ft. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

Respite

Although this option does not have specific respite routes that can be predictably alternated, tactical vectoring does provide a distribution of traffic that the AD6 consultation feedback demonstrated was preferrable to concentration. The RNP-AR route offers some respite for the communities most frequently overflown under final approach and also broader respite for those communities under the existing arrival swathe, during periods of low traffic such as at night.

	Air Quality	The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.
Wider Society	Greenhouse gas impact	The vectoring component of Westerly Arrivals Option 2 remains the same as the baseline and therefore we do not expect any changes to greenhouse gas emissions because of vectoring. The RNP-AR route from ZAGZO will offer a track mileage saving of c7nm which equates to 51.8kg of fuel savings per flight which is a CO_2 equivalent of 0.164mt. The majority of arrivals are expected to continue to be vectored as they are today, however the PBN (RNP-AR) arrival route could be used by some arrivals during periods of low traffic. Given the track mileage and greenhouse gas savings on this route, there may be a marginal benefit to greenhouse gas emissions with the benefit increasing with a greater frequency of use of the route. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.
	Capacity / resilience	This option is not expected to offer a benefit or impact to capacity compared to the baseline. The introduction of the RNP-AR route is for the purposes of noise sharing and potential CO_2 reductions and is not expected to enhance Luton's overall capacity.

Table 74 Westerly Arrivals Option 2 Track Mileage, Fuel Burn and CO_2

	Difference from ZAZGO to THR (nm)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)
W Arriv Option 1 AV from ZAGZO (Baseline)	0	0	0.000
W Arriv Option 2 AV from ZAGZO	0	0	0
W Arriv Option 2 RNP AR from ZAGZO	-7	-51.8	-0.164

<table>
<tr><td></td><td></td><td>This option is not dependent on other FASI ACPs however no change to the airspace around Luton may also inhibit the wider FASI programme of change and AMS benefits associated with the programme.</td></tr>
<tr><td></td><td>Tranquility</td><td>No effect as no AONB overflown.</td></tr>
<tr><td></td><td>Biodiversity</td><td>On arrival all flights will be over 1,000ft when each aircraft is more than 6km from the airfield. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 18km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. Although no designated sites are crossed within this distance Knebworth Woods SSSI lies immediately adjacent to the contours. However, as the designated features of this site are not prone to disturbance and therefore it can be discounted.</td></tr>
<tr><td>General Aviation</td><td>Access</td><td>A lowering of the base of CTA 7 would be required to accommodate this route as it is currently designed. If this option is progressed, we will investigate if there are other alternatives, but those alternatives are likely to mean a longer RNP-AR arrival route and/or overflight of more population.</td></tr>
<tr><td rowspan="2">General Aviation / Commercial airlines</td><td>Economic impact from increased effective capacity</td><td>We do not expect any change from today as a result of this option.</td></tr>
<tr><td>Fuel burn</td><td>The vectoring component of Westerly Arrivals Option 2 remains the same as the baseline and therefore we do not expect any changes to fuel burn because of vectoring. The RNP-AR route from ZAGZO will offer a track mileage saving of c7nm which equates to 51.8kg of fuel savings per flight.

The majority of arrivals are expected to continue to be vectored as they are today, however the PBN (RNP-AR) arrival route could be used by some arrivals during periods of low traffic. Given the track mileage and greenhouse gas savings on this route, there may be a marginal benefit to greenhouse gas emissions. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.
Table 75 Westerly Arrivals Option 2 Track Mileage, Fuel Burn and CO_2
<table>
<tr><th></th><th>Difference from ZAZGO to THR (nm)</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th></tr>
<tr><td>W Arriv Option 1 AV from ZAGZO (Baseline)</td><td>0</td><td>0</td><td>0.000</td></tr>
<tr><td>W Arriv Option 2 AV from ZAGZO</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>W Arriv Option 2 RNP AR from ZAGZO</td><td>-7</td><td>-51.8</td><td>-0.164</td></tr>
</table></td></tr>
<tr><td rowspan="2">Commercial airlines</td><td>Training costs</td><td>Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. The vectoring component of this westerly arrival option is not anticipated to require any additional training costs for airlines.

There will be a cost to airlines to train crews in order to operate the RNP-AR route if they are not already approved, however this route would not be mandatory and airlines could choose whether the benefits of the route balance with any costs before choosing to operate it.</td></tr>
<tr><td>Other costs</td><td>No other airline costs are foreseen as part of the vectoring component of this option. The introduction of an RNP-AR route could result in additional costs for airlines not already approved. It is understood that aircraft manufacturer approvals/certification can be as much as $60,000 per aircraft frame. However, this route would not be mandatory and airlines could consider the benefits against any costs associated with the route before choosing to operate it.</td></tr>
<tr><td rowspan="3">Airport / Air navigation service provider</td><td>Infrastructure costs</td><td>The initial deployment phase of the ACP may require some ATC system engineering amendments, however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.</td></tr>
<tr><td>Operational costs</td><td>This airspace change proposal is not anticipated to significantly change airport or ANSP operational costs other than the increase in costs required to maintain the additional Instrument Flight Procedure.</td></tr>
<tr><td>Deployment costs</td><td>This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options. As this option largely replicates current day and is independent of other neighbouring airports, we anticipate that it will require less training that some of the other options however training still will be required.</td></tr>
<tr><td>All</td><td>Safety</td><td>New safety assurances would be required for the RNP-AR arrivals which have not yet been implemented in the UK.</td></tr>
<tr><td>All</td><td>Interdependencies, conflicts and tradeoffs</td><td>It is expected that this route can be delivered without relying on changes to routes to/from adjacent airports as it can be wholly contained within the existing Luton RMA. We have therefore not identified any Interdependencies, conflicts and tradeoffs for this option.</td></tr>
<tr><td>All</td><td>AMS</td><td>CAP1711 describes the objective as:
Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.
This option would make use of the latest navigational technology to deliver environmental improvements which would directly support the objectives of the AMS. However, as currently designed, the RNP-AR route would require additional CAS which would not be aligned with wider AMS objectives. As this route could potentially be delivered ahead of a Core LTMA deployment, the benefits of CAS release expected with the core deployments may not be available to offset the additional CAS required for this route, if implemented early.</td></tr>
</table>

Westerly Arrivals Option 3

Westerly SID Group 1 (Do Nothing Baseline)		
	This option would see the majority of arrivals from ZAGZO vectored but with the opportunity for continuous descent from 7000ft. There is also an opportunity for a PBN route which could be used during periods of low traffic (as per Westerly Arrivals Group 2) **This option is dependent on the integration with other FASI-S airports and the upper airspace design.**	

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option is the same as Westerly Arrival Option 2 except the vertical profiles are improved to allow improved continuous descent performance for the main vectored arrival swathe. This means that this option is dependent on the FASI-S programme and upper airspace designs. The RNP-AR route as illustrated meets the existing final approach path at around 3nm (around 5.6km) before landing, which is far earlier than the baseline vectoring swathe which joins the final approach at c.8 – 11nm from landing (15-20.5km). This means that implementation of an RNP-AR route would offer a reduction in the frequency of overflight for those under final approach outside of c5-6nm particularly over the densely populated area of Stevenage. Such a route would require a change to Luton's Nighttime noise abatement rules for establishing on final approach. Aircraft using the RNP-AR route would be concentrated on the centreline with no vectoring and therefore the route is currently designed to avoid where possible Hitchin and Letchworth Garden City, and routes to the south of Biggleswade and to the east of Potton. The profile of the RNP-AR route would be contained within the existing (AD6) Luton radar maneuvering area (RMA) and is therefore not expected to have a dependency on other airports. Operator approvals are required for an RNP-AR route therefore not all operators would be able to use it. Unlike with SIDs which have to be managed on a more scheduled basis, this arrival could be made available by Luton ATC ad hoc and/or at relatively short notice. However, doing so during core arrival hours is unlikely because it would be very difficult to mix RNP-AR arrivals in with the main vectored swathe whilst delivering the required arrival spacing to the runway. Therefore, we assume that use of this route would be in the shoulder periods. The RNP-AR route would overfly some communities already overflown by RWY07 easterly OLY departures whereas those communities experience no overflight during westerly operations as part of the baseline. **L_{Aeq}** The arrivals component of the L_{Aeq} contours is mainly based along the extended runway centreline as arrivals are aligned with this when on final approach. The introduction of an RNP-AR route has the potential to make a very small adjustment to the daytime L_{Aeq} contour, as some aircraft will now join final approach closer than they do today, however owing to relatively low numbers of aircraft that are anticipated to operate this route, we do not expect this to fundamentally change the shape or size of the LOAEL day contours. At night when there are lower traffic periods, there is an opportunity to utilise the RNP-AR route and in doing so the overall population overflown is minimised. We expect this to have an impact on the shape of the night time L_{Aeq} contour, with the contour reducing in area to the east, and instead extending further north. This has the potential to reduce the contour area over the densely populated area of Stevenage. Further exploration as part of the FOA at Stage 3 would be required to confirm together with a more details assessment on the number of RNP-AR movements this should this option progress. With regards to LLAOL's L_{Aeq} contours that form part of the planning condition, we do not expect it to impact the size of the 57dB(A) Leq16hr daytime contour however there may be a small reduction in size to the nighttime 48dB(A) Leq8hr contours; this will require

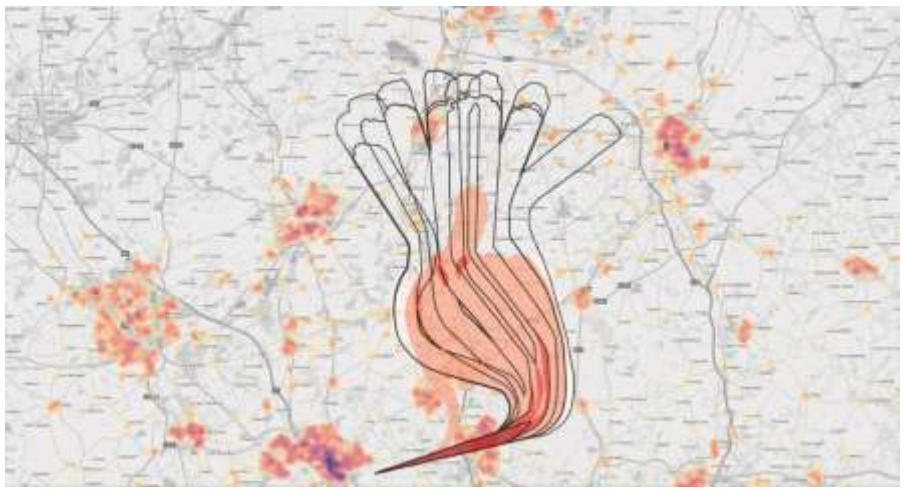


Figure 31 Westerly Arrivals Option 3 overflight day, with population density and baseline (black outline).

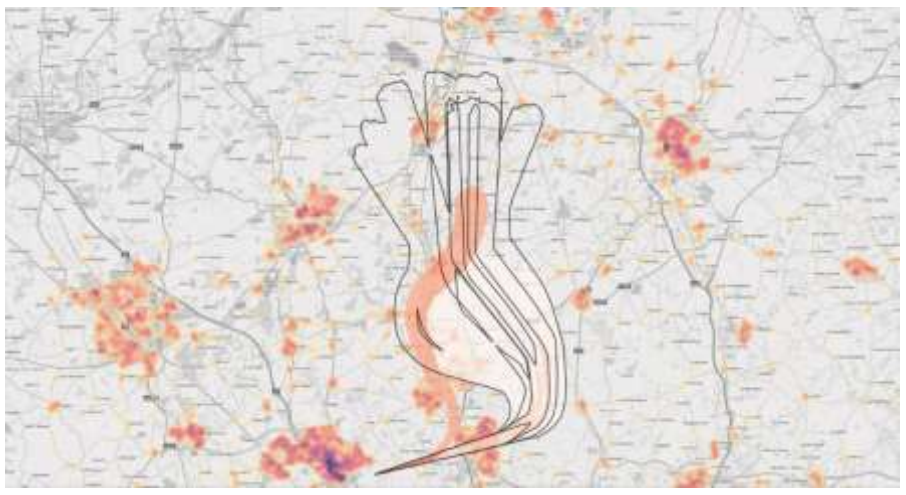


Figure 32 Westerly Arrivals Option 3 overflight night, with population density and baseline (black outline).

further investigation as part of our full options appraisal at Stage 3.

The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal if this option is progressed.

Overflight

The overflight diagrams shown in technical appendix A demonstrate the change in overflight contours as a result of some aircraft now using the RNP-AR route and the improved continuous descent performance. The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline).

Table 76 Westerly Arrivals Option 3 Overflight Data 0-7000ft

	Option	Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
Day	Baseline Westerly Option 1 ARR	215537.6	131310.1	35272.3	25610.5	0.0
	Westerly Arrival Option 3	152034.5	91312.7	30394.1	25513.2	0.0
Night	Baseline Westerly Option 1 ARR	201700.2	35182.6	0.0	0.0	0.0
	Westerly Arrival Option 3	91768.1	42598.6	0.0	0.0	0.0

The data shows a decrease in the number of population overflown 1, 10, 50 and 100 times per day during the day. These decreases can be attributed to the improved continuous descent profiles that enable aircraft to stay higher for longer, before continuously descending at 3° from 7000ft. The decrease in 100 times per day can also be attributed to the introduction of the RNP-AR route, which joins final approach later than today and therefore offers a reduction in frequency of overflight for those under final approach outside of c.5-6nm.

During the nighttime, there is a decrease in the number of people overflown once, which is a result of the improved continuous descent performance, and because there is less vectoring and more aircraft following the RNP-AR route. The increase in population overflown 10 times per night is due to the concentration of aircraft flying the RNP-AR route.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows an overall decrease in the number of schools, hospitals and places of workshop between 0-7000ft. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

Respite

Although this option does not have specific respite routes that can be predictably alternated, tactical vectoring does provide a distribution of traffic that the AD6 consultation feedback demonstrated was preferrable to concentration. The RNP-AR route offers some respite for the communities most frequently overflown under final approach and also broader respite for those communities under the existing arrival swathe during periods of low traffic such as at night.

	Air Quality	The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.
Wider Society	Greenhouse gas impact	The improved vertical profiles due to the FASI-S changes are expected to result in track mileage savings for the vectoring component of westerly arrivals option 3 compared to the baseline. We estimate that this could be a saving of c3.nm per flight which equates to 22.2kg of fuel saving and is the CO_2 equivalent of 0.070mt. In addition to this, the RNP-AR route from ZAGZO will offer a track mileage saving of c7.nm which equates to 51.8kg of fuel savings per flight which is a CO_2 equivalent of 0.164mt. The majority of arrivals are expected to continue to be vectored as they are today, however the PBN (RNP-AR) arrival route could be used by some arrivals during periods of low traffic. Given the track mileage and greenhouse gas savings shown in the table below, we expect there to be a benefit to greenhouse gas emissions. This will be explored in further detail as part of the FOA at Stage 3 should this option progress. *Table 77 Westerly Arrivals Option 3 Track Mileage, Fuel Burn and CO_2* **Difference from ZAZGO to THR (nm)** / **A320 fuel difference at FL160 (kg)** / **CO2 equiv increase (mt)** W Arriv Option 1 AV from ZAGZO (Baseline): 0 / 0 / 0.000 W Arriv Option 3 Av vector from ZAGZO: -3 / -22.2 / -0.070 W Arriv Option 3 RNP AR from ZAGZO: -7 / -51.8 / -0.164
	Capacity / resilience	This option is not expected to offer a benefit or impact to capacity compared to the baseline. The introduction of the RNP-AR route

<table>
<tr><td></td><td></td><td>is for the purposes of noise sharing and potential CO_2 reductions and is not expected to enhance Luton's overall capacity.</td></tr>
<tr><td></td><td>Tranquility</td><td>No effect as no AONB overflown.</td></tr>
<tr><td></td><td>Biodiversity</td><td>On arrival all flights will be over 1,000ft when each aircraft is more than 6km from the airfield. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 18km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. Although no designated sites are crossed within this distance Knebworth Woods SSSI lies immediately adjacent to the contours. However, as the designated features of this site are not prone to disturbance and therefore it can be discounted.</td></tr>
<tr><td>General Aviation</td><td>Access</td><td>Although we assume improved vertical profiles enables by FASI on the vectored arrivals, this would not apply to the RNP-AR arrivals who would be required to follow a similar profile to the RNP-AR route in Westerly Arrivals Option 2 because the shorter track miles drives the same vertical profile. Therefore, a lowering of the base of CTA 7 would be required to accommodate this route as it is currently designed. However, if this option is progressed, we will investigate if there are other alternatives, but those alternatives are likely to mean a longer RNP-AR arrival route and/or overflight of more population.</td></tr>
<tr><td rowspan="2">General Aviation / Commercial airlines</td><td>Economic impact from increased effective capacity</td><td>We do not expect any change from the baseline as a result of this option.</td></tr>
<tr><td>Fuel burn</td><td>The improved vertical profiles due to the FASI-S changes are expected to result in track mileage savings for the vectoring component of westerly arrivals option 3 compared to the baseline. We estimate that this could be a saving of c.3nm per flight which equates to 22.2kg of fuel saving and is the CO_2 equivalent of 0.070mt. In addition to this, the RNP-AR route from ZAGZO will offer a track mileage saving of c.7nm which equates to 51.8kg of fuel savings per flight which is a CO_2 equivalent of 0.164mt.

The majority of arrivals are expected to continue to be vectored as they are today, however the PBN (RNP-AR) arrival route could be used by some arrivals during periods of low traffic. Given the track mileage and greenhouse gas savings shown in the table below, we expect there to be a benefit to greenhouse gas emissions. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 78 Westerly Arrivals Option 3 Track Mileage and Fuel Burn
<table>
<tr><th></th><th>Difference from ZAZGO to THR (nm)</th><th>A320 fuel difference at FL160 (kg)</th></tr>
<tr><td>W Arriv Option 1 AV from ZAGZO (Baseline)</td><td>0</td><td>0</td></tr>
<tr><td>W Arriv Option 3 Av vector from ZAGZO</td><td>-3</td><td>-22.2</td></tr>
<tr><td>W Arriv Option 3 RNP AR from ZAGZO</td><td>-7</td><td>-51.8</td></tr>
</table></td></tr>
<tr><td rowspan="2">Commercial airlines</td><td>Training costs</td><td>Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. The vectoring component of this westerly arrival option is not anticipated to require any additional training costs for airlines.

There will be a cost to airlines to train crews to operate the RNP-AR route if they are not already approved however this route would not be mandatory and airlines could choose whether the benefits of the route balance with any costs before choosing to operate it.</td></tr>
<tr><td>Other costs</td><td>No other airline costs are foreseen as part of the vectoring component of this option. The introduction of an RNP-AR route could result in additional costs for airlines not already approved. It is understood that aircraft manufacturer approvals/certification can be as much as $60,000 per aircraft frame. However, this route would not be mandatory, and airlines could consider the benefits against any costs associated with the route before choosing to operate it.</td></tr>
<tr><td rowspan="3">Airport / Air navigation service provider</td><td>Infrastructure costs</td><td>The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.</td></tr>
<tr><td>Operational costs</td><td>This airspace change proposal is not anticipated to significantly change airport or ANSP operational costs other than the increase in costs required to maintain the additional Instrument Flight Procedure.</td></tr>
<tr><td>Deployment costs</td><td>This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options. As this option would form part of wider FASI airspace changes , we anticipate that it will require more training that some of the other options.</td></tr>
<tr><td>All</td><td>Safety</td><td>New safety assurances would be required for the RNP-AR arrivals which have not yet been implemented in the UK. Increased vertical profiles (CDA from a higher altitude) will require assurances that they are separated from the new LTMA traffic flows.</td></tr>
<tr><td>All</td><td>Interdependencies, conflicts and tradeoffs</td><td>This option would require a re-design of the Luton RMA to enable CDA from above 5000ft and potentially more direct routes from ZAGZO. This relies on the improvement to vertical profiles of traffic from Heathrow, Northolt, London City and Stansted. There are a small number of RWY22 departure options in Stansted's Comprehensive List of Options which are currently positioned directly towards Luton's arrivals from ZAGZO which potentially conflict with the ability to deliver CDA from ZAGZO onto Runway 25 at Luton although they have many options that would not conflict.</td></tr>
<tr><td>All</td><td>AMS</td><td>CAP1711 describes the objective as:</td></tr>
</table>

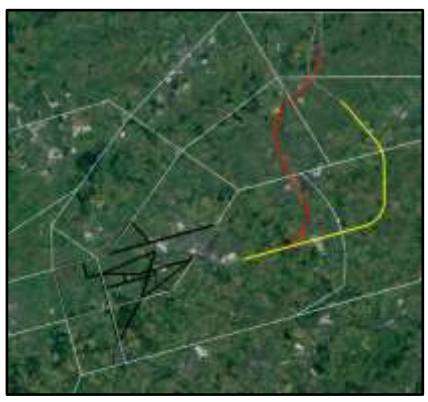
		Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace. This option would support the objectives of the AMS through improvements to CDA and therefore noise levels (above 5000ft) and makes use of the latest navigational technology to deliver environmental improvements which would directly support. However, as currently designed, the RNP-AR route would require additional CAS which would not be aligned with wider AMS objectives. As this route would potentially be with a Core LTMA deployment, the benefits of CAS release expected with the core deployments could be expected to offset against this additional CAS requirement, hopefully resulting in an overall reduction in the volume of Luton's CAS.

LLAOL FASI-S Initial Options Appraisal

Westerly Arrivals Option 4

Westerly SID Group 1 (Do Nothing Baseline)

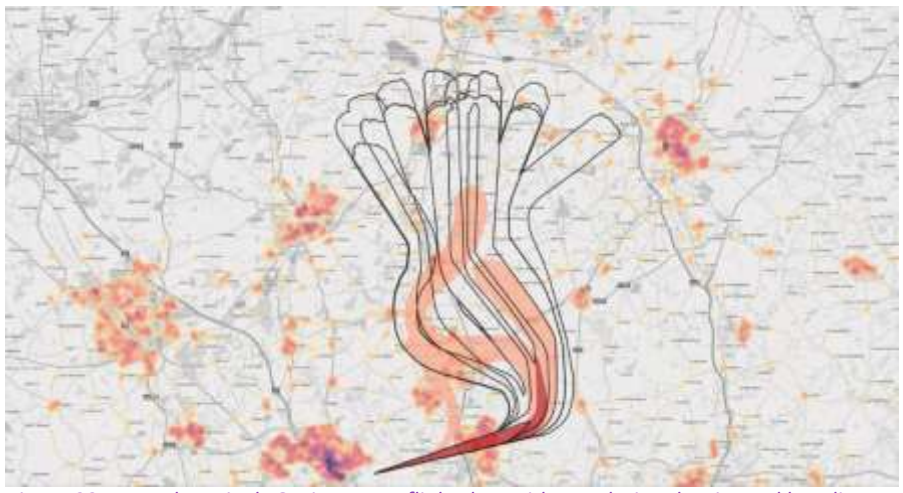
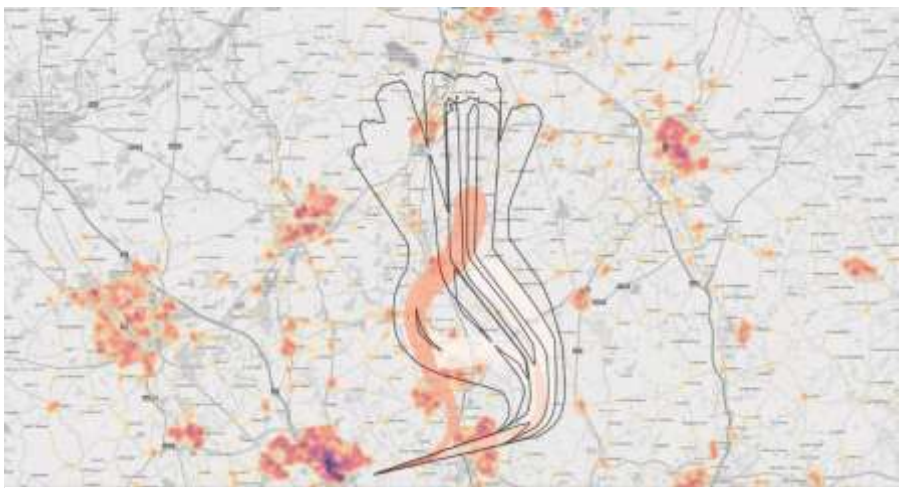
Period 1 (above) period 2 (below)



This option would see two PBN arrival transitions (yellow) from ZAGZO used in rotation to offer some respite. For this IOA, we have assumed they alternative each day, therefore each arrival route is in operation an equal amount of time over a year.

A third more direct RNP-AR route is also available for periods of low traffic (red) for some aircraft that are equipped to use it.

This option is dependent on the integration with other FASI-S airports and the upper airspace design.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option offers 2 PBN approach transitions for respite, alongside an RNP-AR route for periods of low traffic (for those operators equipped and approved to use it). For this IOA, we estimate that the split of traffic is 45% on each of the PBN approach Transitions and c.10% on the RNP-AR route to the shorter final approach; this will be investigated in further detail as part of the Stage 3A Full Options Appraisal subject to the option proceeding. Aircraft would be largely concentrated on the PBN Transitions however there would be some occasions, particularly during peak periods, where ATC will be required to vector aircraft to achieve the sequencing and spacing requirements between arrivals. This is because at the point of implementation, the technology required for the upper airspace to be able to sequence arrivals we anticipate may not be available. This will result in a vectoring swathe, although it is expected to be smaller than the baseline with clear concentration along the PBN transitions. At this stage, quantifying the dispersion of a vectoring swathe that is not currently in operation is a challenging task owing to the unpredictable nature of vectoring; subject to this option progressing, we will explore this in further detail as part of the Full Options Appraisal at Stage 3. Those aircraft on the RNP-AR route would be concentrated on the route and no vectoring would occur.  *Figure 33 Westerly Arrivals Option 4 overflight day, with population density and baseline (black outline).*  *Figure 34 Westerly Arrivals Option 4 overflight night, with population density and baseline (black outline).* The period 1 PBN transition flies to the north of Letchworth before turning south and routing down approximately the middle of the baseline swathe area. This involves some overflight of Arlesley, Fairfield and the northern parts of Letchworth. The period 2 transition begins from the north and largely avoids any densely populated areas, it follows a track slightly east of the middle of the baseline vectoring swathe area where the baseline overflight contours show some existing concentration. The two transitions join at c.9nm before landing and overfly Stevenage, as aircraft do today. The RNP-AR route is identical to Westerly Arrival option 2 and 3. It meets the existing final approach path at around 3nm (around 5.6km) before landing, which is far earlier than the baseline vectoring swathe which joins the final approach at c.8 – 11nm from landing (15-20.5km). This means that implementation of an RNP-AR route would offer a reduction in the frequency of overflight for those under final approach outside of c5-6nm, particularly over the densely populated area of Stevenage. Such a route would require a change to Luton's Nighttime noise abatement rules for establishing on final approach.

Aircraft using the RNP-AR route would be concentrated on the centreline with no vectoring and therefore the route is designed to avoid where possible Hitchin and Letchworth Garden City, and routes to the south of Biggleswade and to the east of Potton. Operator approvals are required for an RNP-AR route, therefore not all operators would be able to use it. Unlike with SIDs which have to be managed on a more scheduled basis, this arrival could be made available by Luton ATC ad hoc and/or at relatively short notice.

The RNP-AR route would overfly some communities already overflown by RWY07 easterly OLY departures where those communities experience no overflight during westerly operations as part of the baseline.

We have assumed that the vertical profiles allow improved continuous descent approaches compared to the baseline. This means that this option is dependent on the FASI-S programme and upper airspace designs.

L_{Aeq}

The arrivals component of the L_{Aeq} contours is mainly based along the extended runway centreline as arrivals are aligned with this when on final approach. The introduction of the two PBN transitions and the RNP-AR route are a fundamental change from the vectoring that occurs today however we do not anticipate that this option will result in a significant change to the westerly arrivals component of the daytime and nighttime LOAEL contours because the PBN transitions would join final approach at similar points to today (outside the LOAEL). At night when there are lower traffic periods, there is an opportunity to utilise the RNP-AR route more and we expect this to have an impact on the shape of the L_{Aeq} nighttime contour, with the contour reducing in area to the west, and instead extending further north. This has the potential to reduce the nighttime contour area from over the densely populated area of Stevenage. Further exploration as part of the FOA at Stage 3 would be required to confirm this should this option progress.

With regards to LLAOL's L_{Aeq} contours that form part of the planning condition, we do not expect it to impact the size of the 57dB(A) Leq16hr daytime contour, however there may be a small reduction in size to the nighttime 48dB(A) Leq8hr contours; this will require further investigation as part of our full options appraisal at Stage 3.

The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal if this option is progressed.

Overflight

The overflight diagrams shown in technical appendix A demonstrate the change in overflight contours from the 2 PBN transitions, the RNP-AR route and the improved continuous descent performance. The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline).

	Option	Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
Day	Baseline Westerly Option 1 ARR	215537.6	131310.1	35272.3	25610.5	0.0
	Westerly Arrival Option 4	106775.0	105634.8	65325.7	25783.4	0.0
Night	Baseline Westerly Option 1 ARR	201700.2	35182.6	0.0	0.0	0.0
	Westerly Arrival Option 4	106410.3	42665.0	0.0	0.0	0.0

The data shows a decrease in the number of people overflown 1 and 10 times per day and an increase in the number of people overflown 50 and 100 times per day. At night, the number of people overflown once decreases and the number of people overflown 10 times increases. This can be linked to the nature of PBN where this option removes the dispersal of vectoring and concentrates traffic.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows an overall decrease in the number of schools, hospitals and places of workshop overflown between 0-7000ft owing to the concentration of the PBN routes. Noise sensitive sites that are overflown by these routes may now be overflown at a higher frequency. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

Respite

This option offers 2 PBN approach transitions for respite alongside the RNP-AR route. For this IOA, we estimate that the split of traffic is 45% on each of the PBN approach Transitions and c.10% on the RNP-AR route to the shorter final approach. However the requirement to still vector arrivals to deliver accurate runway spacing means that the amount of respite that could be guaranteed is not known at this stage; this will be investigated in further detail as part of the Full Options Appraisal subject to the option proceeding.

Air Quality	The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have

<table>
<tr><td></td><td></td><td>much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.</td></tr>
<tr><td rowspan="5">Wider Society</td><td>Greenhouse gas impact</td><td>The Period 1 approach transition as illustrated is expected to increase track mileage by c.5nm compared to the baseline. We estimate that this would be an increase in fuel burn of 37kg and is the CO_2 equivalent of 0.117mt.

The period 2 approach transition as illustrated is expected to decrease track mileage by c.2nm compared to the baseline. We estimate that this would be a fuel burn saving of 14.8kg and is the CO_2 equivalent of 0.047mt.

As these approach transitions are anticipated to be used around 45% of the time each, this results in an overall net increase to greenhouse gas emissions. It may be possible to design a shorter transition for Period 1 but this will bring is close to the other transition, reducing the amount of respite available from operation of the other route.

The RNP-AR route from ZAGZO will offer a track mileage saving of c7.nm which equates to 51.8kg of fuel savings per flight which is a CO_2 equivalent of 0.164mt. This route is anticipated to be used for around 10% of movements.

Overall based on this initial assessment, it is anticipated that there might be an increase to greenhouse gas emissions as a result of this option; this will be refined and explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 79 Westerly Arrivals Option 4 Track Mileage, Fuel Burn and CO_2
<table>
<tr><th></th><th>Difference from ZAZGO to THR (nm)</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th></tr>
<tr><td>W Arriv Option 1 AV from ZAGZO (Baseline)</td><td>0</td><td>0</td><td>0.000</td></tr>
<tr><td>W Arriv Option 4 PBN 1 from ZAGZO</td><td>5</td><td>37</td><td>0.117</td></tr>
<tr><td>W Arriv Option 4 PBN 2 from ZAGZO</td><td>-2</td><td>-14.8</td><td>-0.047</td></tr>
<tr><td>W Arriv Option 4 RNP AR from ZAGZO</td><td>-7</td><td>-51.8</td><td>-0.164</td></tr>
</table></td></tr>
<tr><td>Capacity / resilience</td><td>The introduction of two PBN transitions is not expected to offer a benefit or impact to capacity compared to the baseline, providing that ATC retain the ability to vector arrivals to ensure accurate and safe final approach spacing. Without the ability to vector, this option would impact capacity. The RNP-AR route is not expected to enhance capacity.</td></tr>
<tr><td>Tranquility</td><td>No effect as no AONB overflown.</td></tr>
<tr><td>Biodiversity</td><td>On arrival all flights will be over 1,000ft when each aircraft is more than 6km from the airfield. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 18km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. Although no designated sites are crossed within this distance Knebworth Woods SSSI lies immediately adjacent to the contours. However, as the designated features of this site (habitats and invertebrate fauna) are not prone to disturbance this potential effect can be discounted.</td></tr>
<tr><td>General Aviation</td><td>Access</td><td>Although we assume improved vertical profiles enables by FASI on the vectored arrivals, this would not apply to the RNP-AR arrivals who would be required to follow a similar profile to the RNP-AR route in Westerly Arrivals Option 2 because the shorter track miles drives the same vertical profile. Therefore, a lowering of the base of CTA 7 would be required to accommodate this route as it is currently designed. However, if this option is progressed, we will investigate if there are other alternatives, but those alternatives are likely to mean a longer RNP-AR arrival route and/or overflight of more population.</td></tr>
<tr><td rowspan="2">General Aviation / Commercial airlines</td><td>Economic impact from increased effective capacity</td><td>We do not expect any change from the baseline as a result of this option.</td></tr>
<tr><td>Fuel burn</td><td>The Period 1 approach transition as illustrated is expected to increase track mileage by c.5nm compared to the baseline. We estimate that this would be an increase in fuel burn of 37kg. The period 2 approach transition as illustrated is expected to decrease track mileage by c.2nm compared to the baseline and we estimate that this would be a fuel burn saving of 14.8kg. As these approach transitions are anticipated to be used around 45% of the time each, this results in an overall net increase to fuel burn. It may be possible to design a shorter transition for Period 1 but this will bring is close to the other transition, reducing the amount of respite available from operation of the other route.

The RNP-AR route from ZAGZO will offer a track mileage saving of c7.nm which equates to 51.8kg of fuel savings per flight. This route is anticipated to be used for around 10% of movements.

Overall based on this initial assessment, it is anticipated that there might be an increase to fuel burn as a result of this option; this will be refined and explored in further detail as part of the FOA at Stage 3 should this option progress.</td></tr>
</table>

<table>
<tr><td></td><td></td><td>Table 80 Westerly Arrivals Option 4 Track Mileage and Fuel Burn
<table>
<tr><th></th><th>Difference from ZAZGO to THR (nm)</th><th>A320 fuel difference at FL160 (kg)</th></tr>
<tr><td>W Arriv Option 1 AV from ZAGZO (Baseline)</td><td>0</td><td>0</td></tr>
<tr><td>W Arriv Option 4 PBN 1 from ZAGZO</td><td>5</td><td>37</td></tr>
<tr><td>W Arriv Option 4 PBN 2 from ZAGZO</td><td>-2</td><td>-14.8</td></tr>
<tr><td>W Arriv Option 4 RNP AR from ZAGZO</td><td>-7</td><td>-51.8</td></tr>
</table></td></tr>
<tr><td rowspan="2">Commercial airlines</td><td>Training costs</td><td>Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. The two PBN transitions that form part of this option are not expected to result in any additional training costs for airlines.

There will be a cost to airlines to train crews to operate the RNP-AR route if they are not already approved, however this route would not be mandatory, and airlines could choose whether the benefits of the route balance with any costs before choosing to operate it.</td></tr>
<tr><td>Other costs</td><td>No other airline costs are foreseen as part of the RNAV1 PBN transitions. The introduction of an RNP-AR route could result in additional costs for airlines not already approved. It is understood that aircraft manufacturer approvals/certification can be as much as $60,000 per aircraft frame. However, this route would not be mandatory, and airlines could consider the benefits against any costs associated with the route before choosing to operate it.</td></tr>
<tr><td rowspan="3">Airport / Air navigation service provider</td><td>Infrastructure costs</td><td>The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.</td></tr>
<tr><td>Operational costs</td><td>This airspace change proposal is not anticipated to significantly change airport or ANSP operational costs other than the increase in costs required to maintain the additional three Instrument Flight Procedure.</td></tr>
<tr><td>Deployment costs</td><td>This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options. As this option would form part of wider FASI airspace changes, we anticipate that it will require more training that some of the other options.</td></tr>
<tr><td>All</td><td>Safety</td><td>New safety assurances would be required for the RNP-AR arrivals which have not yet been implemented in the UK. The risk of an aircraft incorrectly selecting the wrong PBN arrival route also needs to be managed, with three different arrival routes published in the AIP.</td></tr>
<tr><td>All</td><td>Interdependencies, conflicts and tradeoffs</td><td>This option would require a re-design of the Luton RMA to enable CDA from above 5000ft and the PBN transitions from ZAGZO, especially the shorter Period 2 arrival. They both rely on the improvement to vertical profiles of traffic from Heathrow, Northolt, London City and Stansted.

The Period 2 arrival is currently in conflict with a small number of RWY22 departure options in Stansted’s Comprehensive List of Options which are currently positioned directly towards Luton’s arrivals from ZAGZO which potentially conflict with the ability to deliver CDA from ZAGZO onto Runway 25 at Luton although they have many options that would not conflict.</td></tr>
<tr><td>All</td><td>AMS</td><td>CAP1711 describes the objective as:
Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.

This option would support the objectives of the AMS through improvements to CDA and therefore noise levels (above 5000ft) and makes use of the latest navigational technology to deliver environmental improvements which would directly support. However, as currently designed, the RNP-AR route would require additional CAS which would not be aligned with wider AMS objectives. As this route would potentially be with a Core LTMA deployment, the benefits of CAS release expected with the core deployments could be expected to offset against this additional CAS requirement, hopefully resulting in an overall reduction in the volume of Luton’s CAS.</td></tr>
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Easterly Arrivals Option 1 (Do Nothing)

Easterly Arrivals Option 1 (Do nothing baseline)	
	All arrivals would be vectored from ZAGZO exactly as per the AD6 ACP (with the same vertical profiles). This is also the 'do nothing' baseline scenario. **This option is not dependent on changes at neighbouring airports.**

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	Due to wind direction, easterly operations on runway 07 occur approximately 30% of the year. The noise data and qualitative assessment has considered this modal split. From 7000ft, aircraft arriving at Luton on easterlies are vectored from ZAGZO onto final approach. In November 2021 ACP-2018-65 (known as SAIP AD6) was approved; this was an ACP co-sponsored between LLAOL and NATS which made improvements to arrivals to address latent risk identified. At the year of implementation of this FASI-S ACP (c.2028), AD6 will be implemented and therefore this Easterly Arrival option 1 baseline scenario will take into account the Luton AD6 airspace change. The following image shows the expected main AD6 vectoring swathe in purple:  *Figure 35 Baseline Easterly arrival swathe following SAIP AD6 implementation* The AD6 Airspace Change describes the vectoring swathe as: *Controllers would take most of the LLA arrivals at 8,000ft and vector them within the swathes depicted. Note that controllers do not always use ground references (towns, roads, lakes or other features) though some may be marked on their radar displays. Arrival traffic would fly south of Grafham Water past St Neots, to the east of the A1 main road and roughly parallel with it. To the east of Sandy, aircraft would be descended to 5,000ft and turned right (in the vicinity of Biggleswade or Henlow), mostly north of the A1-A505 junction near Letchworth similar to today. The LLA arrival flow continues west, level at 5,000ft for about 40km, over the northern part of the Chilterns AONB, with the controller vectoring most aircraft south of Leighton Buzzard (though some may be vectored to the north). As the traffic reaches an area northeast of Aylesbury the aircraft would be turned left, roughly perpendicular to the extended runway centreline, and descended to 4,000ft, then turned left and descended once more to establish on final approach, typically somewhere between the east of Stoke Mandeville area around 4,000ft and Pitstone Hill around 3,000ft. The swathe within which controllers vector aircraft narrows until it aligns with the runway on final approach. The final approach path to Runway 07 always overflies part of the Chilterns AONB, from Pitstone Hill to Kensworth Common, in a very narrow path. Vectoring naturally causes some dispersion, and our controllers expect the areas described here to be the most commonly overflown below 7,000ft. Some would be vectored on shortcuts from the east similar to today, or to the north of Leighton Buzzard like today*[20] The technical appendix to this document includes images and maps showing areas of overflight. The overflight data, generated using the CAA's definition of overflight, gives us information about this baseline scenario. The table below shows the overflight data for the baseline easterly arrival option 1 scenario:

[20] Under a previous airspace change implemented in May 2006, the CAA placed a condition on Luton arrivals which is that arriving traffic for Runway 07 (formerly Runway 08, designation changed in May 2020 due to magnetic variation) should not be routinely vectored over the town of Leighton Buzzard, unless tactically unavoidable. The AD6 ACP inferred that the intent of this CAA condition is to minimise overflight of the town (whether via a published route, or vectoring), unless tactically unavoidable. See CAA Airspace Policy, Post Implementation Review letter dated 31 Jan 2008, ref 8AP/066/02/06/02 p.3 para 2.2.3 et seq.

Table 81 Easterly arrivals baseline overflight data

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
Day	Baseline Easterly Option 1 ARR	251829.3	52554.5	0.0	0.0	0.0
Night	Baseline Easterly Option 1 ARR	105765.2	0.0	0.0	0.0	0.0

The data from this table will be used to compare the easterly arrival options against the 'do nothing' baseline.

In addition to population overflown, we also have data on the overflight of noise sensitive buildings such as schools, hospitals and places of worship; the full data around these is shown in technical appendix a, and as part of this IOA we will provide a qualitative statement around this data.

L_{Aeq}

Easterly operations occur approximately 30% of the year and this has been considered when appraising the potential impacts to the L_{Aeq} average daytime and nighttime contours. Owing to % split between easterly and westerly operations, changes to the easterly arrivals have a lower overall impact on the L_{Aeq} contours compared to the westerly options.

We have used the overall contours from 2019, as an indicative contour for 2028 as it is expected that contours will be a similar size or smaller in 2028 as Luton has a planning condition to reduce the size. The AD6 airspace change Full Options Appraisal model predicted a very small change to these contours which was put down to the modelling rather than expecting a change in real life. We have also taken this into account when qualitatively describing the baseline and comparing it to our other airspace change options.

Respite

Although this baseline option does not have specific respite routes that can be predictably alternated, tactical vectoring does provide a distribution of traffic that the AD6 consultation feedback demonstrated was preferrable to concentration.

Wider Society

Air Quality

Impacts to air quality are considered for changes below around 650ft (200m). Aircraft flying above this are unlikely to have a significant impact on local ground air quality.

Aircraft arriving at Luton fly a standard 3-degree angle of approach and descend through 650ft whilst aligned with the extended runway centreline. This is in the last stages of the final approach. It's therefore very unlikely that any arrivals options will offer any significant impact to air quality however we will review each option for changes against this baseline.

Greenhouse gas impact

Emissions of greenhouse gases arise from the combustion of aviation fuel, and as the combustion of aviation fuel is linked to track length, we have initially looked at the track length for the baseline easterly arrivals options.

For the purposes of this Initial Options Appraisal, we have taken the track mileage information generated for the AD6 ACP and used this as our 'do nothing' track length.

Table 82 Easterly Arrival Baseline Track Mileage

Option	NM from ZAZGO to THR
E Arriv Option 1 AV from ZAGZO Baseline	53

We will estimate the differences between this baseline and the option, to understand if there are any anticipated advantages/disadvantages of the option against current day. This estimation will consider whether the aircraft tracks will be longer or shorter than a typical flight today. As CO_2 emissions are linked to the difference in aviation fuel burnt, this will allow us to calculate a high level estimation of the greenhouse gas impacts as a result of the option. Full details are shown in technical appendix A.

Capacity / resilience

Although Luton has recently undertaken a separate ACP to remove interdependencies between Luton and Stansted arrivals, in future, increased forecast movement levels across the LTMA are anticipated to result in capacity and resilience disbenefits. As traffic increases, the extra complexity and workload for air traffic controllers and pilots would likely result in the use of flow regulations at all LTMA airports including Luton. Flow regulations stabilise the number of movements until the peak in traffic subsides, however in doing so they generate delay.

Tranquility

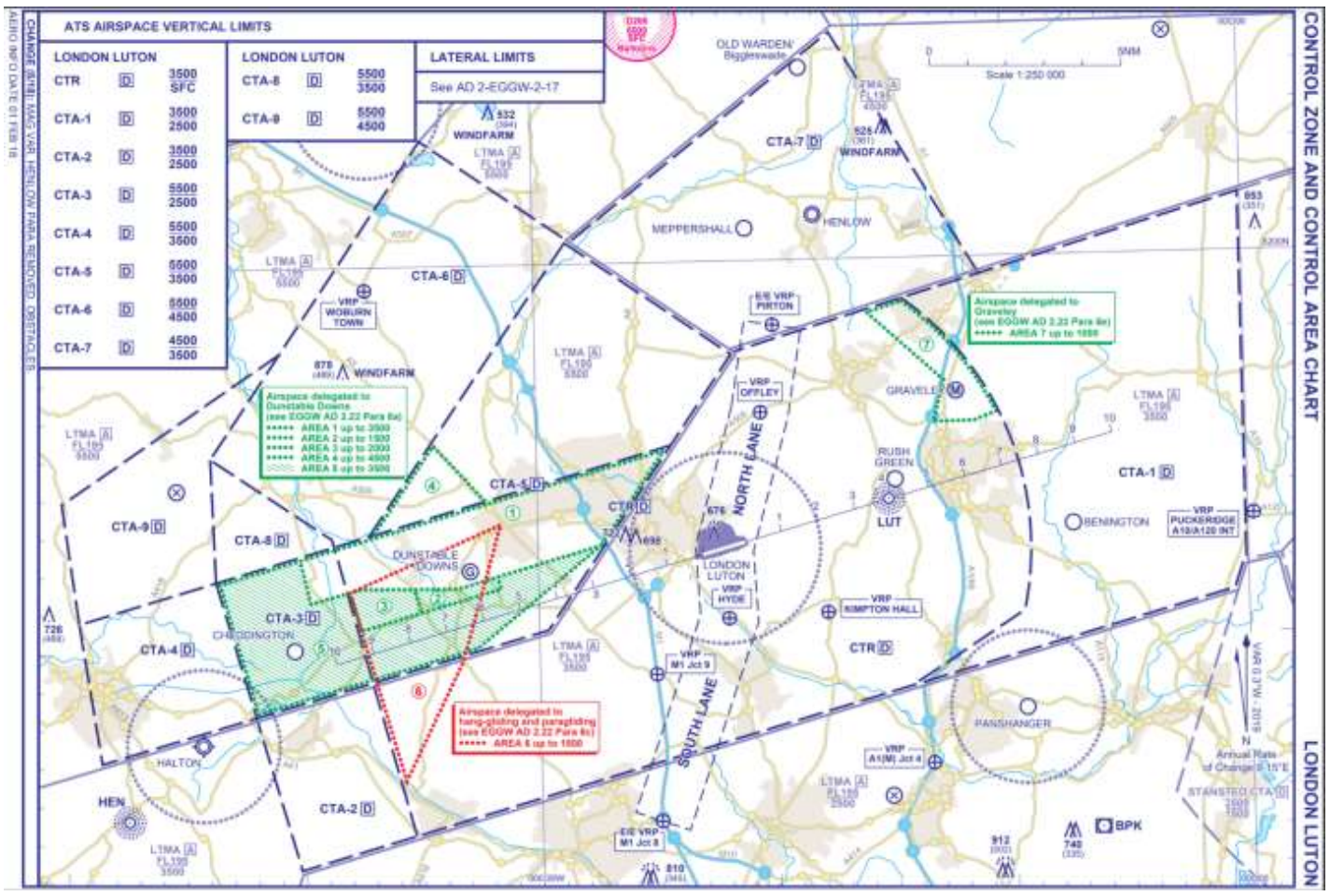
Aircraft today overfly the Chilterns AONB. Aircraft overfly the Chilterns AONB as they are vectored onto final approach, the alignment of aircraft on final approach then results in concentrated noise occurring over the Chilterns AONB.

Table 83 Easterly Arrival Baseline AONB Overflown

		Area (Km2) of AONB overflown. 0-7000ft
Day	Baseline Easterly Option 1 ARR	55.2
Night	Baseline Easterly Option 1 ARR	25.0

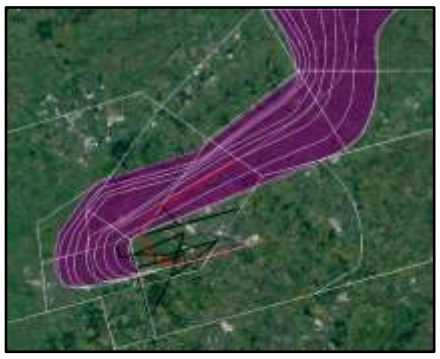
Biodiversity

On arrival all flights will be over 1,000ft when each aircraft is more than 6km from the airfield. Over this altitude the potential effects

		of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 18km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. Within 13.5km of the airfield and on the arrival route lies the Dunstable and Whipsnade Downs SSSI. However, as the designated features of this site (habitats and invertebrate fauna) are not prone to disturbance this potential effect can be discounted.
General Aviation	Access	This baseline scenario would not offer any change from the existing Controlled Airspace (CAS) arrangements in place today. The options will be qualitatively compared against this existing scenario. Today, Luton's instrument flight procedures are contained within Class D controlled airspace. The base of this airspace varies and is shown on the chart below (for the current published chart, please see the UK eAIP):  Within the Luton TMA, there are areas of airspace delegated to gliding activities. The Gliding areas are used differently depending on whether Luton are on easterly or westerly operations. Use of the portions of gliding areas within Controlled Airspace is strictly controlled by a Letter of Agreement between various parties. Luton Approach controllers ensure that all Luton arriving and departing commercial traffic stays within controlled airspace and remain clear of the airspace delegated to gliding activities. There would be no change to these arrangements or letters of agreement as a result of this baseline option. Although the existing baseline scenario will not result in the requirement for more airspace, this option offers no opportunity to simplify the airspace boundaries.
General Aviation / Commercial airlines	Economic impact from increased effective capacity	There will be no change from today as a result of this option; later in this IOA we will qualitatively estimate the differences between this and the airspace change options.
	Fuel burn	As the combustion of aviation fuel is linked to track length, we have initially looked at the track length for the baseline westerly arrivals. For the purposes of this IOA, we have taken the track mileage information generated for the AD6 ACP and used this as our 'do nothing' track length. *Table 84 Easterly Arrival Baseline Track Mileage* **Option** | **NM from ZAZGO to THR** **E Arriv Option 1 AV from ZAGZO Baseline** | 53 We will estimate the differences between this baseline and the option, to understand if there are any anticipated advantages/disadvantages of the option against current day. This estimation will consider whether the aircraft tracks will be longer or shorter than a typical flight today. As track length is linked to the difference in aviation fuel burnt, this will allow us to calculate a high level estimation of fuel burn impacts as a result of the option. Full details are shown in technical appendix A.
Commercial airlines	Training costs	As this option will already be in operation, there are no training costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
	Other costs	As this option will already be in operation, there are no other costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
Airport / Air	Infrastructure costs	As this option will already be in operation, there are no infrastructure costs anticipated as there will be no change; later in this IOA

navigation service provider		we will estimate the difference between our options and this baseline.
	Operational costs	As this option will already be in operation, there are no operational costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
	Deployment costs	As this option will already be in operation, there are no deployment costs anticipated as there will be no change; later in this IOA we will estimate the difference between our options and this baseline.
All	Safety	At current traffic levels, there are no safety concerns with the current arrangements at Luton. Future traffic growth across the LTMA could however result in increased complexity and workload for Air Traffic Controllers and pilots, which may lead to traffic within the LTMA being capped to maintain safety, leading to delays.
All	Interdependencies, conflicts and tradeoffs	As described on our Stage 2A documentation, Luton's arrivals are currently forced to be lower than optimal to manage the existing interdependencies within the LTMA. The result is that Luton's arrivals are required to be down at 5000ft early, with CDA only guaranteed from that altitude. It is not expected that changes to Luton's arrivals below 7000ft will be required to manage new interdependencies that arise from changes to traffic flows to/from adjacent airports. On the contrary, it is expected that improvements to Luton's arrivals can be made in the form of CDA from above 5000ft as a result of changes to traffic flows to/from adjacent airports. However, Easterly SID Groups 5 and 6 do rely on changes to Easterly Arrival flows into Luton.
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* Whilst it is not expected that changes to Luton's Easterly Arrival flows will be required to enable wider LTMA improvements, doing nothing with Easterly arrivals will not align with the AMS. It will not enable any environmental benefits through improvements to vertical profiles into Luton and will not enable any reduction in the volume of controlled airspace which may be possible with CDA from above 5000ft.

Easterly Arrivals Option 2

Easterly Arrivals Option 2	
	This option would see the majority of arrivals vectored from ZAGZO as per Easterly Arrivals Group 1 but we also introduce a PBN (RNP-AR) arrival route which some arrivals could use during 2100 – 0700. **This option is not dependent on changes at neighbouring airports.**

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option would see the majority of all arrivals vectored from ZAGZO as described in the Easterly Arrival Option 1 baseline with the same profiles, but we also introduce a PBN (RNP-AR) arrival route which some arrivals could use during periods of low traffic between the hours of c.21:00 and 07:00, outside of Gliding operations. Utilisation of an RNP-AR route during core arrival hours is unlikely because it would be very difficult to mix RNP-AR arrivals in with the main vectored swathe whilst delivering the required arrival spacing to the runway. Therefore, we assume that use of this route would be rather infrequent. The RNP-AR route as illustrated meets the existing final approach path at around 6nm (around 11km) before landing, which is earlier than the baseline vectoring swathe which joins the final approach at c.8 – 13nm from landing (15-23.5km). This means that implementation of an RNP-AR route would offer a reduction in the frequency of overflight for those under final approach outside of c.7-8nm. Such a route would require a change to Luton's Nighttime noise abatement rules for establishing on final approach.  *Figure 37 Easterly Arrivals Option 2 overflight day, with population density and baseline (black outline).*  *Figure 36 Easterly Arrivals Option 2 overflight night, with population density and baseline (black outline).* The RNP-AR route would only be available when the Dunstable gliding area is inactive. This has the potential to be managed on an adhoc basis and/or at relatively short notice (for example on days when gliding areas cannot be used due to weather). This however means that it is very difficult to predict the use of the route. For the purposes of this Initial Options Appraisal, we have assumed use of this route is standardised to a 2100-0700 time period but that is subject to negotiation and agreement with multiple industry organisations. Aircraft using the RNP-AR route would be concentrated on the centreline with no vectoring. The earlier part of the route, between 7,000ft and c. 4,500ft flies approximately down the centre of the baseline vectoring swathe where some concentration in overflight is seen today. It then turns south earlier than the swathe, avoiding where possible Edlesborough and Easton Bray, before joining the existing final approach path at c.6nm from landing. The profile of the RNP-AR route would be contained within the existing (AD6) Luton radar maneuvering area (RMA) and is therefore not expected to have a dependency on other airports. Operator approvals are required for an RNP-AR route therefore not all operators would be able to use it. However, for this route to be contained within CAS it would require a lowering of part of CTA5 and possibly CTA6. We do not expect this option to change the frequency of communities being overflown with multiple routes below 7000ft. **L_{Aeq}** The arrivals component of the LAeq contours is mainly based along the extended runway centreline as arrivals are aligned with this when on final approach. The introduction of an RNP-AR route has the potential to make a very small adjustment to the daytime LAeq contour, as some aircraft will now join final approach closer than they do today, however owing to low numbers of aircraft that are anticipated to operate this route, we do not expect this to fundamentally change the shape or size of the LOAEL day contours. At

night when there are lower traffic periods, there is an opportunity to utilise the RNP-AR route. This may have a very small influence on the night time contour however owing to the modal split, it is not anticipated that this would be significant. We will look at this in further detail as part of our FOA at Stage 3 should this option progress.

With regards to LLAOL's LAeq contours that form part of the planning condition, we do not expect this option to impact the size of the 57dB(A) Leq16hr or 48dB(A) Leq8hr contours.

The full LAeq contours will be quantified as part of our Stage 3 Full Options Appraisal if this option is progressed.

Overflight

The overflight diagrams shown in technical appendix A demonstrate the change in overflight contours as a result of some aircraft now using the RNP-AR route. The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline).

Table 85 Easterly Arrivals Option 2 Overflight Data 0-7000ft

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
Day	Baseline Easterly Option 1 ARR	251829.3	52554.5	0.0	0.0	0.0
	Easterly Arrival Option 2	259327.1	51273.7	0.0	0.0	0.0
Night	Baseline Easterly Option 1 ARR	105765.2	0.0	0.0	0.0	0.0
	Easterly Arrival Option 2	65496.5	0.0	0.0	0.0	0.0

The data shows an increase in the number of population overflown once per day during the day, and a small decrease in the number of people overflown 10 times per day. The decrease in 10 times per day can be attributed to the introduction of the RNP-AR route, which joins final approach later than today and therefore offers a reduction in frequency of overflight for those under final approach outside of c.7-8nm. The increase in population overflown once can also be attributed to the RNP-AR route, and the contours shown in the technical appendix show the areas where the contours are extended as a result of the route.

During the nighttime, there is a decrease in the number of people overflown on average once, as there is less vectoring and instead some aircraft operate the RNP-AR route.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows overall increases in the number of schools and places of worship overflown between 0-7000ft. The number of hospitals remains the same. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

Respite

Although this option does not have specific respite routes that can be predictably alternated, tactical vectoring does provide a distribution of traffic that the AD6 consultation feedback demonstrated was preferrable to concentration. The RNP-AR route offers some respite for the communities most frequently overflown under final approach and also broader respite for those communities under the existing arrival swathe during periods of low traffic at night.

	Air Quality	The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.
Wider Society	Greenhouse gas impact	The vectoring component of Easterly Arrivals Option 2 remains the same as the baseline and therefore we do not expect any changes to greenhouse gas emissions because of vectoring. The RNP-AR route from ZAGZO will offer a track mileage saving of c10nm which equates to 74kg of fuel savings per flight which is a CO_2 equivalent of 0.234mt. The majority of arrivals are expected to continue to be vectored as they are today, however the PBN (RNP-AR) arrival route could be used by some arrivals during periods of low traffic between 21:00 – 07:00. Given the track mileage and greenhouse gas savings on this route, there may be a marginal benefit to greenhouse gas emissions. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 86 Easterly Arrivals Option 2 Track Mileage, Fuel Burn and CO_2

	Difference from ZAZGO to THR (nm)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)
E Arriv Option 1 AV from ZAGZO (Baseline)	0	0	0.000
E Arriv Option 2 AV from ZAGZO	0	0	0
E Arriv Option 2 RNP AR frm ZAGZO	-10	-74	-0.234

	Capacity / resilience	This option is not expected to offer a benefit or impact to capacity compared to the baseline. The introduction of the RNP-AR route is for the purposes of noise sharing and potential CO_2 reductions and is not expected to enhance Luton's overall capacity. This option is not dependent on other FASI ACPs however no change to the airspace around Luton may also inhibit the wider FASI programme of change and AMS benefits associated with the programme.
	Tranquility	Aircraft today overfly the Chilterns AONB. Aircraft overfly the Chilterns AONB as they are vectored onto final approach, the alignment of aircraft on final approach then results in concentrated noise occurring over the Chilterns AONB. The RNP-AR route, introduces some additional overflight of the Chilterns AONB. This cannot be designed to avoid the AONB without also overflying Luton town centre at low altitude (c.1-2000ft)
	Biodiversity	On arrival all flights will be over 1,000ft when each aircraft is more than 6km from the airfield. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 18km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. Within 18km of the airfield and on the arrival route lies Kensworth Chalk Pit SSSI (11km) and the Dunstable and Whipsnade Downs SSSI (13.5km). However, as the designated features of this site (geology, habitats and invertebrate fauna) are not prone to disturbance this potential effect can be discounted.
General Aviation	Access	An RNP-AR arrival to establish on final approach closer than today would require a lowering of part of CTA5 and possibly CTA6. As discussed, this route would only be available outside of Gliding Operations so the RNP-AR would either be limited to night, with CAS established at Night time only, or if it were to be used ad-hoc when Gliding Operations are not taking place, the CAS would need establishing on a permanent basis. This would be in a very busy piece of GA airspace and the use of the route is likely to be of a relatively low frequency with associated low benefit compared to the disruption to GA activities in order to establish the CAS.
General Aviation / Commercial airlines	Economic impact from increased effective capacity	We do not expect any change from today as a result of this option.
	Fuel burn	The vectoring component of Easterly Arrivals Option 2 remains the same as the baseline and therefore we do not expect any changes to greenhouse gas emissions because of vectoring. The RNP-AR route from ZAGZO will offer a track mileage saving of c10nm which equates to 74kg of fuel savings per flight. The majority of arrivals are expected to continue to be vectored as they are today, however the PBN (RNP-AR) arrival route could be used by some arrivals during periods of low traffic between 21:00 – 07:00. Given the track mileage savings on this route, there may be a marginal benefit to fuel burn. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.
Commercial airlines	Training costs	Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. The vectoring component of this easterly arrival option is not anticipated to require any additional training costs for airlines. There will be a cost to airlines to train crews to operate the RNP-AR route if they are not already approved however this route would not be mandatory and airlines could choose whether the benefits of the route balance with any costs before choosing to operate it.
	Other costs	No other airline costs are foreseen as part of the vectoring component of this option. The introduction of an RNP-AR route could

Table 87 Easterly Arrival Option 2 AONB Overflown

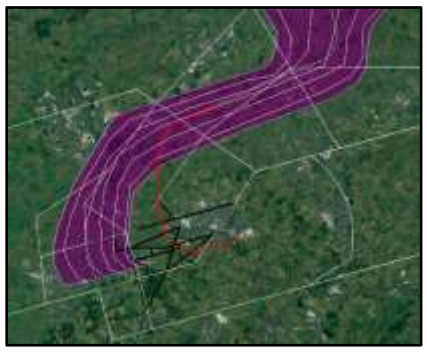
		Area (Km2) of AONB overflown. 0-7000ft
Day	Baseline Easterly Option 1 ARR	55.2
	Easterly Arrival Option 2	59.2
Night	Baseline Easterly Option 1 ARR	25.0
	Easterly Arrival Option 2	25.1

Table 88 Easterly Arrivals Option 2 Track Mileage, Fuel Burn and CO_2

	Difference from ZAZGO to THR (nm)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)
E Arriv Option 1 AV from ZAGZO (Baseline)	0	0	0.000
E Arriv Option 2 AV from ZAGZO	0	0	0
E Arriv Option 2 RNP AR frm ZAGZO	-10	-74	-0.234

		result in additional costs for airlines not already approved. It is understood that aircraft manufacturer approvals/certification can be as much as $60,000 per aircraft frame. However, this route would not be mandatory and airlines could consider the benefits against any costs associated with the route before choosing to operate it.
Airport / Air navigation service provider	Infrastructure costs	The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.
	Operational costs	This airspace change proposal is not anticipated to significantly change airport or ANSP operational costs other than the increase in costs required to maintain the additional Instrument Flight Procedure.
	Deployment costs	This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options. As this option largely replicates current day and is independent of other neighbouring airports, we anticipate that it will require less training that some of the other options however training still will be required.
All	Safety	New safety assurances would be required for the RNP-AR arrivals which have not yet been implemented in the UK. The greater safety issues that would need to be managed would be the operation of a piece of CAS that turned on/off at certain times of the day and/or days of the week.
All	Interdependencies, conflicts and tradeoffs	It is expected that this route can be delivered without relying on changes to routes to/from adjacent airports as it can be wholly contained within the existing Luton RMA. We have therefore not identified any Interdependencies, conflicts and tradeoffs for this option.
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* This option would make use of the latest navigational technology to deliver environmental improvements which would directly support the objectives of the AMS. However, as currently designed, the RNP-AR route would require additional CAS which would not be aligned with wider AMS objectives. As this route could potentially be delivered ahead of a Core LTMA deployment, the benefits of CAS release expected with the core deployments may not be available to offset the additional CAS required for this route, if implemented early.

Easterly Arrivals Option 3

Easterly Arrivals Option 3	
	This option would see the majority of arrivals from ZAGZO vectored but with the swathe moved significantly further north. It would give the opportunity for continuous descent from above 5000ft. This shift in the swathe is to enable the continuous climbs required for Easterly SID groups 5 and group 6. The arrivals would join final approach in the same place as today. There is also an opportunity for a PBN route which could be used when the gliding area is not active. **This option is dependent on the integration with other FASI-S airports and the upper airspace design.**

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option would see the majority of arrivals from ZAGZO vectored but with the swathe moved significantly further north. The vertical profiles are improved to allow improved continuous descent performance for the main vectored arrival swathe. This means that this option is dependent on the FASI-S programme and upper airspace designs. The change to the vectoring swathe compared to the baseline, combined with the improved continuous descent approaches, result in a reduction in overflight over the densely populated areas of north Luton, Hitchin, Letchwoth, Baklock, and Shefford as well as the Chilterns AONB. The relocated swathe largely routes over less dense areas of population, although this will introduce more frequent overflight to some areas that are not overflown today. As aircraft descent, the vectoring swathe will broadly begin to align with the baseline and vectored arrivals would join final approach at the same distances as today. This option also includes a PBN (RNP-AR) arrival route which some arrivals could use during periods of low traffic between the hours of c.21:00 and 07:00, outside of Gliding operations. Utilisation of an RNP-AR route during core arrival hours is unlikely because it would be very difficult to mix RNP-AR arrivals in with the main vectored swathe whilst delivering the required arrival spacing to the runway. Therefore, we assume that use of this route would be rather infrequent.. This routes over the populated area of Ampthill however otherwise avoids areas of dense population. Aircraft using the RNP-AR route would be concentrated on the centreline with no vectoring. The RNP-AR route as illustrated meets the existing final approach path at around 6nm (around 11km) before landing, which is earlier than the proposed vectoring swathe which joins the final approach at c.8 – 13nm from landing (15-23.5km). This means that implementation of an RNP-AR route would offer a reduction in the frequency of overflight for those under final approach outside of c.6nm. Such a route would require a change to Luton's Nighttime noise abatement rules for establishing on final approach. The RNP-AR route would only be available when the Dunstable gliding area is inactive. This has the potential to be managed on an adhoc basis and/or at relatively short notice (for example on days when gliding areas cannot be used due to weather). This however means that it is very difficult to predict the use of the route. For the purposes of this Initial Options Appraisal, we have assumed use of this route is standardised to a 2100-0700 time period but that is subject to negotiation and agreement with multiple industry organisations. However, for this route to be contained within CAS it would require a lowering of part of CTA5 and possibly CTA6. Relocating the vectored arrival swathe to the north reduces the likelihood of cumulative impact through communities being overflown by multiple routes from neighboring airports. With regards to overflight from other Luton routes, it would be possible for the swathe to be deconflicted from easterly departures. The the RNP-AR arrival route could overfly the same communities as the night time westerly SID Group 7 MATCH/OLY SIDs.. **L_{Aeq}** The arrivals component of the L_{Aeq} contours is mainly based along the extended runway centreline as arrivals are aligned with this when on final approach. Although this option results in a significant change in vectoring area, aircraft will join the final approach at

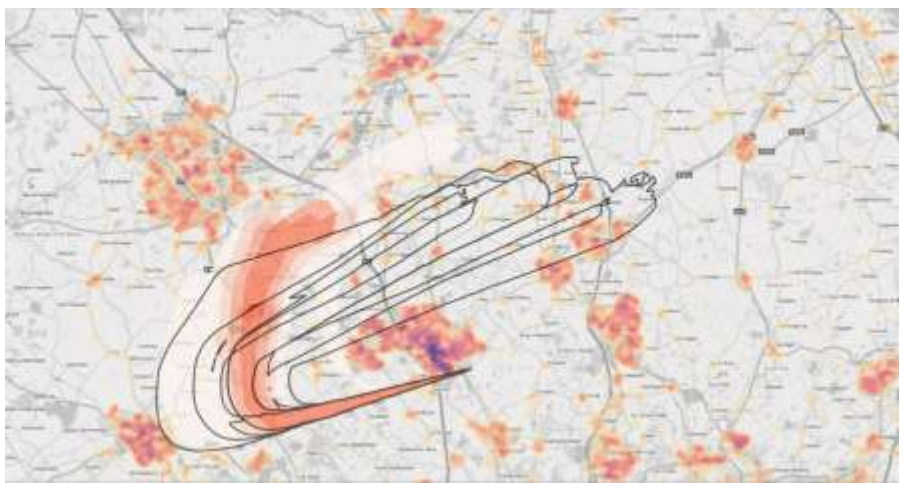


Figure 38 Easterly Arrivals Option 3 overflight day, with population density and baseline (black outline).

Figure 39 Easterly Arrivals Option 3 overflight night, with population density and baseline (black outline).

the same places as today. The introduction of an RNP-AR route has the potential to make a very small, almost imperceptible adjustment to the daytime L_{Aeq} contour, as some aircraft will now join final approach closer than they do today, however owing to low numbers of aircraft that are anticipated to operate this route during the daytime period, we do not expect this to fundamentally change the shape or size of the LOAEL day contours. At night when there are lower traffic periods, there is an opportunity to utilise the RNP-AR route more which may have a very small influence on the night time contours however owing to the modal split, it is not anticipated that this would be significant. We will look at this in further detail as part of our FOA at Stage 3 should this option progress.

With regards to LLAOL's L_{Aeq} contours that form part of the planning condition, we do not expect this option to impact the size of the 57dB(A) Leq16hr or 48dB(A) Leq8hr contours.

The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal if this option is progressed.

Overflight

The overflight diagrams shown in technical appendix A demonstrate the change in overflight contours as a result of the change to the vectoring areas and some aircraft now using the RNP-AR route. The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline).

Table 89 Easterly Arrivals Option 3 Overflight Data 0-7000ft

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
Day	Baseline Easterly Option 1 ARR	251829.3	52554.5	0.0	0.0	0.0
	Easterly Arrival Option 3	96196.0	54197.2	0.0	0.0	0.0
Night	Baseline Easterly Option 1 ARR	105765.2	0.0	0.0	0.0	0.0
	Easterly Arrival Option 3	62486.4	0.0	0.0	0.0	0.0

The data shows a significant decrease in the number of population overflown once per day during the day, and a small increase in the number of people overflown 10 times per day. This can be attributed to the relocated swathe avoiding densely populated areas and the improved continuous descent profiles that enable aircraft to stay higher for longer. The small increase in population overflown 10 times per day results from slightly more concentration down the centre of the vectoring swathe compared to today.

During the nighttime, there is a decrease in the number of people overflown on average once, as there is less vectoring and instead some aircraft operate the RNP-AR route.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) shows overall decreases in the number of schools and places of worship overflown between 0-7000ft. The number of hospitals remains the same. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

Respite

Although this option does not have specific respite routes that can be predictably alternated, tactical vectoring does provide a distribution of traffic that the AD6 consultation feedback demonstrated was preferrable to concentration. The RNP-AR route offers some respite for the communities most frequently overflown under final approach and also broader respite for communities during periods of low traffic at night.

	Air Quality	The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.
Wider Society	Greenhouse gas impact	The improved vertical profiles due to the FASI-S changes are expected to result in reduced CO_2 emissions for the vectoring component of Easterly Arrivals Option 3, compared to the baseline. The shift in the vectoring area itself is not expected to impact overall track miles. We estimate that the RNP-AR route from ZAGZO will offer a track mileage saving of c12nm which equates to 88.8kg of fuel savings per flight which is a CO_2 equivalent of 0.281mt. The majority of arrivals are expected to continue to be vectored as they are today, however the PBN (RNP-AR) arrival route could be used by some arrivals during periods of low traffic between 21:00 – 07:00. Given the track mileage and greenhouse gas savings on this route, we anticipate that there will be greenhouse gas emission benefits. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.

Table 90 Easterly Arrivals Option 3 Track Mileage and Fuel Burn

	Difference from ZAZGO to THR (nm)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)
E Arriv Option 1 AV from ZAGZO (Baseline)	0	0	0.000
E Arriv Option 3 Av vector from ZAGZO	0	0	0
E Arriv Option 3 RNP AR from ZAGZO	-12	-88.8	-0.281

	Capacity / resilience	This option is not expected to offer a benefit or impact to capacity compared to the baseline. The introduction of the RNP-AR route is for the purposes of noise sharing and potential CO_2 reductions and is not expected to enhance Luton's overall capacity.
	Tranquility	Aircraft today overfly the Chilterns AONB. Aircraft overfly the Chilterns AONB as they are vectored onto final approach, the alignment of aircraft on final approach then results in concentrated noise occurring over the Chilterns AONB. The change in vectoring swathe reduces the overflight of the AONB until joining final approach.
	Biodiversity	On arrival all flights will be over 1,000ft when each aircraft is more than 6km from the airfield. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 18km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. Within 18km of the airfield and on the arrival route lies Kensworth Chalk Pit SSSI (11km) and the Dunstable and Whipsnade Downs SSSI (13.5km). However, as the designated features of this site (geology, habitats and invertebrate fauna) are not prone to disturbance this potential effect can be discounted.
General Aviation	Access	This option is dependent on changes to other airports' routes to enable CDA and does not require more Controlled airspace to facilitate the move to the main arrival swathe. An RNP-AR arrival to establish on final approach closer than today would require a lowering of part of CTA5 and possibly CTA6. As discussed, this route would only be available outside of Gliding Operations so the RNP-AR would either be limited to night, with CAS established at Night time only, or if it were to be used ad-hoc when Gliding Operations are not taking place, the CAS would need establishing on a permanent basis. This would be in a very busy piece of GA airspace and the use of the route is likely to be of a relatively low frequency with associated low benefit compared to the disruption to GA activities in order to establish the CAS.
General Aviation / Commercial airlines	Economic impact from increased effective capacity	We do not expect any change from the baseline as a result of this option.
	Fuel burn	The improved vertical profiles due to the FASI-S changes are expected to result in fuel burn savings for the vectoring component of easterly arrivals option 3 compared to the baseline. The shift in the vectoring area itself is not expected to impact overall track miles. We estimate that the RNP-AR route from ZAGZO will offer a track mileage saving of c12nm which equates to 88.8kg of fuel savings per flight. Most arrivals are expected to continue to be vectored as they are today, however the PBN (RNP-AR) arrival route could be used by some arrivals during periods of low traffic between 21:00 – 07:00. Given the track mileage on this route, we anticipate that there will be fuel burn benefits. This will be explored in further detail as part of the FOA at Stage 3 should this option progress.
Commercial airlines	Training costs	Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. The vectoring component of this easterly arrival option is not anticipated to require any additional training costs for airlines. There will be a cost to airlines to train crews to operate the RNP-AR route if they are not already approved however this route would not be mandatory and airlines could choose whether the benefits of the route balance with any costs before choosing to operate it.
	Other costs	No other airline costs are foreseen as part of the vectoring component of this option. The introduction of an RNP-AR route could result in additional costs for airlines not already approved. It is understood that aircraft manufacturer

Table 91 Easterly Arrivals Option 3 AONB Overflown

		Area (Km2) of AONB overflown. 0-7000ft
Day	Baseline Easterly Option 1 ARR	55.2
	Easterly Arrival Option 3	17.6
Night	Baseline Easterly Option 1 ARR	25.0
	Easterly Arrival Option 3	17.3

Table 92 Easterly Arrivals Option 2 Track Mileage, Fuel Burn and CO_2

	Difference from ZAZGO to THR (nm)	A320 fuel difference at FL160 (kg)	CO2 equiv increase (mt)
E Arriv Option 1 AV from ZAGZO (Baseline)	0	0	0.000
E Arriv Option 3 Av vector from ZAGZO	0	0	0
E Arriv Option 3 RNP AR from ZAGZO	-12	-88.8	-0.281

		approvals/certification can be as much as $60,000 per aircraft frame. However, this route would not be mandatory and airlines could consider the benefits against any costs associated with the route before choosing to operate it.
Airport / Air navigation service provider	Infrastructure costs	The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.
	Operational costs	This airspace change proposal is not anticipated to significantly change airport or ANSP operational costs other than the increase in costs required to maintain the additional Instrument Flight Procedure.
	Deployment costs	This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options. As this option largely replicates current day and is independent of other neighbouring airports, we anticipate that it will require less training that some of the other options however training still will be required.
All	Safety	New safety assurances would be required for the RNP-AR arrivals which have not yet been implemented in the UK. The greater safety issues that would need to be managed would be the operation of a piece of CAS that turned on/off at certain times of the day and/or days of the week. Changes to the Luton RMA to facilitate the move of the arrivals and improved CDA would require assurances once the wider LTMA design is established.
All	Interdependencies, conflicts and tradeoffs	The enabler for the move of the arrival swathe and improved CDA is improvements to vertical profiles for departures from Heathrow, Northolt and London City. Subject to improvements in those other profiles, no tradeoffs are anticipated.
All	AMS	CAP1711 describes the objective as: *Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.* This option would make use of the latest navigational technology to deliver environmental improvements which would directly support the objectives of the AMS. However, as currently designed, the RNP-AR route would require additional CAS which would not be aligned with wider AMS objectives. Improvements to CDA at Luton will deliver environmental benefits and noise reductions with fewer people overflown below 7000ft and less overflight of the Chilterns AONB.

Easterly Arrivals Option 4

Easterly Arrivals Option 4	
 **Period 1 (above) period 2 (below)** 	This option would see two PBN arrival transitions (yellow) from ZAGZO used in rotation to offer some respite (yellow). For this IOA, we have assumed they alternative each day, therefore each arrival route is in operation an equal amount of time over a year. A third more direct RNP-AR route is also available for periods of low traffic (red) between the hours of 21:00 and 07:00 for some aircraft that are equipped to use it. **This option is dependent on the integration with other FASI-S airports and the upper airspace design.**

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	This option offers 2 PBN approach transitions for respite, alongside an RNP-AR route for periods of low traffic between the hours of 21:00 and 07:00 (for those operators equipped and approved to use it). For this IOA, we estimate that the split of traffic is 45% on each of the PBN approach transitions and c.10% on the RNP-AR route to the shorter final approach; this will be investigated in further detail as part of the Full Options Appraisal subject to the option proceeding. Aircraft would be largely concentrated on the PBN Transitions however there would be some occasions, particularly during peak periods, where ATC will be required to vector aircraft to achieve the sequencing and spacing requirements between arrivals. This is because at the point of implementation, the technology required for the upper airspace to be able to sequence arrivals we anticipate may not be available. This will result in a vectoring swathe although it is expected to be smaller than the baseline. At this stage, quantifying the dispersion of a vectoring swathe that is not currently in operation is a challenging task owing to the unpredictable nature of vectoring; subject to this option progressing, we will explore this in further detail as part of the Full Options Appraisal at stage 3. The period 1 transition and period 2 transitions are positioned further north than the existing baseline arrival swathe in order to be able to accommodate Easterly Departure Group 5 and 6. The early part of the transitions (between 7000 – c.6000ft) routes slightly to the north of Leighton Buzzard, which results in the period 2 transition overflying this area. The areas of Wing and Wingrave are overflown by both the period 1 and period 2 transitions. The two transitions then join the final approach at c.12nm (22.5km) and overfly the same areas as arrivals today. This option also includes a PBN (RNP-AR) arrival route which some arrivals could use during periods of low traffic between the hours of c.21:00 and 07:00, outside of Gliding operations. Utilisation of an RNP-AR route during core arrival hours is unlikely because it would be very difficult to mix RNP-AR arrivals in with the main vectored swathe whilst delivering the required arrival spacing to the runway. Therefore, we assume that use of this route would be rather infrequent. This routes over the populated area of Ampthill however otherwise avoids areas of dense population. Aircraft using the RNP-AR route would be concentrated on the centreline with no vectoring. The RNP-AR route as illustrated meets the existing final approach path at around 6nm (around 11km) before landing, which is earlier than the proposed vectoring swathe which joins the final approach at c.8 – 13nm from landing (15-23.5km). This means that

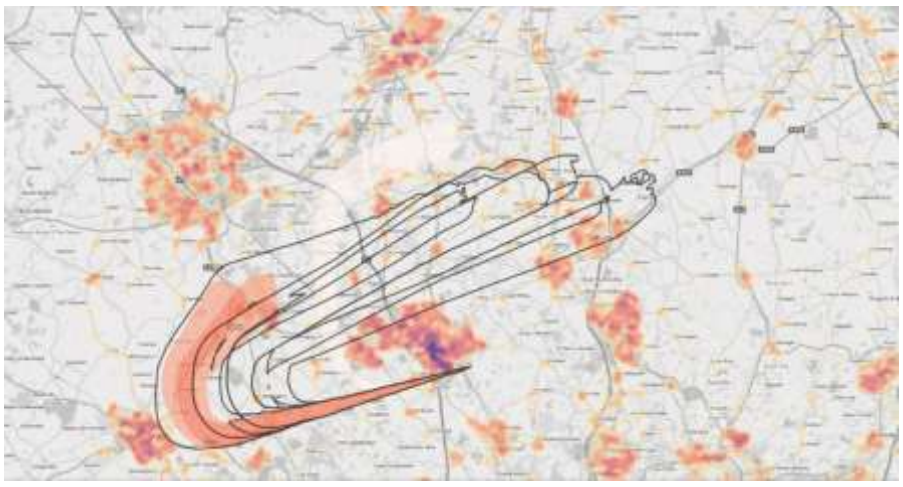


Figure 40 Easterly Arrivals Option 4 overflight day, with population density and baseline (black outline).

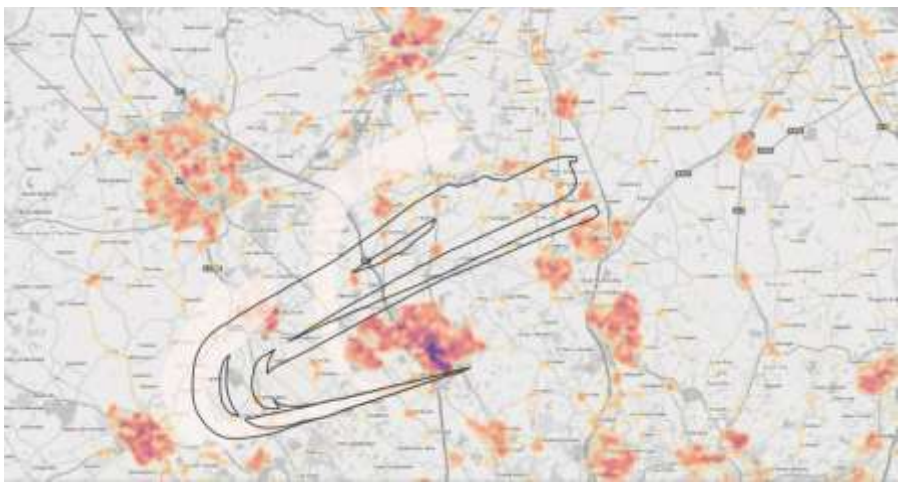


Figure 41 Easterly Arrivals Option 4 overflight night, with population density and baseline (black outline).

implementation of an RNP-AR route would offer a reduction in the frequency of overflight for those under final approach outside of c.6nm. Such a route would require a change to Luton's Nighttime noise abatement rules for establishing on final approach.

The RNP-AR route would only be available when the Dunstable gliding area is inactive. This has the potential to be managed on an adhoc basis and/or at relatively short notice (for example on days when gliding areas cannot be used due to weather). This however means that it is very difficult to predict the use of the route. For the purposes of this Initial Options Appraisal, we have assumed use of this route is standardised to a 2100-0700 time period but that is subject to negotiation and agreement with multiple industry organisations. However, for this route to be contained within CAS it would require a lowering of part of CTA5 and possibly CTA6.

We have assumed that the vertical profiles on all three routes allow improved continuous descent approaches compared to the baseline. This means that this option is dependent on the FASI-S programme and upper airspace designs.

L_{Aeq}

The arrivals component of the L_{Aeq} contours is mainly based along the extended runway centreline as arrivals are aligned with this when on final approach. Although this option results in a change from the baseline vectoring area swathe, aircraft will join the final approach at a similar point to today. The introduction of an RNP-AR route has the potential to make a very small, almost imperceptible adjustment to the daytime L_{Aeq} contour, as some aircraft will now join final approach closer than they do today, however owing to low numbers of aircraft that are anticipated to operate this route during the daytime period, we do not expect this to fundamentally change the shape or size of the LOAEL day contours. At night when there are lower traffic periods, there is an opportunity to utilise the RNP-AR route more which may have a very small influence on the night time contours. This may have a very small influence on the contours however owing to the modal split, it is not anticipated that this would be significant. We will look at this in further detail as part of our FOA at Stage 3 should this option progress.

With regards to LLAOL's L_{Aeq} contours that form part of the planning condition, we do not expect this option to impact the size of the 57dB(A) Leq16hr or 48dB(A) Leq8hr contours.

The full L_{Aeq} contours will be quantified as part of our Stage 3 Full Options Appraisal.

Overflight

The overflight diagrams shown in technical appendix A demonstrate the change in overflight contours as a result aircraft now following the two transitions or the RNP-AR route. The below table shows the 0-7000ft population overflight data for the option along with a comparison against the baseline (centreline).

Table 93 Easterly arrivals option 4 0-7000ft overflight data

		Population over flown 0-7000ft (1 times per day)	Population over flown 0-7000ft (10 times per day)	Population over flown 0-7000ft (50 times per day)	Population over flown 0-7000ft (100 times per day)	Population over flown 0-7000ft (150 times per day)
Day	Baseline Easterly Option 1 ARR	251829.3	52554.5	0.0	0.0	0.0
	Easterly Arrival Option 4	65848.4	52548.1	0.0	0.0	0.0
Night	Baseline Easterly Option 1 ARR	105765.2	0.0	0.0	0.0	0.0
	Easterly Arrival Option 4	65864.7	0.0	0.0	0.0	0.0

The data shows a significant decrease in the number of population overflown once per day during the day. The number of people overflown 10 times per day remains the around about the same. This can be linked to the nature of PBN where this option removes the dispersal of vectoring and concentrates traffic over less populated areas. During the nighttime, there is a decrease in the number of people overflown on average once, which again can be linked to the PBN routes that overfly less populated areas. No population are overflown 10 times per night or more, and this is because the overflight calculations look at the average overflight taking into account modal split; as part of our Stage 3 FOA we will provide 100% easterly and 100% westerly contours.

Data on the number of noise sensitive sites (schools, hospitals and places of worship) largely shows decreases in the number of schools, hospitals and places of worship overflown between 0-7000ft. The full data tables, including a split of overflight between 0-4000ft and 4-7000ft, and counts of noise sensitive sites such as hospitals and schools, are detailed in technical appendix A.

Respite

This option offers 2 PBN approach transitions for respite alongside the RNP-AR route. For this IOA, we estimate that the split of traffic is 45% on each of the PBN approach Transitions and c.10% on the RNP-AR route to the shorter final approach. However the requirement to still vector arrivals to deliver accurate runway spacing means that the amount of respite that could be guaranteed is not known at this stage; this will be investigated in further detail as part of the Full Options Appraisal subject to the option proceeding.

	Air Quality	The option is unlikely to have a significant adverse impact on air quality. Emissions from aircraft more than about 200 m above the ground have negligible impact on ground-level air quality, and the option will not affect emissions below this height. Furthermore, recent air quality assessments for Luton Airport, in support of the 19 mppa planning application and the PEIR for the 32 mppa DCO application, have shown that there would be no likely significant effects on air quality from these proposals; this FASI-S ACP will have

<table>
<tr><td></td><td></td><td>much smaller changes to emissions than the 19 mppa or 32 mppa proposals so is even less likely to have significant impacts on air quality.</td></tr>
<tr><td rowspan="4">Wider Society</td><td>Greenhouse gas impact</td><td>The period 1 and period 2 approach transitions as illustrated are expected to increase track mileage by c.1nm compared to the baseline. We estimate that this would be an increase in fuel burn of 7.4kg and is the CO_2 equivalent of 0.023mt. The RNP-AR route from ZAGZO will offer a track mileage saving of c14nm which equates to 88.8kg of fuel savings per flight which is a CO_2 equivalent of 0.281mt. Most arrivals will use the approach transitions, with a small number using the RNP-AR route between 21:00 -07:00.

Overall based on this initial assessment, it is anticipated that there might be an increase to greenhouse gas emissions as a result of this option however further investigation would be required, should this option progress, as part of the FOA at Stage 3.
Table 94 Easterly Arrivals Option 4 Track Mileage, Fuel Burn and CO_2
<table>
<tr><th></th><th>Difference from ZAZGO to THR (nm)</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th></tr>
<tr><td>E Arriv Option 1 AV from ZAGZO (Baseline)</td><td>0</td><td>0</td><td>0.000</td></tr>
<tr><td>E Arriv Option 4 PBN 1 from ZAGZO</td><td>1</td><td>7.4</td><td>0.023</td></tr>
<tr><td>E Arriv Option 4 PBN 2 from ZAGZO</td><td>1</td><td>7.4</td><td>0.023</td></tr>
<tr><td>E Arriv Option 4 RNP AR from ZAGZO</td><td>-12</td><td>-88.8</td><td>-0.281</td></tr>
</table></td></tr>
<tr><td>Capacity / resilience</td><td>The introduction of two PBN transitions is not expected to offer a benefit or impact to capacity compared to the baseline provided that ATC retain the ability to vector arrivals to ensure accurate and safe final approach spacing. Without the ability to vector, this option could impact capacity. The RNP-AR route is not expected to enhance capacity.</td></tr>
<tr><td>Tranquility</td><td>Aircraft today overfly the Chilterns AONB. Aircraft overfly the Chilterns AONB as they are vectored onto final approach, the alignment of aircraft on final approach then results in concentrated noise occurring over the Chilterns AONB. The RNP-AR arrival cannot be designed to avoid the AONB without also overflying Luton town centre at low altitude (c.1-2000ft). Easterly arrival option 4 offers an opportunity to reduce the area overflown however this does increase the frequency of overflight.

Table 95 Easterly Arrivals Option 4 AONB overflown
<table>
<tr><th></th><th>Option</th><th>Area (Km2) of AONB overflown. 0-7000ft</th></tr>
<tr><td rowspan="2">Day</td><td>Baseline Easterly Option 1 ARR</td><td>55.2</td></tr>
<tr><td>Easterly Arrival Option 4</td><td>16.8</td></tr>
<tr><td rowspan="2">Night</td><td>Baseline Easterly Option 1 ARR</td><td>25.0</td></tr>
<tr><td>Easterly Arrival Option 4</td><td>16.7</td></tr>
</table></td></tr>
<tr><td>Biodiversity</td><td>On arrival all flights will be over 1,000ft when each aircraft is more than 6km from the airfield. Over this altitude the potential effects of air quality on sensitive habitats can be discounted. There are no Ramsar sites, SPAs, SACs or SSSIs within this distance that are overflown or are close to be overflown (using noise contours as a proxy for discrimination). All flights will be over 3,000ft after a distance of 18km is covered. Over this altitude the potential effects of noise and visual disturbance on sensitive species can be discounted. Within 18km of the airfield and on the arrival route lies Kensworth Chalk Pit SSSI (11km) and the Dunstable and Whipsnade Downs SSSI (13.5km). However, as the designated features of this site (geology, habitats and invertebrate fauna) are not prone to disturbance this potential effect can be discounted.</td></tr>
<tr><td>General Aviation</td><td>Access</td><td>This option is dependent on changes to other airports' routes to enable CDA and does not require more controlled airspace to facilitate the PBN transitions.

An RNP-AR arrival to establish on final approach closer than today would require a lowering of part of CTA5 and possibly CTA6. As discussed, this route would only be available outside of Gliding Operations so the RNP-AR would either be limited to night, with CAS established at Night time only, or if it were to be used ad-hoc when Gliding Operations are not taking place, the CAS would need establishing on a permanent basis. This would be in a very busy piece of GA airspace and the use of the route is likely to be of a relatively low frequency with associated low benefit compared to the disruption to GA activities in order to establish the CAS.</td></tr>
<tr><td rowspan="2">General Aviation / Commercial airlines</td><td>Economic impact from increased effective capacity</td><td>We do not expect any change from the baseline as a result of this option.</td></tr>
<tr><td>Fuel burn</td><td>The period 1 and period 2 approach transitions are expected to increase track mileage by c.1nm compared to the baseline and therefore we estimate that this would be an increase in fuel burn of 7.4kg. The RNP-AR route from ZAGZO will offer a track mileage saving of c14nm which equates to 88.8kg of fuel savings per flight. Most arrivals will use the approach transitions, with a small number using the RNP-AR route between 21:00 -07:00.

Overall based on this initial assessment, it is anticipated that there might be a very small impact to fuel burn emissions as a result of this option however further investigation would be required, should this option progress, as part of the FOA at Stage 3.</td></tr>
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<tr><td></td><td></td><td>

Table 96 Easterly Arrivals Option 4 Track Mileage and Fuel Burn

<table>
<tr><th></th><th>Difference from ZAZGO to THR (nm)</th><th>A320 fuel difference at FL160 (kg)</th><th>CO2 equiv increase (mt)</th></tr>
<tr><td>E Arriv Option 1 AV from ZAGZO (Baseline)</td><td>0</td><td>0</td><td>0.000</td></tr>
<tr><td>E Arriv Option 4 PBN 1 from ZAGZO</td><td>1</td><td>7.4</td><td>0.023</td></tr>
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<tr><td>E Arriv Option 4 RNP AR from ZAGZO</td><td>-12</td><td>-88.8</td><td>-0.281</td></tr>
</table>

</td></tr>
<tr><td rowspan="2">Commercial airlines</td><td>Training costs</td><td>Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required. The two PBN transitions that form part of this option are not expected to result in any additional training costs for airlines.

There will be a cost to airlines to train crews to operate the RNP-AR route if they are not already approved however this route would not be mandatory and airlines could choose whether the benefits of the route balance with any costs before choosing to operate it.</td></tr>
<tr><td>Other costs</td><td>No other airline costs are foreseen as part of the RNAV1 PBN transitions. The introduction of an RNP-AR route could result in additional costs for airlines not already approved . It is understood that aircraft manufacturer approvals/certification can be as much as $60,000 per aircraft frame. However, this route would not be mandatory and airlines could consider the benefits against any costs associated with the route before choosing to operate it.</td></tr>
<tr><td rowspan="3">Airport / Air navigation service provider</td><td>Infrastructure costs</td><td>The initial deployment phase of the ACP may require some ATC system engineering amendments however beyond this there are not expected to be any changes to infrastructure for the airport or the ANSP.</td></tr>
<tr><td>Operational costs</td><td>This airspace change proposal is not anticipated to significantly change airport or ANSP operational costs other than the increase in costs required to maintain the additional three Instrument Flight Procedures.</td></tr>
<tr><td>Deployment costs</td><td>This option is expected to require air traffic controller training for the controllers and assistants located at NATS Swanwick and Luton Airport. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal when we are appraising our shortlist of options. As this option would form part of wider FASI airspace changes, we anticipate that it will require more training that some of the other options.</td></tr>
<tr><td>All</td><td>Safety</td><td>New safety assurances would be required for the RNP-AR arrivals which have not yet been implemented in the UK. The risk of an aircraft incorrectly selecting the wrong PBN arrival route also needs to be managed, with three different arrival routes published in the AIP. The greater safety issues that would need to be managed would be the operation of a piece of CAS that turned on/off at certain times of the day and/or days of the week. Changes to the Luton RMA to facilitate the move of the arrivals and improved CDA would require assurances once the wider LTMA design is established.</td></tr>
<tr><td>All</td><td>Interdependencies, conflicts and tradeoffs</td><td>The enabler for the PBN transitions and improved CDA is improvements to vertical profiles for departures from Heathrow, Northolt and London City. Subject to improvements in those other profiles, no tradeoffs are anticipated.</td></tr>
<tr><td>All</td><td>AMS</td><td>CAP1711 describes the objective as:
Deliver quicker, quieter and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.

This option would make use of the latest navigational technology to deliver environmental improvements which would directly support the objectives of the AMS. However, as currently designed, the RNP-AR route would require additional CAS which would not be aligned with wider AMS objectives. Improvements to CDA at Luton will deliver environmental benefits and noise reductions with fewer people overflown below 7000ft and less overflight of the Chilterns AONB.</td></tr>
</table>

5. Conclusion

IOA Summary and Conclusion

The following sections provide an overview of the outcome of the IOA before explaining whether an option has been progressed into Stage 3 and the rationale around this. It is important to note we have identified that further qualitative assessment is required for some categories; details have been included, where applicable, in the full IOA tables and is also summarised in the 'preferred option' section below.

Key	
	Anticipated overall net impacts/costs; the option may have only impacts or may have a mix of benefits and impacts where the impacts outweigh the benefits
	Neutral; the option either offers neutral benefit, or may have a mix of benefits and impacts
	Anticipated overall net benefits/costs; the option may have only benefits or may have a mix of benefits and impacts where the benefits outweigh the impacts

Westerly Departures

Group	Impact	Option 1 (Baseline)	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8
Communities	Noise impact on health and quality of life								
	Air Quality								
Wider Society	Greenhouse gas impact								
	Capacity / resilience								
	Tranquility								
	Biodiversity								
General Aviation	Access								
General Aviation / Commercial airlines	Economic impact from increased effective capacity								
	Fuel burn								
Commercial airlines	Training costs								
	Other costs								
Airport / Air navigation service provider	Infrastructure costs								
	Operational costs								
	Deployment costs								
All	Safety								
All	Interdependencies, conflicts and tradeoffs								
All	AMS								
Option progressed to Stage 3		X	✓	X	✓	✓	✓	X	X

LLAOL FASI-S Initial Options Appraisal

Option	Is the option being progressed	Rationale
Westerly SID Group 1	No	Doing nothing for Westerly departures is not an option. It will not align with the AMS or many of our Design principles. It will not enable any environmental benefits or help to reduce the interdependencies and constraints within the LTMA. No improvements to vertical profiles from Luton will not enable any reduction in the volume of controlled airspace.
Westerly SID Group 2	Yes	Although only a relatively minor change as currently illustrated, the repositioning of the MATCH SID to the north of BPK is expected to reduce the number of interactions with departures from other LTMA airfields. As a result, we would expect to see an improvement in CCO performance, a reduction in numbers of people overflown below 7000ft and a small reduction in complexity within the LTMA. The nature of the benefits will be assessed in the Full Options Appraisal to determine if the costs of making the change delivers sufficient benefit. This change could be progressed earlier than the wider Core LTMA deployments owing to the lack of dependencies on other airports. The change is not expected to constrain the options associated with the core LTMA deployments later because the published SID levels would remain as today, with the SID tracks moved further from those airports. Should Luton progress and implement this option within the existing network, they remain committed to further changes and enhancements as part of the Core LTMA deployments.
Westerly SID Group 3	No	The earlier divergence of the MATCH and CPT/OLY SIDs would share the noise, as desired by our Design principles. However, due to the constraints of the gliding areas, those routes could not diverge sufficiently enough to avoid populated areas. The existing SID tracks all route between Markyate and Flamstead and therefore overfly an area of very low population at low altitude which keeps the number of people adversely affected by aircraft noise to a minimum. By splitting the SID tracks whilst keeping a safe distance away from the gliding areas, this results in direct overflight of Markyate where aircraft could be expected to be c.1500-2000ft which would increase the number of people adversely affected. Whilst this is what can be expected from 'sharing of noise', the low level of population under the existing centreline suggests that significantly more people will disbenefit from this change than would benefit from the reduced frequency of overflight. This option offers no mitigating features for those communities that would be newly affected by aircraft noise and does not offer any other significant benefit in terms of improved environmental performance, CCO, LTMA capacity or CAS reductions. Upgrading the OLY and CPT SIDs to PBN without any another improvements/benefits is not worthy of progression at this time.
Westerly SID Group 4	Yes	Although this option would increase the number of people overflown at low altitude, there are features which could help to mitigate the negative impacts on those newly overflown through the use of multiple SIDs to reduce the frequency of overflight. We will also investigate a divergence slightly later than currently illustrated to reduce numbers adversely affected. There are other benefits which could also make the change worthwhile, particularly through the reduced track miles realised with the shorter MATCH SID. This change could be progressed earlier than the wider Core LTMA deployments owing to the lack of dependencies on other airports. The change is not expected to constrain the options associated with the core LTMA deployments later because the published SID levels would remain as today, with the SID tracks moved further from those airports. Should Luton progress and implement this option within the existing network, they remain committed to further changes and enhancements as part of the Core LTMA deployments.
Westerly SID Group 5	Yes	Whilst very similar to Westerly SID Group 3, the other benefits realised by FASI could expect to improve CCO, LTMA capacity or CAS reductions. We will also investigate in more detail if we can delay the SID divergence until after Markyate together with refinements to the rest of the routes to deliver the greatest FASI benefits.
Westerly SID Group 6	Yes	This option was the best performing option in the Design Principle Evaluation. The ability to potentially have the Period 2 CPT/OLY SIDs further south than today also generates more scope to delay the divergence of these SIDs until after Markyate. This option appears to distribute noise most equitably whilst it is hoped wider LTMA changes can deliver improved CCO and enable reductions in the volume of CAS.
Westerly SID Group 7	No	This option is not being progressed as it is highly likely to increase the size (Km^2) of Luton's noise contours owing the cumulative effect of overflight of easterly arrivals and westerly Period 2 departures which would breach planning constraints. It would also greatly increase population numbers experiencing adverse effects at very low altitude and significantly increase the numbers of people within the nighttime LOAEL. This option would also require additional CAS for the Period 2 SIDs.
Westerly SID Group 8	No	This option is not being progressed as it is highly likely to increase the size (Km2) of Luton's noise contours owing the cumulative effect of overflight of easterly arrivals and westerly Period 2 departures which would breach planning constraints. It would also increase population numbers experiencing adverse effects at very low altitude, significantly increase the numbers of people within the nighttime LOAEL and significantly increase miles (CO2) of MATCH departures.

LLAOL FASI-S Initial Options Appraisal

Easterly Departures

Group	Impact	Option 1 (Baseline)	Option 2	Option 3	Option 4	Option 5	Option 6
Communities	Noise impact on health and quality of life						
	Air Quality						
Wider Society	Greenhouse gas impact						
	Capacity / resilience						
	Tranquility						
	Biodiversity						
General Aviation	Access						
General Aviation / Commercial airlines	Economic impact from increased effective capacity						
	Fuel burn						
Commercial airlines	Training costs						
	Other costs						
Airport / Air navigation service provider	Infrastructure costs						
	Operational costs						
	Deployment costs						
All	Safety						
All	Interdependencies, conflicts and tradeoffs						
AMS	A qualitative (high-level) assessment of how the Design Options perform against the vision and parameters / strategic objectives of the AMS						
Option progressed to Stage 3		✗	✗	✓	✓	✓	✓

Option	Is the option being progressed	Rationale
Easterly SID Group 1	No	Doing nothing for Easterly departures is not an option. It will not align with the AMS or many of our Design principles. It will not enable any environmental benefits or help to reduce the interdependencies and constraints within the LTMA. No improvements to vertical profiles from Luton will not enable any reduction in the volume of controlled airspace.
Easterly SID Group 2	No	Replicating MATCH and largely replicating CPT does not deliver sufficient benefit. Implementing a new OLY SID that still requires routine vectors and with a centreline over increased population is not being progressed. This option performed more poorly than the Do Nothing option (E SID Group 1) in the Design Principle Evaluation.
Easterly SID Group 3	Yes	If it is possible to design a CPT SID which avoids Harpenden then it is worth progressing this option especially if used in combination with a more direct MATCH SID. We also need to keep an option without track adjustments on the table in case they prove to generate technical issues during simulator validation. The ability to avoid Harpenden is heavily reliant on the shortlisted options from Heathrow, Northolt and London City. Once those airports are into Stage 3 we will be able to understand the viability of doing so.
Easterly SID Group 4	Yes	We expect that it is possible to introduce this option ahead of a Core LTMA deployment which would deliver benefits to the AMS early through CO2 reductions, reduced departure intervals and noise benefits to the Breachwood Green community. If this option was to also investigate a more direct MATCH SID, that would further enhance benefits. Should Luton progress and implement this option within the existing network, they remain committed to further changes and enhancements as part of the Core LTMA deployments.
Easterly SID Group 5	Yes	This option performed very well in the Design Principle Evaluation and combines track adjustments on departure with the ability to reduce overflight of the south of Luton, increase the chances of CCO, avoid Hitchen with OLY/CPT departures and enable CO2 savings. Further work required in Stage 3 to understand if improvements can be made to the CPT departures in the upper network to help offset the increased miles by routing to the North of Luton. Note this option is dependent on CCO as well as significant changes to the Easterly Arrivals.
Easterly SID Group 6	Yes	This option performed best in the Design Principle Evaluation and combines track adjustments on departure with the ability to reduce overflight of the south of Luton, increase the chances of CCO, avoid Hitchen with OLY/CPT departures and enable CO2 savings. Further work required in Stage 3 to understand if improvements can be made to the CPT departures in the upper network to help offset the increased miles by routing to the North of Luton. Note this option is dependent on CCO as well as significant changes to the Easterly Arrivals. The presence of 2 sets of SIDs means that the optimal solutions from a CO2 and wider efficiency perspective is reduced and consideration needs to be given in Stage 3 as to the benefits realised from respite SIDs on easterly operations.

Westerly Arrivals

Group	Impact	Option 1 (Baseline)	Option 2	Option 3	Option 4
Communities	Noise impact on health and quality of life				
	Air Quality				
Wider Society	Greenhouse gas impact				
	Capacity / resilience				
	Tranquility				
	Biodiversity				
General Aviation	Access				
General Aviation / Commercial airlines	Economic impact from increased effective capacity				
	Fuel burn				
Commercial airlines	Training costs				
	Other costs				
Airport / Air navigation service provider	Infrastructure costs				
	Operational costs				
	Deployment costs				
All	Safety				
All	Interdependencies, conflicts and tradeoffs				
AMS	A qualitative (high-level) assessment of how the Design Options perform against the vision and parameters / strategic objectives of the AMS				
Option progressed to Stage 3		X	✓	✓	✓

Option	Is the option being progressed	Rationale
Westerly Arrival 1	No	Whilst it is not expected that changes to Luton's Westerly Arrival flows will be required to enable wider LTMA improvements, doing nothing with Westerly arrivals will not align with the AMS. It will not enable any environmental benefits through improvements to vertical profiles into Luton and will not enable any reduction in the volume of controlled airspace which may be possible with CDA from above 5000ft.
Westerly Arrival 2	Yes	An RNP-AR arrival could deliver significant benefit for Westerly operations which are c.70% of the time. Luton will investigate this option in greater detail in Stage 3 and investigate the volume of CAS required as well as looking at refinement of the shorter arrival route to see if it is possible to avoid any additional CAS whilst still delivering environmental benefit.
Westerly Arrival 3	Yes	Even though patterns and traffic flows may not need to change to enable all of Luton's SID options, if the wider LTMA design enables a higher RMA, Luton will make those changes to accommodate improved CDA and where possible, CAS release. An RNP-AR arrival could deliver significant benefit for Westerly operations which are c.70% of the time. Luton will investigate this option in greater detail in Stage 3 and investigate the required CAS required as well as looking at refinement of the shorter arrival route to see if it is possible to avoid any additional CAS whilst still delivering environmental benefit.
Westerly Arrival 4	Yes	This option performed the best in our design principle evaluation. However, we note that in the recent AD6 consultation, there was a clear desire for vectoring to remaining the preferred arrival mechanism for Luton. Use of PBN arrivals can improve CDA performance and provides more certainty for crews however vectoring will still be required during peak arrival times.

LLAOL FASI-S Initial Options Appraisal

Easterly Arrivals

Group	Impact	Option 1 (Baseline)	Option 2	Option 3	Option 4
Communities	Noise impact on health and quality of life				
	Air Quality				
Wider Society	Greenhouse gas impact				
	Capacity / resilience				
	Trainquillity				
	Biodiversity				
General Aviation	Access				
General Aviation / Commercial airlines	Economic impact from increased effective capacity				
	Fuel burn				
Commercial airlines	Training costs				
	Other costs				
Airport / Air navigation service provider	Infrastructure costs				
	Operational costs				
	Deployment costs				
All	Safety				
All	Interdependencies, conflicts and tradeoffs				
AMS	A qualitative (high-level) assessment of how the Design Options perform against the vision and parameters / strategic objectives of the AMS				
Option progressed to Stage 3		✗	✗	✓	✓

Option	Is the option being progressed	Rationale
Easterly Arrival 1	No	Whilst it is not expected that changes to Luton's Easterly Arrival flows will be required to enable wider LTMA improvements, doing nothing with Easterly arrivals will not align with the AMS. It will not enable any environmental benefits through improvements to vertical profiles into Luton and will not enable any reduction in the volume of controlled airspace which may be possible with CDA from above 5000ft.
Easterly Arrival 2	No	The benefits of an RNP-AR arrival that was only available on easterly operations and outside of gliding hours would be limited. The additional CAS required in a very busy piece of GA airspace would not be justified on a permanent basis. This would drive a requirement for an FUA CAS arrangement which would be extremely complicated to manage and we consider will introduce significant risk of confusion. Although the easterly RNP-AR arrival features in Easterly Arrival 3 and 4, it is likely that element of each option will not be progressed. However, if Easterly Arrival 3 and 4 are not eventually implemented, if the wider LTMA design enables a higher RMA, Luton will make those changes to accommodate improved CDA and where possible, CAS release
Easterly Arrival 3	Yes	The move of the arrival swathe will be progressed alongside Easterly SID Groups 5 and 6 as this is needed to facilitate left turn CPT departures from Runway 07. The RNP-AR element of this option is unlikely to be progressed due to the additional CAS and negative impacts on GA which are expected to outweigh the benefit to Luton.
Easterly Arrival 4	Yes	This option performed the best in our design principle evaluation. However, we note that in the recent AD6 consultation, there was a clear desire for vectoring to remaining the preferred arrival mechanism for Luton. Use of PBN arrivals can improve CDA performance and provides more certainty for crews. The RNP-AR element of this option is unlikely to be progressed due to the additional CAS and negative impacts on GA which are expected to outweigh the benefit to Luton.

Preferred option and Information to collect as part of the Full Options Appraisal

We have outlined which options we plan to take forward to Stage 3 as part of our IOA Summary and conclusion section. Throughout this Initial Options Appraisal, we have highlighted where we plan to undertake further detailed appraisal as part of our Stage 3 Full Options Appraisal, in order to further assess the benefits and impacts of an option. This is particularly the case with the primary noise metric data, where at Stage 3 we will full quantify the L_{Aeq} contours associated with each option allowing us to quantify the benefits and impacts and also understand what this might mean for the size of the contours.

As outlined throughout our stage 2A and stage 2B documentation, Luton's planning conditions require that we produce and publish daytime (57 dB LAeq,16h) and night-time 48 dB LAeq,8h contours on an annual basis. A constraint within the planning conditions mandates a limit on the area (km^2) of those contours, not the population numbers within them. This condition is extremely important for this ACP as it means that if any airspace design option is assessed as breaching this condition or in any way limiting LLAOL in achieving future reductions to the size of these contours, the option would be not progressed by LLAOL. However, to determine the size of the forecast contours based on the new airspace design option, requires noise modelling at a system level. This requires a complete system design of arrivals and departures modelled with a forecast schedule and fleet mix which is very detailed and time-consuming work. This detailed level of noise assessment will be undertaken as part of our Full Options Appraisal at Stage 3 on the options that have progressed from this IOA.

At this stage, where we do not have this detailed quantitative data, and where we have also identified other categories where further quantitative appraisal work is required, we do not feel it is appropriate to select a preferred option. We therefore plan to collect the following data as part of our Full Options Appraisal assessment and following this assessment we will outline the options that we intend to take to Consultation and our preferred option.

- Quantitative L_{Aeq} contours, population counts and size (km^2)
- WebTAG outcomes
- Quantitative overflight contours including 100% easterlies and westerlies, and cumulative impacts from arrivals/departures and other airports
- Detailed track length comparison
- Detailed fuel burn and equivalent CO_2 emissions data
- Further information around interdependencies with the upper network and neighbouring airports
- ATC deployment / training costs
- Quantitative capacity information
- Quantified CAS requirements
- Further information following engagement with gliding areas around airspace availability

Impacted Audiences

At the 'Develop and assess' gateway, the IOA must set out impacted audiences, as this information will be a key feature in developing the consultation strategy required during Step 3A and at the 'Consult' gateway.

The following figures show our dependent and independent options on one map image, displayed using overflight contours. We will use this mapping as a starting point to identify our impacted audiences and ensure that this is considered when developing our consultation strategy at Stage 3. We're aware that other factors also need to be taken into account when identifying the audience such as other noise metrics, changes to controlled airspace etc and we will ensure these are also factored in.

Figure 43 All Independent Options for Stage 3 (Overflight Contours)

Figure 42 All dependent Options for Stage 3 (Overflight Contours)