Initial Options Appraisal – V2

Stage 2 Develop and Assess

MAG London Stansted Airport

Document Details

Reference	Description
Document Title	Initial Options Appraisal Report (IOA)
Version	V2
Date	April 2022
Document History	V1 – submitted to CAA February 2022
Amendments	1. Description of the 'Do Nothing' baseline scenario has been amended to improve clarity and consistency: • Section 2.6.2, page 22 • Section 3.4, page 28 • Section 3.6.1, page 20 • Section 3.7.1, page 40 • Section 3.8, page 41 2. The rationale for using a 'Do Nothing' baseline in the IOA has been updated to improve clarity: • Section 2.5.1, page 18 3. Addition of an explanation of the noise modelling category currently assigned to STN and the approach that is proposed for this airspace change: • Section 6.2, page 56 4. Addition of a reference to the Design Options Evolution document, a new report provided to show the evolution of the design options: • Section 2.5.1, page 18 5. The IOA has been amended to clarify the approach to CAS requirements: • Section 8, page 62

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Glossary of Terms

Term	Definition
ACOG	Airspace Change Organisation Group
'Listening to Stakeholders – Our Proposed Design Principles for Airspace Change'	A document that formed part of London Stansted Airport's Stage 1 submission to the CAA https://airspacechange.caa.co.uk/documents/download/2156
ABBOT	One of two existing hold stacks used at London Stansted Airport.
ACP	The Airspace Change Proposal at London Stansted Airport.
Agl	Above ground level
AIP	Aeronautical Information Publication. A document published by the UK CAA which contains information essential to air navigation. eAIS Package United Kingdom (nats.co.uk)
AMS	Airspace Modernisation Strategy (CAP1711). This is the Government's strategy and plan for the use of UK airspace, including the modernisation of airspace. www.caa.co.uk/cap1711
ACOG	Airspace Change Organisation Group
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AMS	Airspace Modernisation Strategy (CAP1711). This is the Government's strategy and plan for the use of UK airspace, including the modernisation of airspace. www.caa.co.uk/cap1711
Amsl	Above mean sea level

Term	Definition
ANSP	Air Navigation Service Provider: An organisation which operates the technical system, infrastructure, procedures and rules of an air navigation service system, which includes air traffic control.
AONB	Area of Outstanding Natural Beauty: An area of countryside which has been designated for conservation because of its significant landscape value, recognising its national importance.
AQMA	Air Quality Management Area: Designated by a local authority and subject to a Local Air Quality Management Plan
ATC	Air Traffic Control: Service from an air navigation service provider providing guidance to aircraft through controlled airspace.
ATM	Air Transport Movement: An aircraft operation for commercial purposes, as opposed to flight for recreational or personal reasons.
ATS	Air Traffic Services
Biodiversity	The variability among living things from all ecosystems (including terrestrial, marine, and other aquatic among others) and the ecological complexes of which they are part; including diversity within species, between species and of ecosystems (ref: www.caa.co.uk/cap1616)
BKY	Abbreviation for the Barkway navigation beacon and routes that use that as a navigation point.
CAA	Civil Aviation Authority: the aviation industry's regulator.
CAP	Civil Aviation Publication: A document published by the UK CAA which can provide information, guidance or policy depending on the subject covered. The list of all CAPs is published on the CAA website at www.caa.co.uk
CAP1616	The CAA's Airspace Change guidance document. It sets out the regulatory process which all airspace change proposals must follow.www.caa.co.uk/cap1616
CCO	Continuous Climb Operations: Allows departing aircraft to climb continuously, which reduces the level of noise heard on the ground and also reduces fuel burn and emissions.
CDA	Continuous Descent Approach: Allows arriving aircraft to descend continuously which reduces the level of noise heard on the ground and also reduce fuel burn and emissions.
Change sponsor	An organisation that proposes, or sponsors, a change to the airspace design in accordance with the CAA's airspace change process.
CLN	Abbreviation for the Clacton navigation beacon and routes that use that as a navigation point.

Term	Definition
Comprehensive List	The full list of design options that are viable designs as required by Stage 2 of the CAP1616 process and which are detailed in the Design Options Report.
CONOPS	Concept of Operations: A document that outlines how we want the airspace system to work in the future and the standards that we will use.
Controlled airspace	Controlled airspace is airspace within which air traffic control services are provided. There are different classifications which define the air traffic control service provided and the requirements of aircraft flying within it. All commercial (passenger) flights fly within controlled airspace.
COVID-19	A disease caused by a new strain of Coronavirus.
CP	Country Park: Areas of land designated and protected by local authorities to provide access to the countryside.
dB	Decibels: a unit used to measure noise levels.
DEFRA	Department for the Environment, Food and Rural Affairs (UK Government)
DER	Departure End of Runway. A term that, when used in PANS-OPS 8168, determines the start point for the design of a departure procedure.
Design option	An output from the route design process that responds to the design principles and the Statement of Need (SoN). Design options are a requirement of the CAP1616 process. During the engagement carried out at Stage 2, design options were also referred to as "route options".
Design principles	The principles encompassing the safety, environmental and operational criteria and the strategic policy objectives that the change sponsor seeks to achieve in developing the airspace change proposal. They are an opportunity to combine local context with technical considerations and are therefore drawn up through discussion with affected stakeholders and – in Stansted's case – members of the public. The design principles at London Stansted Airport were established during Stage 1 of the CAP1616 process.
DET	Abbreviation for the Detling navigation beacon and routes that use that as a navigation point.
DfT	Department for Transport
DME	Distance Measuring Equipment
DOR	Design Options Report: This responds to the requirements of CAP1616 to develop a comprehensive list of options that address the Statement of Need (SoN) and that align with the design principles. It details the design process and the output of that process in the form of design options for both departures and arrivals.
DPE	Design Principles Evaluation: The document that undertakes an evaluation of the Viable and Good fit options described in this report against the Design Principles.
FAF	Final Approach Fix: The point at which an aircraft starts its final approach to land.

Term	Definition
FASI-S	Future Airspace Strategy Implementation - South: The programme of airspace changes across the southern part of the UK, including London, that is implementing the Governments Airspace Modernisation Strategy.
FIR	Flight Information Region: Airspace delegated to a country by ICAO. In the UK there are two FIRs, London and Scottish.
Flight path	The routes taken by aircraft within airspace.
FOA	Full Options Appraisal: The options appraisal carried out at Stage 3 of the CAP1616 process.
Focus group	Group of representative stakeholders brought together to discuss proposals and offer feedback.
Ft.	Feet
GA	General Aviation
GDPR	The General Data Protection Regulations
GIS	Geographic Information System
GNSS	Global Navigation Satellite System: A term used to describe a system that uses satellites for position fixing.
IAF	Initial Approach Fix: The start of the approach phase of flight. For the Stansted arrival design options, the IAF is at 7,000ft unless stated otherwise.
ICAO	International Civil Aviation Organisation: an agency of the United Nations
IFP	Instrument Flight Procedures.
ILS	Instrument Landing System: A radio navigation system that provides vertical and horizontal guidance to arriving aircraft to help them land safely, especially in bad weather.
IOA	Initial Options Appraisal: The document that is the first iteration of the three option appraisals required by CAP1616 - the design options appraised within the IOA are the outputs from the Design Principles Evaluation (DPE).
LAM	Abbreviation for the Lambourne navigation beacon and routes that use that as a navigation point.
LNAV	Lateral Navigation: A term for lateral navigation used within Performance Based Navigation
LOREL	One of two existing hold stacks used at London Stansted Airport.
LTMA	London Terminal Manoeuvring Area: The designated area of controlled airspace surrounding the London airports.

Term	Definition
m	Metres
MAGIC Map	Interactive map managed by DEFRA containing authoritative geographic information about the natural and built environment from across Government.
MAP	Missed Approach Procedure: A documented procedure for an aircraft to follow if a safe landing cannot be completed.
Masterplan	The strategic plan for the coordinated national programme of airspace change, created by the Airspace Change Organising Group (ACOG) under the direction of the CAA and DfT.
MSD	Minimum Stabilisation Distance: A design criteria within PANS-OPS 8168 that ensures aircraft stability when flying a procedure.
NATS	The air navigation service provider for the UK, formerly National Air Traffic Services. NATS 'en-route' manage the traffic in the upper airspace and also climbing and descending to land in the London area.
NERL	NATS En-Route Ltd: The part of NATS that delivers en-route air traffic control.
Nm	Nautical Miles
NNR	National Nature Reserves: Designated under the National Parks and Access to the Countryside Act 1949 and the Wildlife and Countryside Act 1981 to protect important habitats, species or geology.
Noise-sensitive receptors	Specific locations identified as likely to be adversely affected by noise from or due to aircraft operations. Individual locations will have varying degrees of sensitivity (measured noise exposure levels) depending upon their use.
NP	National Park: Designated areas under the National Parks and Access to the Countryside Act 1949 to protect landscapes because of their special qualities
NUGBO	A navigation fix to the NW of Stansted used by STN departures that exit UK to the south west.
PANS-OPS 8168	An ICAO document that stands for Procedures for Air Navigation Services. This outlines the rules and criteria for designing instrument flight procedures for aircraft.
PBN	Performance Based Navigation: Which is a range of specifications that requires aircraft to navigate to specific accuracy standards, mainly by using satellite-based navigation systems. It is designed to improve track-keeping accuracy for departing and arriving aircraft. The transition to PBN is a foundation to the Airspace Modernisation Strategy and this ACP.
RAG	Red, Amber, Green
Ramsar	Wetlands of international importance designated under the Ramsar Convention 1976.

Term	Definition
RNAV1	Area Navigation 1 is one of the specifications within Performance Based Navigation (PBN). Aircraft must maintain specific navigational accuracy within the flight.
RNP APCH	Required Navigation Performance Approach: A type of RNP procedure used in the descent phase of flight.
RNP1	Required Navigation Performance: One of the specifications under Performance Based Navigation (PBN). Aircraft must maintain specific navigation accuracy, and in RNP are aided by on board performance monitoring and alerting. It provides slightly more predictable track keeping when compared to RNAV1.
Route options	A term used in engagement to describe the Design options that have been created in this step of the airspace change process.
SAC	Special Area of Conservation: Designated under the Conservation of Habitats and Species Regulations 2017 as making a significant contribution to the conserving of the habitats of protected species.
SID	Standard Instrument Departure: A pre-determined flightpath set by Air Traffic Control that aircraft follow when departing an airport.
SoN	Statement of Need: The means by which the change sponsor sets out what airspace issue or opportunity it is seeking to address and what outcome it wishes to achieve, without specifying solutions, technical or otherwise. London Stansted Airport's SoN can be found at https://airspacechange.caa.co.uk/documents/download/514.
SPA	Special Protection Area: Protected areas for birds classified under the Wildlife and Countryside Act 1981 and protected under the Conservation of Habitats and Species Regulations 2017.
SSSI	Sites of Special Scientific Interest: Areas of importance designated and protected by Natural England under the Wildlife and Countryside Act 1981 to recognise the land's wildlife, geology or landform is of special interest.
STAR	Standard Terminal Arrival Route
Tranquillity	There is no universally accepted definition of tranquillity and therefore no accepted metric by which it can be measured. In general terms it can be defined as a state of calm. The consideration of impacts upon tranquillity for airspace change 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 (ref: www.caa.co.uk/cap1616).
Transition	The part of the arrival route from the Initial Approach Fix (IAF) prior to joining the final approach at the Final Approach Fix (FAF).
Unviable	Options which would not comply with the rules or for flight procedure design, specifically the requirements of ICAO PANS-OPS 8168, or if they are not compliant with these rules, did not have a supporting safety justification.

Term	Definition
UTAVA	A navigation fix to the NW of Stansted used STN departures that exit UK to the west and north west.
VHF	Very High Frequency
Viable and good fit	Options that are viable to design and which would be expected to meet the three design principles with which all design options 'must' comply (Safety, Policy and Demand).
Viable but poor fit	Options that are viable to design but which would not be expected to meet the requirements of the Safety, Policy or the Demand Design Principles.
VNAV	Vertical Navigation. A term used in Performance Based Navigation.
VOR	VHF Omni-directional Range (Beacon)

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1 Introduction

1.1 Document Purpose & Scope

The London Stansted Airport (STN) Airspace Change Programme (ACP) is currently at Stage 2 – Develop and Assess - of the CAA's CAP1616 [Ref 1] airspace change process. Step 2B requires the sponsor to conduct an Initial Options Appraisal in respect of the comprehensive list of options development during Step 2A.

This **Initial Options Appraisal (IOA)** sets out London Stansted's response to that requirement, explaining the steps, rationale, and outcomes of Step 2B, and the IOA conducted. The full detailed analysis of the individual route options is provided separately and is available on the CAA Airspace change portal. An extract of the full analysis can be seen in Appendix A1. This document is the accompanying explanatory document to support the Full Analysis Tables which are provided separately.

This IOA forms part of the suite of documents submitted to the Civil Aviation Authority (CAA) at Gateway 2 of the CAP1616 process and is intended to be read alongside these documents.

The full suite of Stage 2 submission documents is:

- Stage 2 Summary Document, which draws together the key points from the Stage 2 submission.
- Design Options Report (DOR) [Ref 2], which presents the design options that were progressed to the design principle evaluation, as reported in the Design Principle Evaluation Report (DPE);
- Design Principles Evaluation (DPE) [Ref 3], which assesses how the design options have responded to the Design Principles and identify those that warrant further analysis at the next step: the Initial Options Appraisal at Step 2B.
- Initial Options Appraisal Report (IOA), this document, which is the first iteration of the three option appraisals required by CAP1616. The design options appraised within the IOA are the outputs from the Design Principles Evaluation (DPE). The purpose of the IOA is to provide, at a minimum, a qualitative assessment of each option providing stakeholders and the CAA with the relative differences between impacts, both positive and negative.; and
- The Stakeholder Engagement Report, which explains how engagement has been used in the processes described in the other Stage 2 documents and records its outputs.

The Summary Document provides details of the Government's national programme of airspace change, the process under CAP1616 and the progress to date of the ACP. This information is not repeated in this report.

The full suite of reports, together with their supporting appendices, will be published on the CAA Airspace Change Portal www.airspacechange.caa.co.uk.

1.2 Document Overview

This document forms part of the document set required for the CAP1616 airspace change process: Stage 2 Develop and Assess, Step 2B Options Appraisal (Phase 1 Initial) including Safety Considerations. Its purpose is to consider the shortlist of airspace design options which have progressed through the DPE, to provide comparisons of each option via qualitative assessment or, if available and proportional, quantitative analysis. Under Stage 2, the designs are not fully developed and so the level of analysis possible and its granularity is inevitably less than applies to later, fuller appraisals as part of the CAP1616 process.

This document includes the methodology, baseline definition and results summary of the IOA along with supporting Appendices.

This document is structured as follows:

1. Introduction
2. Initial Options Appraisal Methodology
3. Baseline Definition.
4. Initial Options Appraisal Results.
5. Qualitative Safety Assessment.
6. Noise Methodology.
7. Design Options Shortlist.
8. Initial Options Appraisal Full Analysis Table (Appendix A1).

It is important that readers review this document either before or alongside the IOA Full Analysis Table (an example is shown in Appendix A1) to provide additional context, clarification, and rationale. In addition, it is important to note that all altitudes referred to within this document are based on Above Mean Sea Level (amsl).

1.3 Step 2B – Initial Options Appraisal

As part of the CAP1616 process, change sponsors are required to complete a formal Options Appraisal process that assesses the benefits of various route options compared to a baseline scenario. For the IOA required at Step 2B, the requirement is to determine the high-level criteria and then conduct a qualitative assessment against each route option. This IOA serves as the foundation for a more quantitative assessment later in the CAP1616 process.

At Step 2B, the Comprehensive List of Viable Options is tested against the criteria contained in CAP1616, (Appendix E, Table E2). In addition, the following qualitative assessments are required for any airspace change that has the potential to alter aircraft traffic patterns below 7,000ft (known as a Level 1 Airspace Change Proposal), such as the ACP:

- Safety
- Biodiversity

Options Appraisal is used as a tool throughout the CAP1616 process to help refine the options from an initial longlist, down to a short list and a final set of preferred options.

The Options Appraisal consists of the following elements:

- High-level objective and assessment criteria.
- Baseline definition – current operations.
- Longlist of options (including a do-nothing/minimum option).
- Shortlist of options.
- Preferred or final option(s).

The options appraisal requirement of CAP1616 evolves through three iterations with the CAA reviewing at each phase as follows:

1. 'Initial' appraisal at Step 2B with the CAA review at the 'Develop and Assess' Gateway
2. 'Full' appraisal at Step 3A with the CAA review at Step 3B and the subsequent 'Consult' Gateway
3. 'Final' appraisal at Step 4A, with the CAA review after the formal submission of the airspace change proposal at the end of Stage 4.

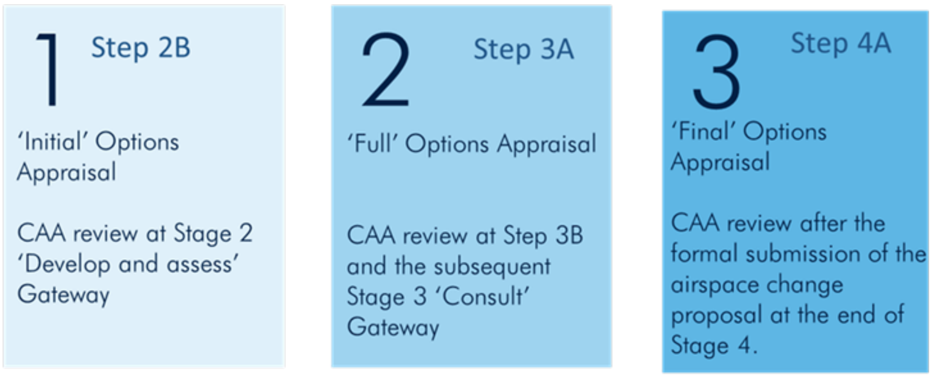

Figure 1 CAP1616 Options Appraisal Process

2 Initial Options Appraisal Methodology

2.1 CAP1616 Options Appraisal Requirements

The Options Appraisal process was carried out in accordance with the guidance in CAP1616, and in conjunction with The Green Book [Ref 4] and the Department of Transport's WebTAG [Ref 5] (although this is not of relevance to the Options Appraisal process until the Full Options Appraisal (FOA) at Stage 3), which constitute best practice in options appraisal.

The Options Appraisal process is used as an iterative tool throughout the CAP1616 [Ref 1] process to help refine the design options from the Statement of Need, Comprehensive List, Suitable List to an initial Comprehensive List of Viable Options, down to a Short List (including preferred option[s]).

2.2 IOA Minimum Requirements

CAP1616 prescribes that the following should be included within an IOA as a minimum:

- A Comprehensive List of Viable Options (including the 'Do Nothing/Minimum' option which will act as a baseline for analysis).
  - A description of the change proposal.
  - An indicator of likely noise impacts.
  - A high-level assessment of benefits and costs involved.
- The criteria for assessing the list of options and the application of these criteria to determine a shortlist of options.
- What evidence the change sponsor will collect, and how it will be collected in order to fill in its evidence gaps and to develop the FOA, during Stage 3. (See Section 2.3)

There is a minimum requirement within CAP1616 to conduct qualitative analysis within the IOA. However, change sponsors can choose to supplement this with quantitative analysis if they so choose. This is the case for the STN ACP, where quantitative data has been used to supplement the qualitative analysis.

2.3 Full Options Appraisal (FOA) Evidence Capture

Consistent with the requirements of CAP1616, the IOA is primarily a qualitative analysis of each option against a defined baseline. This is expanded on within the FOA, which is conducted at Stage 3, to include quantitative analysis. The FOA, requires change sponsors to assess each of the design options against each other in relation to the criteria defined in CAP1616, Appendix E using primarily quantitative metrics. These metrics include the assessment of the environmental impacts of the proposed change.

As defined in CAP1616a [Ref 6], the FOA requires change sponsors to collect quantitative environmental metrics that describe the baseline scenario and conduct a series of modelling activities for each of the design options, to enable an environmental comparison. The required metrics include:

- 10-year traffic forecasts
- Standard noise metrics:
    - L_{Aeq} noise contours
    - 100% noise mode contours
    - Nx contours
    - Difference contours
    - L_{max} spot point levels
- Operational diagrams
- Overflight (based on the CAA definition of overflight found in CAP1498 [Ref 7])

The modelling is intended to provide a comparison between today's operation (the baseline), in order to show the impact of the proposed change at the point of implementation and also 10 years post-implementation. Modelling is also required to show the situation at the proposed implementation date and 10 years post-implementation ***without*** applying the proposed change. More information regarding these metrics shall be provided during the FOA at Stage 3.

2.4 High-level Objectives & Assessment Criteria

For the purposes of CAP1616, the London Stansted ACP has been provisionally assigned as a Level 1; this is expected to be confirmed by the CAA at the end of step 2B. For a Level 1 airspace change, the criteria against which options are assessed are defined within CAP1616, Appendix E, Table E2 [Ref 1]. These criteria are described in Table 1 below. STN has also conducted quantitative analysis to support the assessment within the DPE and IOA. This includes an assessment of overflight to support elements of the IOA. These metrics are designed to support the assessment of the criteria shown in Table 1, rather than act as additional criteria. Additionally, Safety Assessment, Tranquillity and Biodiversity (as defined in CAP1616, Appendix B [Ref 1]) have been added at the bottom of the below table, as these additional assessments are required for Level 1 airspace changes.

Affected Group	Impact	Description
Communities	Noise impact on health and quality of life	Requires consideration of noise impact on communities including residents, schools, hospitals, parks, and other sensitive areas.
	Air Quality	Any change in air quality is to be considered[1].
Wider Society	Greenhouse Gas impact	Assessment of changes in greenhouse gas levels in accordance with WebTAG is required.
	Capacity and resilience	A qualitative assessment of the impact on overall UK airspace structure.
General Aviation	Access	A qualitative assessment of the effect of the proposal on the access to airspace for GA users.
General Aviation/commercial airlines	Economic impact from increased effective capacity	Forecast increase in air transport movements and estimated passenger numbers or cargo tonnage carried.
	Fuel burn	The change sponsor must assess fuel costs based on its assumptions of the fleets in operation.
Commercial airlines	Training costs	An assessment of the need for training associated with the proposal.
	Other costs	Where there are likely to be other costs imposed on commercial aviation, these should be described.
Airport/Air Navigation Service Provider	Infrastructure costs	Where a proposal requires a change in infrastructure, the associated costs should be assessed.
	Operational costs	Where a proposal would lead to a change in operational costs, these should be assessed.
	Deployment costs	Where a proposal would lead to a requirement for retraining and other deployment, the costs of these should be assessed.
Safety Assessment	Safety Assessment	CAP1616 requires a safety assessment of the proposal to be undertaken in accordance with CAP

[1] Air Quality assessments are only applicable below 1,000 feet and includes the consideration of Air Quality Management Areas (AQMAs).

Affected Group	Impact	Description
		760 (Guidance on the Conduct of Hazard Identification, Risk Assessment, and the Production of Safety Cases: For Aerodrome Operators and Air Traffic Service Providers) [Ref 8].
Wider Society	Tranquillity	The impact upon tranquillity need only be considered with specific reference to Areas of Outstanding Natural Beauty (AONB) and National Parks (NPs) unless other areas for consideration are identified through community engagement.
	Biodiversity	The variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Table 1 IOA Assessment Criteria

2.5 Methodology

2.5.1 Appraisal Methodology

STN has reviewed the requirements within CAP1616 in detail and has adopted a clear and consistent methodology for assessing design options against a baseline of 'Do Nothing' (as explained in Section 3). This is consistent with the requirements of CAP1616, including paragraph 133, which requires the relative differences between each option to be assessed *'against a 'do nothing' scenario (the 'counterfactual')'*. The IOA has enabled each of the route options that together make up the Comprehensive List of Viable Options (the output from the DPE) to be assessed against the criteria in Table 1, so that a Short List, including a set of Preferred Options can be identified. The criteria and contextual factors used to assess the route options against the baseline are explained within this document.

The full Design Options Evolution can be found in Stage 2 Summary Appendix A – Design Options Evolution

The IOA has been carried out by comparing all the route options against the defined baseline, considering each criterion defined in CAP1616 (as shown in Table 1). This exercise was conducted using a tabular format: an assessment of each route option is shown against each criterion set against the baseline. For clarity, the results are presented in multiple tables. For departures, each design envelope[2] is reported within a separate table. Arrivals have been assessed by runway, and by the altitude of the Final Approach Fix (FAF). All relevant documents have been uploaded to the CAA airspace change portal.

Additionally, the appraisal contains the results of a Qualitative high-level Safety Assessment (see Section 5) together with a high-level qualitative noise assessment, supported by the methodology described in Section 6.

An extract of the full analysis of all the options is shown at Appendix A1.

2.5.2 Option Colouring

Following the completion of the IOA assessment, each option has been annotated with a colour to indicate how it performed. This is based on a simple Red, Amber, Green (RAG) status methodology. The classification of options is based on the professional judgement of the assessor /change sponsor, considering each route option's overall performance against the defined criteria. The RAG status criteria are defined in Table 2 below.

Colour Key	
Preferred Option(s)	When compared to the baseline, there is a clear and obvious benefit. This option is viewed as more favourable than the other options within the design envelope and as such is the preferred option within the design envelope.
Favourable	When compared to the baseline, there is a clear and obvious benefit.
Acceptable	When compared to the baseline, there is an equal benefit.
Rejected	When compared to the baseline, there is a clear and obvious dis-benefit. As such, these options are rejected.
Baseline/Previously Rejected	Option included for completeness but, in the case of previously rejected options, not subject to IOA.

Table 2 IOA Options RAG Status

2.5.3 Arrivals Combined Assessment

STN understands that the proposed systemised changes for arrivals will require a single point for the route options to start from, which will be used for both runways. Due to this network connectivity constraint, STN has taken the view that arrival options taken forward must deliver benefits and be compatible for both runways (RW 04 **and** RW 22) rather than each individual runway.

[2] A design envelope is a specified area, heading in a particular direction, within which multiple design options are contained. These design envelopes were defined during Step 2A of the CAP1616 process and were shared with stakeholders accordingly. More details can be found in the Design Options Report, available on the CAA airspace change portal.

Consequently, STN has assessed the combined impact of the proposed arrival options (for both runways) to enable an outcome to be reached. As per our assessment of the departures route options, a higher weighting has been afforded to minimising the number of people overflown (in accordance with Air Navigation Guidance 2017 Altitude Based Priorities [Ref 9]).

STN has combined the population data (for each arrival option for each corresponding runway) to provide an overall total. This overall total has been used to identify a Preferred, Favourable and Acceptable option that applies to both RWs.

STN has assessed arrival options in terms of how they were described in the Stakeholder Engagement, and therefore, the 'envelopes' that we have applied are:

- (East/West/Central) applicable to both runways.
- Separate assessment for 2,000ft Final Approach Fix (FAF) and 2,500ft FAF.

This methodology differs from how we assessed the departures as it considered both runways in combination rather than just one runway.

2.5.4 Shortlisting

Following the assessment of all route options carried forward from the DPE, a short list of options is presented in Section 7, which also specifies the preferred options.

At this stage of the process, the change sponsor is only required to assess the design options in isolation against the baseline. Following the definition of the preferred design option(s) within the short list, as part of the wider airspace modernisation programme, the next step will be for STN to undertake a systemised assessment of the design options that are carried forward from the IOA. This will likely involve examining combinations of route options to determine whether they are viable as a system and how they integrate with other changes proposed within the London Terminal Manoeuvring Area (LTMA) cluster. Essentially, this will determine which design options 'fit together' best as part of a wider suite of options, including combinations of departures and arrivals/transitions. These are the options that will then be taken forward to Stage 3 for full appraisal and public consultation. This will be determined in coordination with ACOG, other ACP sponsors and with input as necessary from other stakeholders.

2.6 IOA Assessment Criteria Considerations

As part of the IOA assessment criteria, certain contextual factors are considered by the assessor while conducting the IOA. These allow the assessor to gain a more holistic view of the assessment criteria, enabling a more informed assessment.

The remainder of this section explains these contextual factors.

2.6.1 Overflight Analysis

Quantitative overflight analysis (as defined in CAP1498 [Ref 7]) has been used to support judgements made in the IOA. This is over and above the minimum requirements of CAP1616, which only requires qualitative analysis during Stage 2.

A Geographic Information System (GIS) has been used to consider the track associated with each route option (including the baseline scenario[s]). The resulting analysis has provided data showing several relevant elements including, but not exclusively:

- Number of people overflown[3]
- Number of Residential Properties overflown
- Track Mileage
- Air Quality Management Areas (AQMAs) overflown.
- Areas of Outstanding Natural Beauty (AONBs) overflown.
- National Parks (NPs) overflown.
- Internationally Designated Sites:
    - Special Areas of Conservation (SACs)
    - Special Protection Areas (SPAs)
    - RAMSAR Sites.
- Nationally Designated Sites:
    - Sites of Specialist Scientific Interest (SSSI) overflown.
    - National Nature Reserves overflown.
- Country Parks (CPs) overflown.

Overflight of proposed developments was assessed and considered in the DPE. This metric has not been used in the IOA to assess individual performance of the options. However, planned developments will be considered in the full environmental assessments conducted as part of Stage 3, which include not only overflight, but LA_{eq} noise contours, which will inform the analysis at FOA.

During the IOA assessment, priority was assigned to route options that were assessed to overfly fewer people and residential buildings before considering the track length. None of the departure options overfly any Areas of Outstanding Natural Beauty (AONB) or National Parks. The quantitative analysis of overflight conducted by STN also considered Internationally and Nationally designated sites and Country Parks and these metrics were used in the DPE to test route options against the DPs. However, we have not considered the impact the overflight of these features when providing a summary of the outcome of the IOA as further analysis will be required to understand the specific impacts on these designated sites.

Overflight of Air Quality Management Areas (AQMAs) was analysed within the overflight assessment, and concluded that none of the departure route options overfly any AQMAs within a 5 NM radius of STN. From this, we have deduced that there are no changes to overflight of AQMAs below 1,000ft for any of our departure options. Although some of the arrival route options have been assessed to overfly some AQMAs, these are at the start of the arrival profile, and the aircraft is above 1,000ft. A full assessment of any potential impact will be conducted at Stage 3 of the ACP.

To enable a clear and consistent comparison, an overflight assessment was conducted on the baseline scenario(s). The data collected has enabled a direct comparison between each route option and the baseline scenario (today's operation) to be made within the IOA. The results are included within the Full Analysis Tables (see Appendix A1) and have been used to formulate an assessment of the following IOA criteria:

[3] Population figures based on CACI database using 2011 census plus an estimated projection of population increase up to 2021.

- Noise impact on health and quality of life
- Air quality (Specific to AQMAs)
- Greenhouse Gas impact
- Tranquillity
- Fuel burn

2.6.2 Climb Gradient

With reference to departure options, the current published SIDs at STN are designed with a minimum climb gradient of 3.3%, as specified in the UK Aeronautical Information Publication [Ref 10]. However, analysis of the Noise Track Keeping data has shown that, due to recent advances in aircraft performance, the majority of aircraft departing STN fly a climb gradient of 6% or greater. This is consistent with the results of the STN Fleet Equipage Survey, which included data collected from aircraft operators, including aircraft fleet and performance specifications.

Therefore, within the 'Do Nothing baseline' scenario (described in Section 3.3), the actual rate of climb for each route has been assumed, to better reflect the true nature of the existing operations.

2.6.3 Track Mileage and Fuel Burn

At this stage of the CAP1616 process, the change sponsor is only required to conduct a qualitative assessment within the IOA; detailed quantitative assessment takes place later in the process as part of the Full Options Appraisal in Stage 3.

Going beyond the minimum requirements of CAP1616, the overflight assessment described in Section (1.4.1) has allowed the track mileage associated with each option to be derived. In line with standard aviation practice, this is presented in Nautical Miles (NM) although we have applied a conversion to kilometres (km) for completeness. This analysis has also been carried out on the baseline scenario(s), to enable a direct comparison within the IOA.

In terms of track length, to enable a more meaningful comparison, for departures, STN has measured track length from the airfield up to a defined common point at the end of each design envelope. Depending on the specific route in question, this may mean that an aircraft may have already reached 7,000ft before arriving at this common point, especially those with route options with a higher climb gradient applied. Otherwise, aircraft climbing on the same climb gradient would all reach 7,000ft within the same track distance, meaning a worthwhile comparison could not be drawn.

To clarify, no specific fuel burn metrics have been captured for each route option; instead, the track mileage information has been used as a proxy, on the assumption that the shorter the route, the less fuel is burnt. This rationale is utilised for Stage 2 only. Further analysis of fuel burn will be conducted at Stage 3 of the process. The metrics used to define this will also be described in more detail within the FOA at Stage 3.

2.6.4 Air Quality Management Areas (AQMAs)

CAP1616 [Ref 1] requires change sponsors to consider the impact of proposed changes on Air Quality Management Areas (AQMAs). AQMAs are areas within which local authorities are required to measure, review, and assess the impact of air quality on people's health and the environment [Ref 11], most associated with road traffic.

Figure 2 below shows the location of AQMAs (shown in pink) within the vicinity of STN (shown in the red circle). The closest AQMA is at Bishop's Stortford, but this is not directly overflown. Sawbridgeworth, which is to the south-west of STN could potentially be overflown and is approximately 7.8km (4.2 NM) from STN.

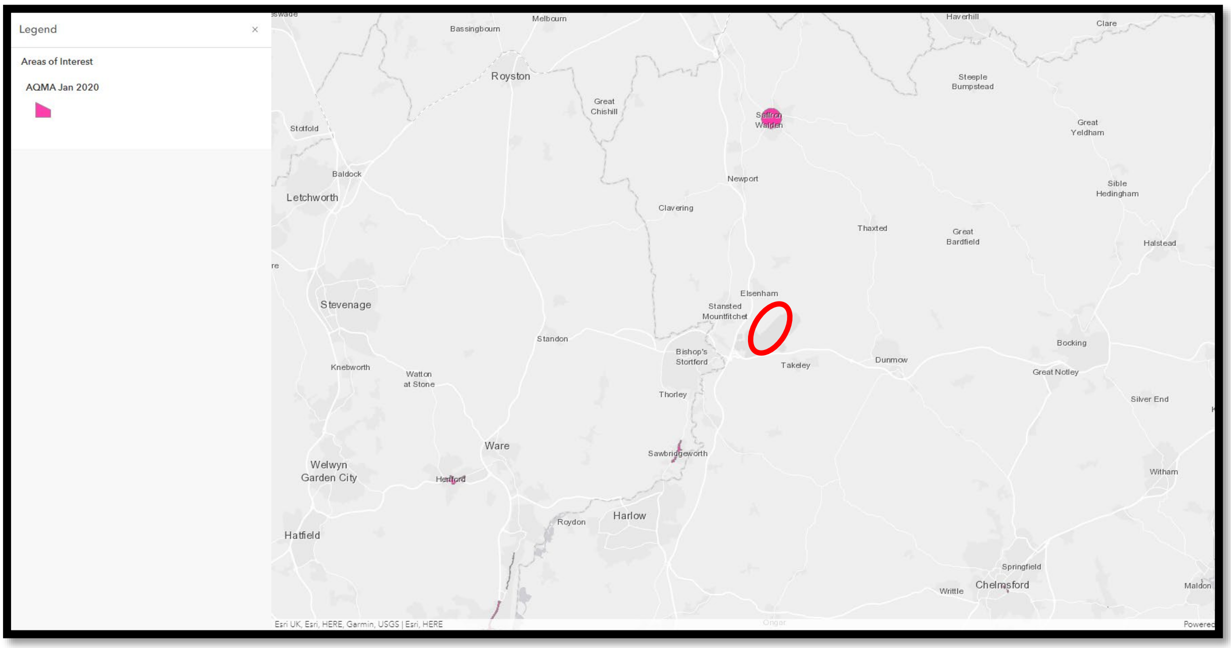

Figure 2 STN AQMA Map (Source: UK Government)

During the completion of the IOA, the overflight analysis has been used to determine whether a proposed design option overflies an AQMA. This analysis has demonstrated that although some departure route options overfly AQMAs, they are towards the end of the route profile and will therefore be either at or close to 7,000ft. The same applies to arrivals whereby those options that overfly AQMAs are generally at the start or early part of the route option, and therefore before the aircraft has commenced the descent profile.

This means that our route options do not overfly any AQMAs below 1,000 feet. CAP1616, Appendix B, Paragraph B74 [Ref 1] states:

"Due to the effects of mixing and dispersion, emissions from aircraft above 1,000 feet (amsl) are unlikely to have a significant impact on local air quality. Therefore the impact of airspace design on local air quality is generally negligible compared with other factors such as changes in the volume of air traffic, and local transport infrastructures feeding the airport."

Based on the above, the impact of the ACP in terms of local air quality is minimal as there is limited change to overflight below 1,000 ft.

2.6.5 Tranquillity

As specified in CAP1616, Appendix B, Paragraph B76 [Ref 1]:

"For the purposes of airspace change proposals, the impact upon tranquillity need only be considered with specific reference to Areas of Outstanding Natural Beauty (AONB) and National Parks unless other areas for consideration are identified through community engagement."

None of the departure or arrival route options proposed for the STN ACP overfly any AONBs or NPs. As mentioned in Section 2.6.1 above, the overflight assessment conducted also identified whether any route options overflew any CPs and SSSIs.

In order to maintain consistency with other Stage 2 documentation, the sponsor has also mapped internationally and nationally designated habitats and historical designations. The possible impact will be assessed at Stage 3 of the ACP, and they were not used as a discriminator in the final assessment within the IOA.

Figure 3 below shows the registered AONBs (shown in green) within the vicinity of STN (shown in the red circle). These are:

- Chilterns AONB (to the west); and
- Dedham Vale AONB (to the east).

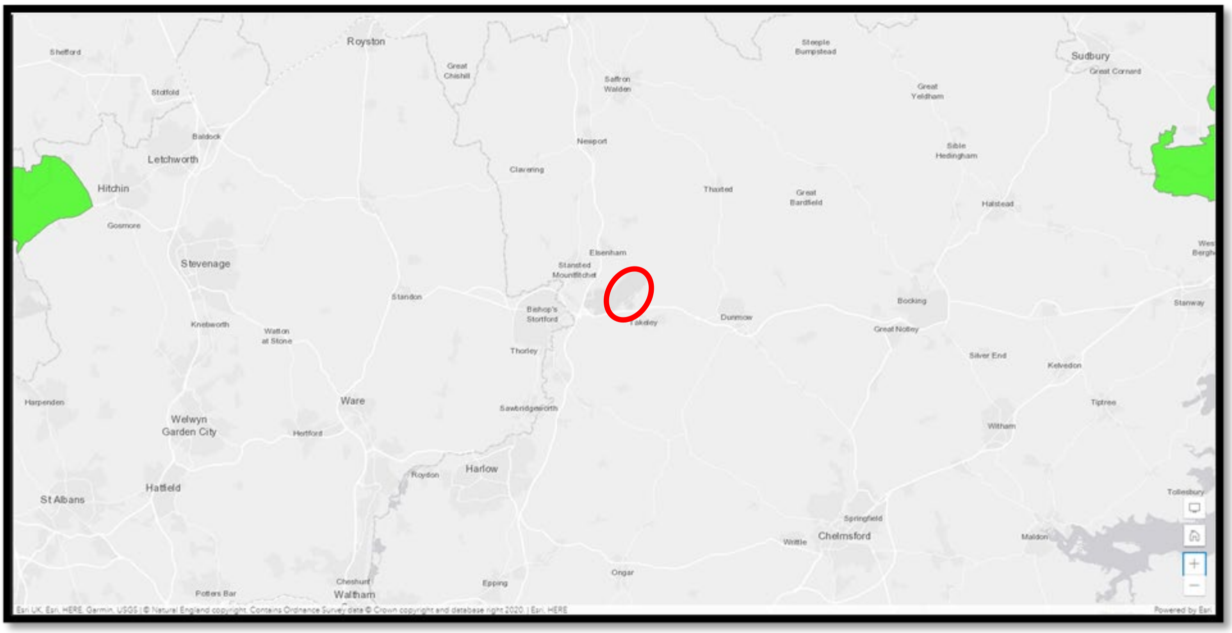

Figure 3 STN AONB Map [Source: DEFRA]

There are no National Parks within the vicinity of STN, but the sponsor has chosen to map overflight of internationally and nationally designated habitats and historical designations. Figure 4 below shows SSSIs and Country Parks (CPs) within the vicinity of STN, which is shown in the red circle. The possible impact of overflight of these areas will be assessed at Stage 3.

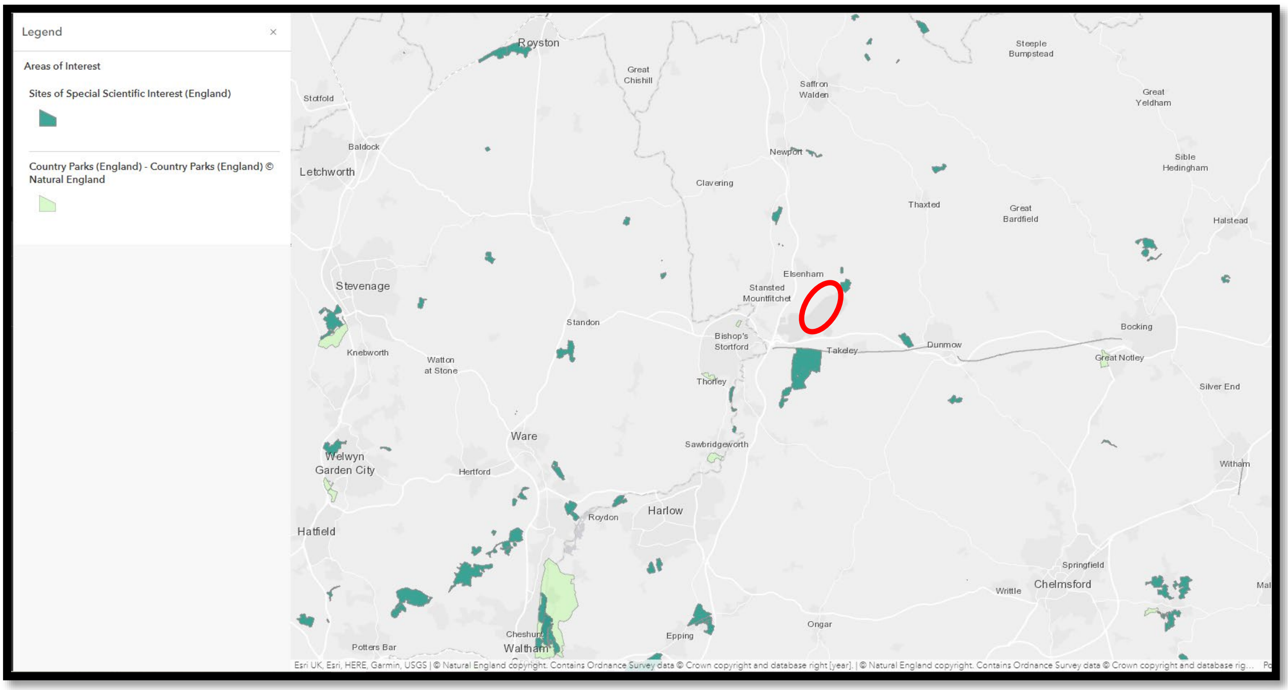

Figure 4 STN Country Parks (CP) and Sites of Special Scientific Interest (SSSI). [Source DEFRA]

2.6.6 Biodiversity

As defined in Table 1 (see Section 2.4), CAP1616 [Ref 1] requires change sponsors to consider the impact the proposed change may have on biodiversity within the vicinity of the change. CAP1616, Appendix B, Paragraph B80 states:

"In general, airspace change proposals are unlikely to have an impact upon biodiversity because they do not involve ground-based infrastructure" [Ref 1].

This statement is particularly relevant to this ACP, as the change does not involve any change to ground infrastructure. Nevertheless, STN has sought to identify "terrestrial, marine and other aquatic ecosystems" that may be affected, as per CAP1616, Appendix B, Paragraph B79 [Ref 1].

To conduct this initial assessment, STN has reviewed Special Areas of Conservation (SACs), Special Protected Areas (SPAs) and RAMSAR sites within the vicinity of STN. Figure 5 below shows these sites in relation to STN.

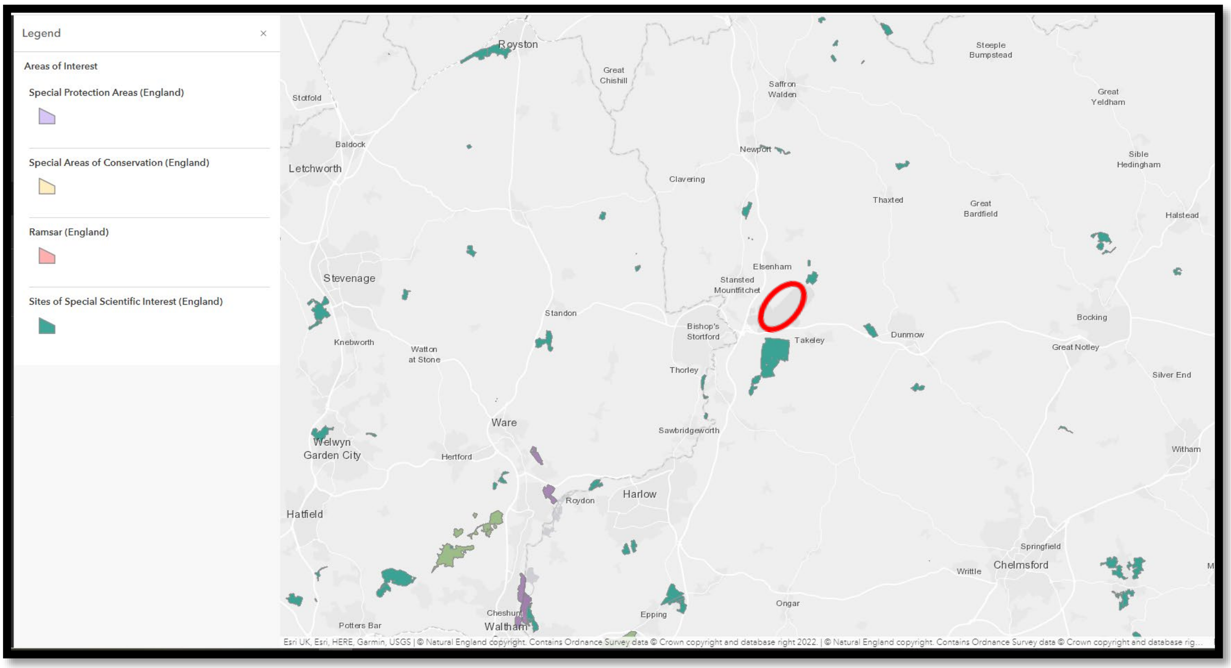

Figure 5 STN SPAs, SACs, RAMSAR and SSSIs. (Source: DEFRA)

Additionally, as stated in CAP1616, the change sponsor has considered the impact of the change on European Protected Species as defined in the Conservation of Habitats and Species Regulations 2010 [Ref 12]. The UK Government interactive map indicates that there are a number of sites within the STN area where species such as Great Crested Newts (a European Protected Species) can be found.

Based on the assessments carried out to date, STN's position is that when compared to the baseline assessment (today's operation), the proposed changes will have an insignificant impact on biodiversity, but this will be fully assessed at Stage 3 of the ACP process.

2.7 Assessment Criteria and Weighting

Each option has been assessed against the 'Do Nothing' baseline. Its performance is assessed in terms of overflight to determine which options perform better. We have applied a higher weighting to minimising overflight of people in accordance with the UK Government's Altitude Based Priorities articulated within the Air Navigation Guidance 2017 [Ref 9]. The next criteria that we have assessed is track length to ascertain an indication of greenhouse gas emissions and fuel burn for each option. Where route options perform equally in these areas, the other criteria are applied to determine a single Preferred Option, a Favourable Option, and an Acceptable Option within each design envelope. These Options make up the Short List of Options presented at Step 2B.

3 Baseline Definition

3.1 Baseline Overview

In accordance with CAP1616 [Ref 1], a baseline has been established for the IOA, which will be used to inform subsequent environmental assessments. CAP1616, Appendix J [Ref X] defines the baseline as the:

"Scenario in analysis of different options where the impacts of the change not being implemented are analysed (also known as 'do nothing' or 'do minimum' option)" [Ref 1]

The baseline is intended to allow the change sponsor to conduct an assessment to understand the current impacts so that a comparison can be made with the impacts of the proposed options. Full analysis of the baseline scenarios is contained within the Full Analysis Tables found in Appendix A1 and on the CAA airspace change portal.

3.2 Baseline Rationale

STN has established a set of baseline scenarios, against which the proposed route options have been assessed.

Several contextual factors were considered during the selection of the baseline.

3.2.1 VOR Decommissioning

In today's operation, aircraft operating to/from STN rely on ground-based navigational beacons to arrive at and depart from the airport. For departing aircraft, after an initial climb-out, aircraft are established on Standard Instrument Departure (SID) routes which rely on ground-based navigational aids, prior to joining the wider enroute airspace structure. In terms of arriving aircraft, aircraft file flight plans that will see them join a hold at either ABBOT or LOREL, enabling them to follow the Standard Terminal Arrival Routes (STARs) currently in place. However, if there are no anticipated delays, ATCOs will provide radar vectors from the point that the aircraft is released from the ATC network, until it is established on the final approach. This allows the appropriate sequencing and spacing to be established before the aircraft is guided on to the Instrument Landing System (ILS). This is supported by ground-based navigational aids known as VHF [Very High Frequency] Omni-directional Range (VOR) beacons.

The main beacons applicable to operations at STN are:

- DETLING (DET)
- BARKWAY (BKY)

As part of the wider plans to modernise UK airspace, as set out in the Airspace Modernisation Strategy (AMS), the UK's enroute Air Navigation Service Provider (ANSP), NATS Enroute Limited (NERL) is planning to decommission these beacons allowing more efficient navigation-based aircraft systems linked to satellite-based navigation, known as Global Navigation Satellite System (GNSS).

In October 2018, NERL formally notified all airports, including STN, affected by the removal of the VOR beacons, that the planned withdrawal date of these beacons is 1st December 2022.

As the sponsor of this ACP, STN is aware of the options available to mitigate for the planned withdrawal of the DVORs. Any mitigations applied are separate to, and outside of, this ACP, which seeks to implement an enduring solution that is not reliant upon ground-based infrastructure, in accordance with the UK's AMS.

For the purposes of this ACP, STN's position is that 'Do Nothing' is a suitable baseline for comparison in the IOA, notwithstanding that 'Do Nothing' is not a feasible option for the ACP. STN is taking action outside this ACP to ensure that the tracks above the ground after 1st December 2022 will be no different to how they are today. This position constitutes the 'informed view of the future' that is required by CAP1616.

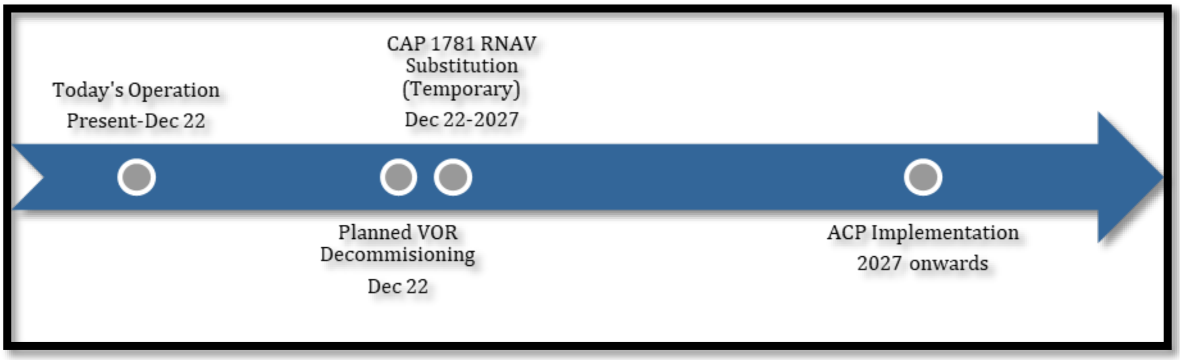

Figure 6 Estimated Progression of Planned VOR Decommissioning

3.3 The 'Do Nothing' Baseline

As this ACP includes both Departures and Arrivals/Transitions, STN has selected a set of 'Do Nothing Baseline' scenarios which reflect today's operation. Furthermore, as this ACP captures both Runways available at STN (RW 04 and RW 22), appropriate Do-Nothing scenarios have been selected for each runway orientation.

Note: the UTAVA/NUGBO SIDs and LOREL/ABBOT Transitions are utilised as examples in the sub-sections below; the same rationale has been applied to all other SIDs, Arrivals/Transitions within this ACP. Furthermore, the use of the 'Do Nothing' baseline is applicable to all design envelopes across this ACP.

3.4 Departures

For Departures, the 'Do Nothing' baseline consists of several SIDs which are utilised in today's operation. The 'Do Nothing' means aircraft will continue as they do today, which means aircraft departing STN and routing towards the UTAVA, NUGBO, BKY, Clacton (CLN), LAMBOURNE (LAM) and DETLING (DET) waypoints. At these points, aircraft then join the wider enroute network.

An example of the lateral tracks for the existing SIDs is described below. As is often the case when assessing departure routes defined by ground-based infrastructure, there may be variances between the published routes and the actual routes flown by aircraft. This is a result of a variety of factors, such as aircraft type, experience of pilot/crew, type of Flight Management System (FMS) on board, wind speed and direction, and other factors such as ATC instructions. For these reasons, STN has utilised Noise Track Keeping data to establish the modal tracks used by aircraft following these procedures; this is shown in Figure 7 and Figure 8 below. Furthermore, the modelling of the baseline reflected the actual rate of climb achieved by the modal track for each route, rather than the minimum published 3.3% climb gradient, as this is considered more representative of today's operation. In doing so, STN aims to show complete transparency in using the tracks actually flown by aircraft today as a comparator.

With regard to RW 04, aircraft currently depart from the airfield in a north-easterly direction. At 2NM (approximately 3.7 km) from the airfield, aircraft make a left turn to head in a westerly direction towards the BKY VOR. On reaching the beacon, aircraft make a slight left turn and head to the NUGBO or UTAVA waypoints. At this point, they join the enroute network. This is depicted in Figure 7 below.

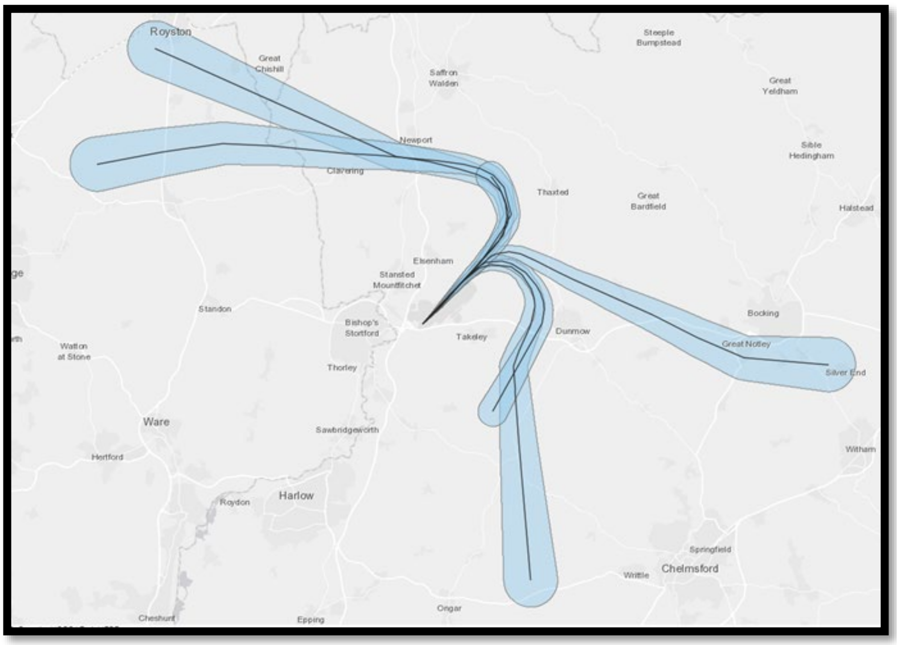

Figure 7 STN RW 04 SID Modal Track

For RW 22, aircraft depart in a south-westerly direction and then begin a right turn (towards the north) once they are 3.1NM away from the airfield. Once the aircraft is 2NM away from the BKY VOR, aircraft perform a left turn (towards the west) to intercept either the NUGBO or UTAVA waypoints. This is shown in Figure 8 below.

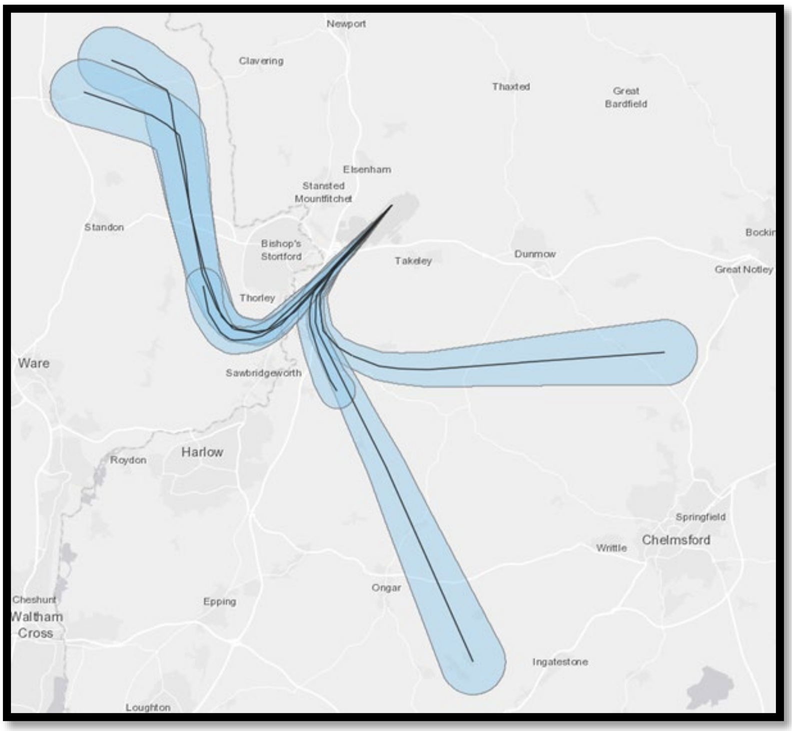

Figure 8 STN RW 22 SIDs Modal Tracks

For the purposes of the overflight analysis, the modal tracks of these SIDs have been used to provide a clear and consistent benchmark when comparing against new departure route options in the IOA.

The LAM and BKY SIDs have been treated differently. The LAM SID is used specifically by aircraft carrying out positioning flights between STN and London Heathrow. Similarly, the BKY SID is mainly used by aircraft carrying out positioning flights between STN and London Luton or exiting Controlled Airspace. As a result, aircraft utilising these SIDs do not climb as high as the other SIDs due to the relative geographic location of their destinations. Furthermore, data shows that both these SIDs are currently infrequently utilised. To produce a modal departure track to 7,000 feet was therefore not a practical proposition, nor an accurate representation of current operations. In this instance therefore (for 'Do Nothing' only) our overflight assessment was truncated to 4,000 feet.

Looking forward, it is intended that the design options, including 'Do Minimum' will not be limited in this way and may be more widely used. Therefore, to provide a more accurate representation of their potential use following the ACP these design options were extended to 7,000 feet. The effect of this when the 'Do Nothing' is compared to other design options, including the 'Do Minimum', is to present a relatively large difference between the 'Do Nothing' and the other design options.

3.5 Arrivals/Transitions

In today's operation, aircraft can theoretically be presented for an arrival to STN from any direction. ATCOs provide radar vectors to the aircraft, that mean that arrival routes are dispersed over a wide area. The majority of arrivals for Runway 04/22 are presented from the east and west.

During busy periods, to ensure that runway capacity is managed safely, aircraft may be required to join the holds at LOREL or ABBOT. These are racetrack like patterns based on DVORs, located to the northwest and northeast of STN respectively.

During peak traffic flows, aircraft arriving onto RW 04 may hold at either LOREL or ABBOT, before tracking southwest, parallel to the runway before making a left-hand turn to establish on the final approach.

For RW 22 during busy times, aircraft arriving from the east may be required to enter the ABBOT hold before heading southwest and making a left-hand turn onto final approach. Alternatively, aircraft arriving from a westerly direction would join the LOREL hold before heading northeast and then making a right-hand turn to establish on a final approach.

To enable these operations, Air Traffic Controllers at STN, in coordination with enroute network colleagues, provide aircraft with radar vectors to establish on the ILS. Radar Vectoring is a common technique used by controllers to manage traffic flows. It involves controllers providing pilots with verbal instructions, over the radio, based on the surveillance picture they are presented with on their radar screen. As this is a manual task, there is some variation in terms of tracks over the ground, but the general direction of the tracks remains the same. Due to the use of radar vectoring, aircraft currently making an approach to STN cumulatively fly over a greater area (more widely dispersed); however, the frequency of overflight within a specific location is likely to be lower.

These radar vectoring patterns are shown in Figure 9 below for RW 04 and RW 22 respectively.

MAG London Stansted Airport

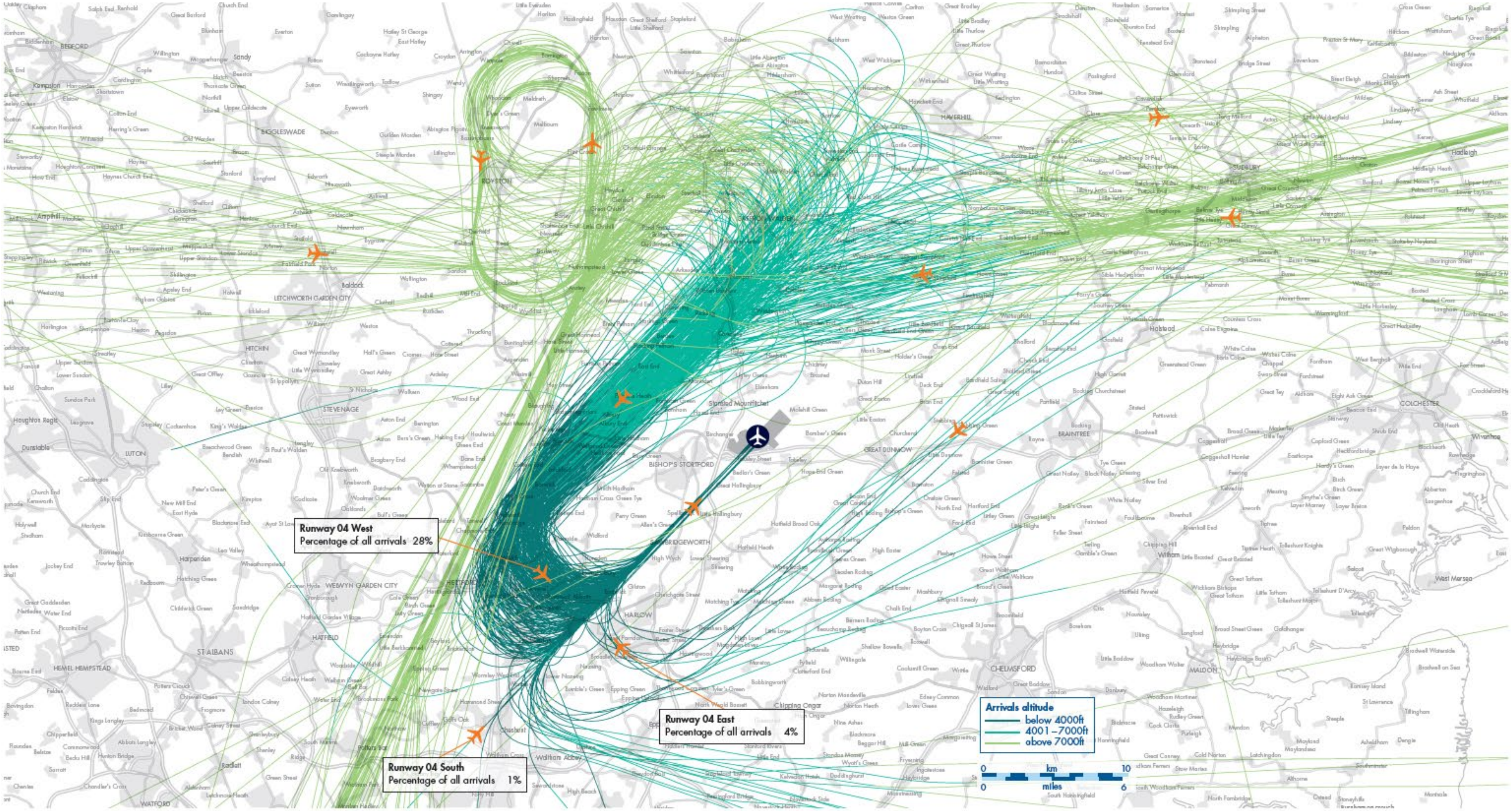

Figure 9 Existing Radar Vectoring Patterns for Runway 04 (Average Summer Day)

MAG London Stansted Airport

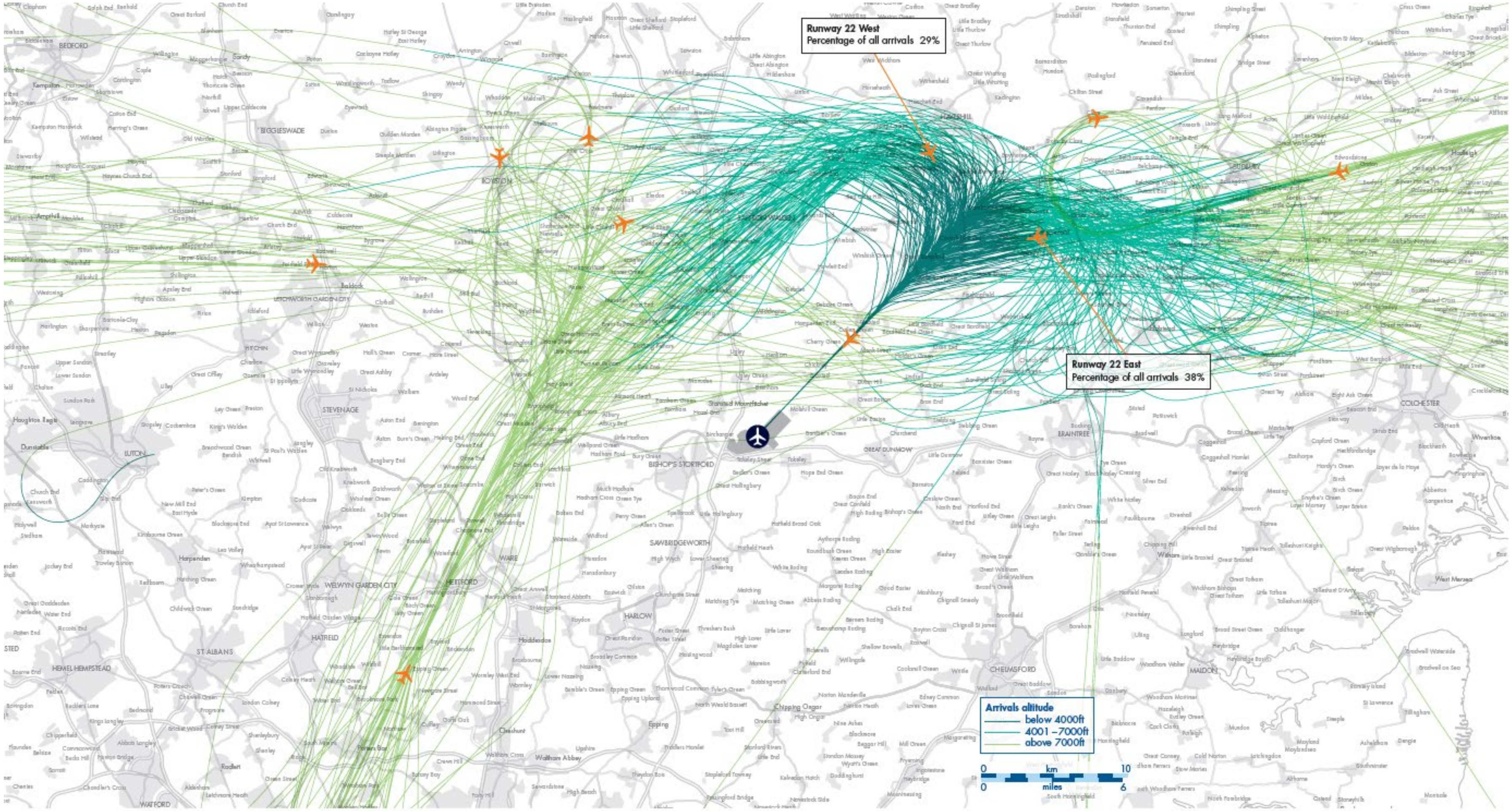

Figure 10 Existing Radar Vectoring Patterns for Runway 22 (Average Summer Day)

In order to provide a consistent approach to the IOA assessment, overflight analysis has been conducted on the existing radar vectoring areas. To achieve this, STN has carried out work to establish modal tracks within the radar vectoring areas from each direction for each runway configuration. Once a single track was identified, an overflight assessment was conducted to enable a meaningful comparison to be made with the route options. The most common tracks are shown in Figure 11 (RW 04) and Figure 12 (RW 22) below.

It is acknowledged, as seen in Figure 9, that some tracks originate from different directions when compared to the modal tracks illustrated in Figure 11 and Figure 12. To enable the overflight analysis to be conducted, a singular track is required. This allows for consistent assessment within the IOA, when comparing the proposed arrival/transition design options to the 'Do Nothing' baseline.

As there are multiple 'single' lines to compare as a baseline, STN has taken the modal tracks shown above, and has created a single 'modal modal' track to be used as a baseline. The 'modal modal' tracks are constructed based on an average path when comparing the multiple tracks shown above. The 'modal modal' track has been assessed in terms of overflight, but postcodes that are duplicated by the multiple tracks have been included only once. The appropriate 'modal modal' track has been used to assess arrivals from the relevant quadrant to make a relevant comparison. The assessor has used professional judgement to pick the most appropriate and logical radar vectoring track to use as a comparator. For example, for a route option originating from a westerly direction, the assessor has selected the use of radar vectors that also originate from the west.

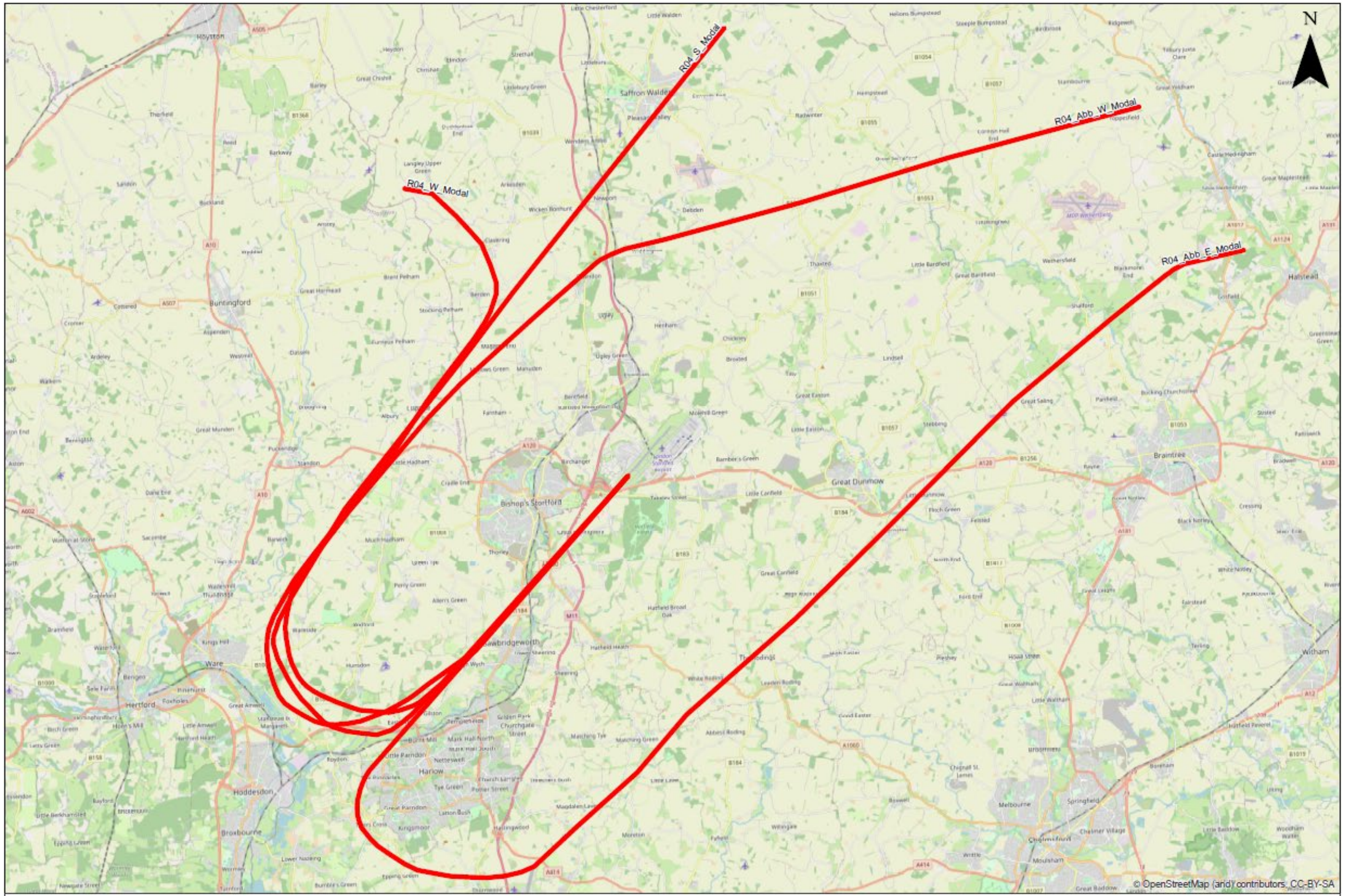

Figure 11 Modal Radar Vectoring Tracks for Runway 04 Arrivals

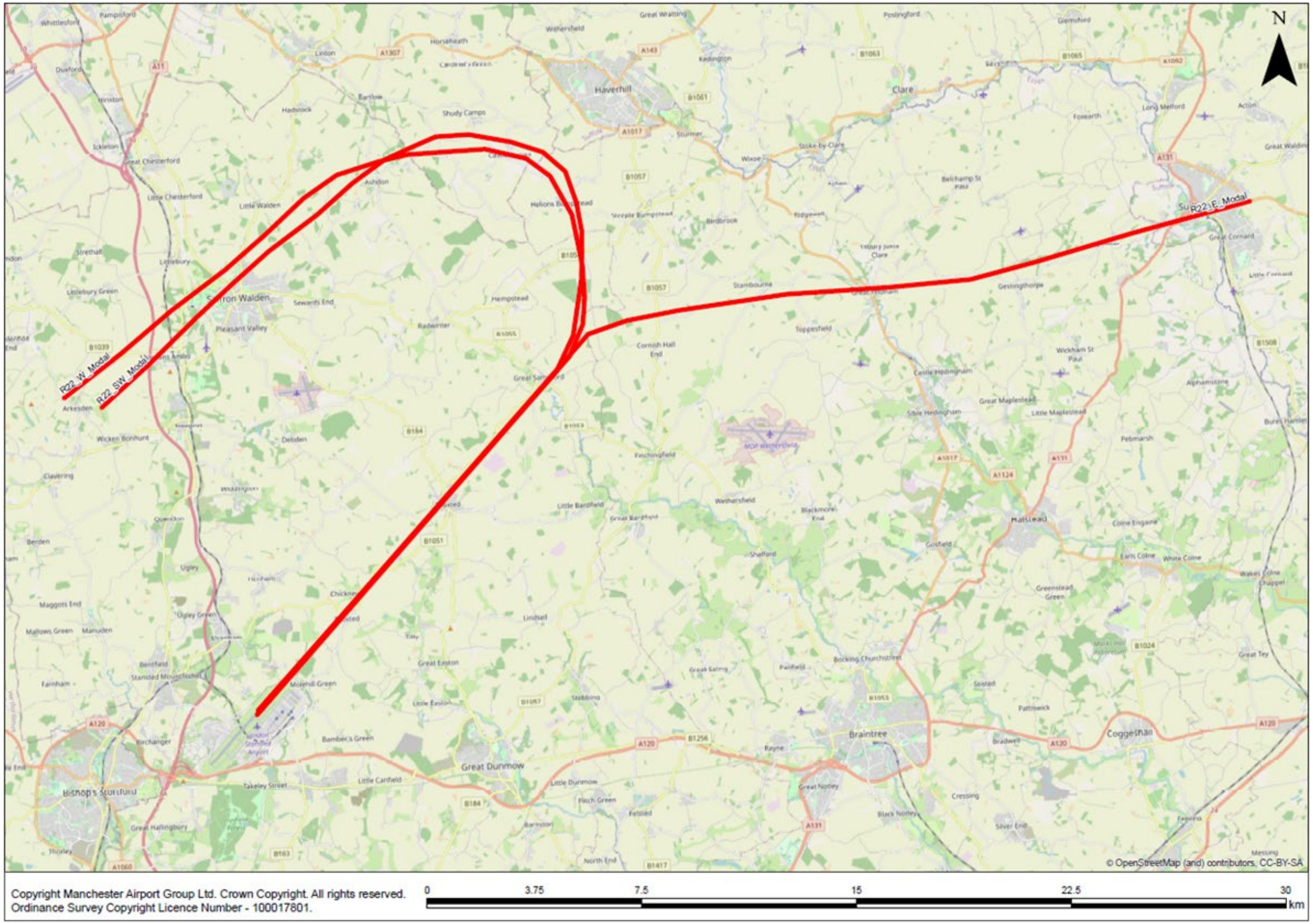

Figure 12 Modal Radar Vectoring Tracks for Runway 22 Arrivals

3.6 The 'Do Minimum Option'

3.6.1 Departures

Whilst the 'Do Nothing' scenario has been used as a baseline for assessment within the IOA, a 'Do Minimum' scenario for the Departures and Arrivals/Transitions has also been considered. These are described in the sections below. Where applicable, these 'Do Minimum' options have been assessed against the 'Do Nothing' baseline within the IOA Full Analysis Tables.

The 'Do Minimum' option for departures constitutes an RNAV replication of the existing conventional SIDs, but instead of designing to the current minimum 3.3% climb gradient, a 6% climb gradient has been applied. This more accurately reflects the feedback provided by airlines in the fleet equipage survey, which confirmed that the greater performance of current aircraft and means that this is a realistic minimum climb gradient for today's aircraft, and provided a reasonable but conservative basis for assessment. These tracks are contained within each of the RW 04/22 design envelopes. Figure 13 below shows an example of the replication that has been designed for the UTAVA and NUGBO SIDs for both runways. To clarify, the design envelope known as 'WEST A' refers to route options that terminate at UTAVA whereas the design envelope known as 'WEST B' refers to route options terminating at NUGBO.

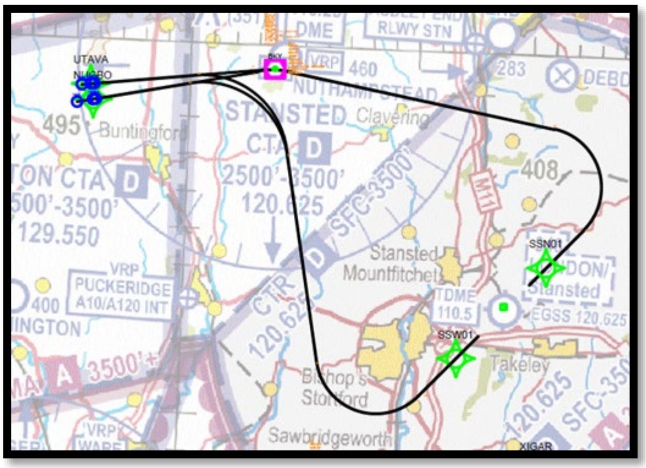

Figure 13 RNAV Replication of Existing UTAVA/NUGBO SIDs

As these are RNAV replication routes, they are designed in accordance with requirements specified in Procedures for Air Navigation Services – Operations (PANS-OPS), as published by the International Civil Aviation Organisation (ICAO) in Document No 8168. STN is required to design routes in accordance with PANS-OPS criteria, as specified in the AMS. Since this is a different design criteria than that in place when the conventional SIDs were originally designed, there may be a slight lateral difference in tracks over the ground, but this would be limited. However, the 'Do Minimum' designs assume a minimum climb gradient of 6%, whereas in practice the modal tracks that inform the 'Do Nothing' scenarios have climb gradients greater than 6%. As a result, whilst the lateral tracks remain broadly similar between 'Do Nothing' and 'Do Minimum', the population 'overflown', fuel burn and greenhouse gas emissions may not. This is reflected in the results of this IOA.

This approach has been expanded to include a replication of all existing SIDs for Runway 04/22. The exceptions to this are design envelopes SOUTH-WEST and NORTH-EAST as these represent completely new design areas, and therefore there are no current conventional procedures published to replicate for these envelopes. Since aircraft that would benefit from the NORTH-EAST envelope would currently use a CLN departure, and those we would expect to use the SOUTH-WEST envelope would currently use a NUGBO SID, for the purposes of the IOA, the SOUTH-WEST envelope shall be compared to the NUGBO SID, and the NORTH-EAST envelope shall be compared to the CLN SID, as the appropriate 'Do Nothing' comparator.

This provides a mechanism for comparison at this stage of the ACP, but it is recognised that the data and the comparison of overflight data, provides limited information. At Stage 3 of the ACP, all route options are assessed as systems which will provide a more realistic and comparative basis for analysis as it will also consider factors such as route loadings and aircraft types.

3.6.2 Arrivals/Transitions

Establishing a 'Do Minimum' option(s) for the arrivals/transitions is more challenging. The AMS requires sponsors to change the way aircraft arrive at airports by using a systemised approach where possible, and to reduce the reliance on radar vectoring. This brings significant benefits but represents a completely different way of operating when compared to today's operations.

Since aircraft arriving at STN are currently presented from a variety of directions, and the tracks are dispersed over a wide area, it was difficult to establish a single route option which truly represents the 'Do-Minimum' scenario.

In the DPE, departures were compared to 'Do Minimum' options to test the route options against each of the DPs. Since it was not possible to replicate (and create a 'Do-Minimum' option), the Arrivals options were instead compared to the set of modal tracks compiled using historical Noise Track Keeping (NTK) Data showing where the majority of flights currently overfly. These modal tracks are essentially the same as the 'Do Nothing' baseline, and represent today's operation. A total of four modal tracks were identified (two for each runway) and these were used to compare within the DPE to test the route options against the DPs. Section 3.5 above describes how these tracks were derived. The same modal tracks were used within the IOA since they also provide a mechanism to demonstrate today's operation and therefore represent the 'Do Nothing' baseline to compare the new route options.

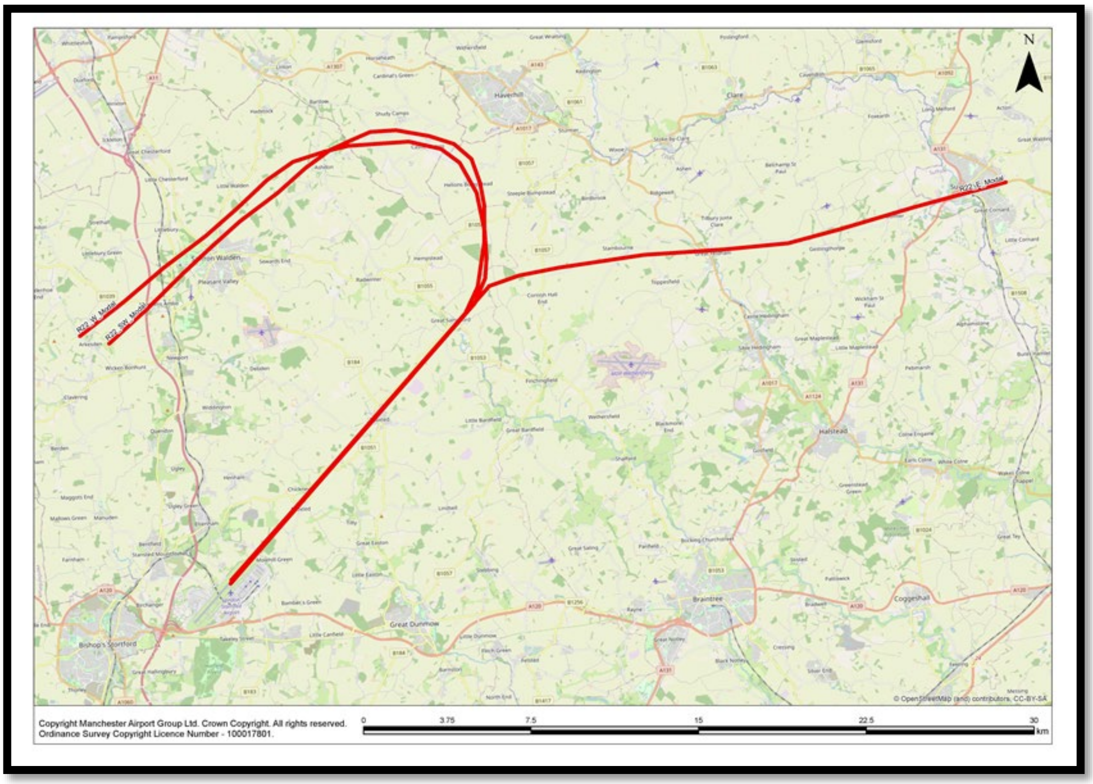

Figure 14 RW 22 Modal Paths from NTK System

Overflight data was collated from two modal tracks for RW22 arrivals. Figure 14 shows the three modal paths; for the assessment, the two paths originating from the west were combined and assessed as one single path. However, duplicated postcode data was ignored, meaning households were not double counted in terms of overflight, so the results could be more comparable at this stage. This data was also used within the IOA as the data derived best demonstrates today's operations (baseline).

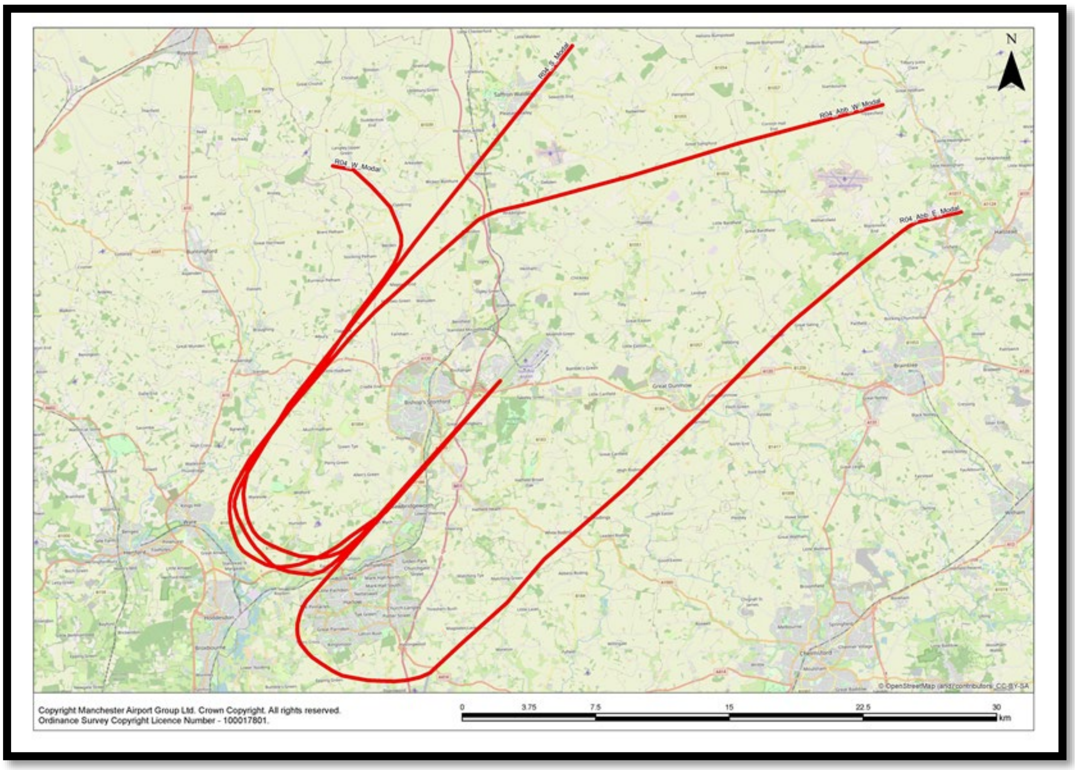

Figure 15 RW 04 Modal Paths from NTK System

3.7 'Do Nothing' Baseline vs 'Do Minimum' Option

As specified in CAP1616, Appendix E, Paragraph E21 [Ref 1]:

"In certain cases, doing nothing is not a feasible option in reality. For example, airspace may need to be changed to reflect the UK's international obligations. In such cases, in addition to the 'do nothing' baseline, the change sponsor must set out its informed view of the future and the minimum changes required to address the issues identified – a 'do minimum' option. Assessing the 'do minimum' option against a 'do nothing' baseline allows communities to understand the effect of the 'do minimum' in relation to current circumstances."

The sub-sections below clarify the differences between the 'Do Nothing' and 'Do Minimum' scenarios, to enable a better understanding of the "effect of the 'Do Minimum' in relation to current circumstances".

3.7.1 Departures

For the purposes of the baseline scenario within the IOA, the 'Do Nothing' for departures is the modal tracks of the existing published SIDs (UTAVA/NUGBO/LAM/CLN/DET/BKY). A slight difference in modal tracks flown when compared to the published SIDs is acknowledged, but this provides a more accurate representation of what occurs today. The analysis of these has also been conducted based on athe actual climb gradient of the modal track, rather than the published minimum climb gradient of 3.3% to better reflect today's operations.

Meanwhile, the 'Do Minimum' is a replication of the existing published SIDs (this is an RNAV1 design of each of the SIDs, using a 6% climb gradient). Therefore, if the

'Do Minimum' is implemented, there will be little change when compared to the lateral track flown by aircraft in today's operation. Due to the strict application of PANS-OPS criteria, there may be a slight difference between these lateral tracks; this difference cannot be determined at this stage but is expected to be very minor.

Whilst the lateral tracks for 'Do Nothing' and 'Do Minimum' show limited differences, the 'Do Minimum' designs assume a minimum climb gradient of 6%, whereas in practice the modal tracks that inform the 'Do Nothing' scenarios have climb gradients greater than 6%. As set out in Section 6.2, the assessment of some factors, including noise, has been informed by an overflight analysis. Since the dimensions of the overflight 'envelope' (as opposed to lateral track), are dependent upon the rate of climb, the difference in climb gradients between the 'Do Nothing' and 'Do Minimum' scenarios has meant that the 'Do Nothing' (steeper climb) envelope widens more quickly and is rather shorter than that of the 'Do Minimum' (shallower climb). The effect of this can be seen in the Full Analysis Tables, which are published separately and are available on the CAA Portal. They show that whilst the lateral tracks remain broadly similar between 'Do Nothing' and 'Do Minimum', in some instances the population 'overflown' may vary considerably.

3.7.2 Arrivals/Transitions

When considering the 'Do Nothing' scenarios, the radar vectoring patterns illustrated in Figure 9 are broadly similar to the modal tracks shown in Figure 11 and Figure 12, though it is acknowledged that a small number of aircraft present from different locations. As such, the 'Do Nothing' scenarios are based on the modal radar vectoring tracks.

Since aircraft arriving at STN are currently presented from a variety of directions, and the tracks are dispersed over a wide area, it was difficult to establish a 'Do-Minimum' scenario that could attempt to replicate today's operation. Therefore, there is no 'Do Minimum' scenario for Arrivals/Transitions; the 'Do Nothing' is used as a comparator in the DPE to test the route options against the DPs and is used as baseline to compare the route options within the IOA.

3.8 IOA Baseline Scenario Summary

The information presented in this section is technical in nature. To aid clarity, Table 3 below presents the baseline scenarios used for comparison within the IOA.

Baseline	Scenario	Variations
'Do Nothing' – Departures	The existing SIDs utilising UTAVA, NUGBO, BKY, LAM, DET and CLN	Modal track of existing Runway 04 UTAVA SID
		Modal track of existing Runway 04 NUGBO SID
		Modal track of existing Runway 04 BKY SID (up to 4,000ft)
		Modal track of existing Runway 04 LAM SID (up to 4,000ft)
		Modal track of existing Runway 04 DET SID
		Modal track of existing Runway 04 CLN SID
		Modal track of existing Runway 22 UTAVA SID
		Modal track of existing Runway 22 NUGBO SID
		Modal track of existing Runway 22 BKY SID (up to 4,000ft)
		Modal track of existing Runway 22 LAM SID (up to 4,000ft)
		Modal track of existing Runway 22 DET SID
		Modal track of Existing Runway 22 CLN SID
'Do Nothing' – Arrivals/Transitions	A defined track identified as the most commonly used routing based on existing radar vectoring patterns.	Modal radar vectoring pattern from an easterly direction to Runway 04
		Modal radar vectoring pattern from a westerly direction to Runway 04 ('Modal modal')
		Modal radar vectoring pattern from an easterly direction to Runway 22
		Modal radar vectoring pattern from a westerly direction to Runway 22 ('Modal modal')

Table 3 IOA Baseline Scenario Summary

4 Initial Options Appraisal Results

4.1 Introduction

This section provides some additional clarification to assist the reader in understanding the rationale behind the IOA Results, which are presented in full, at the end of this section. The Results Summary, presented in Section 4.4 is a high-level extract of the Full Analysis Table, which can be found in Appendix A1 or on the CAA Airspace Change Portal as a separate document. It is highly recommended that any reader has already read this section before proceeding to read the Full Analysis Table (found in Appendix A1) to provide context and an explanation of the terminology used.

4.2 IOA Background

This sub-section provides some additional clarification which should be considered when reviewing the IOA Full Analysis Table (as shown in Appendix A1). Furthermore, the details provided in this sub-section form a crucial element in terms of the rationale and thought process behind which options are taken forward into Stage 3 of the CAP1616 [Ref 1] process.

4.3 Comprehensive List of Viable Options

The Comprehensive List of Viable Options is the output of the DPE. This list acts as an input to the IOA, containing all of the route options that shall be assessed within the IOA. To view the Comprehensive List of Viable Options for the STN ACP, please refer to the DPE [Ref 3].

4.4 Results Summary

This section provides a high-level summary of the IOA. An extract of the full analysis table is available in Appendix A1. The complete table can be found on the CAA airspace change portal.

Table 4 below contains a high-level summary of the IOA results, broken down by option. For details on the full analysis, please refer to the separate Appendix on the CAA airspace change portal, as detailed in Appendix A1 of this document. The colouring utilised in Table 4 below is the same as that used throughout the IOA as shown in Table 2 previously.

Envelope	Option	Status
RW 22 SID WEST A	Option 1A	Rejected
	Option 6A	Favourable
	Option 7A	Preferred
	Option 9A	Acceptable
RW 22 SID WEST B	Option 2B	Favourable
	Option 8B	Preferred
	Option 11B	Acceptable
RW 22 SID SOUTH-WEST	Option 1	Rejected
	Option 3	Preferred
	Option 4	Rejected
	Option 5	Acceptable
	Option 6	Favourable
RW 22 SID SOUTH	Option 0	Rejected
	Option 1	Rejected
	Option 2	Acceptable
	Option 3	Favourable
	Option 4	Rejected
	Option 5	Rejected
	Option 6	Preferred
RW 22 SID SOUTH-EAST	Option 0	Rejected
	Option 1	Rejected
	Option 2	Acceptable
	Option 3	Preferred
	Option 4	Rejected
	Option 5	Favourable

RW 22 SID EAST	Option 0	Rejected
	Option 1	Preferred
	Option 2	Favourable
	Option 3	Acceptable
RW 22 SID NORTH	Option 0	Rejected
	Option 1	Rejected
	Option 5	Favourable
	Option 7	Acceptable
	Option 8	Preferred
RW 22 SID NORTH-EAST	Option 3	Favourable
	Option 4	Preferred
RW 04 SID SOUTH	Option 0	Rejected
	Option 1	Rejected
	Option 2	Rejected
	Option 3	Acceptable
	Option 4	Preferred
	Option 5	Favourable
	Option 6	Rejected
RW 04 SID SOUTH-EAST	Option 0	Rejected
	Option 1	Favourable
	Option 2	Rejected
	Option 3	Acceptable
	Option 4	Preferred
RW 04 SID EAST	Option 0	Rejected
	Option 1	Acceptable
	Option 2	Rejected

	Option 4	Favourable
	Option 5	Preferred
RW 04 SID NORTH-EAST	Option 1	Rejected
	Option 4	Acceptable
	Option 7	Preferred
	Option 8	Favourable
RW 04 SID NORTH	Option 0	Rejected
	Option 2	Rejected
	Option 3	Preferred
	Option 4	Acceptable
	Option 5	Rejected
	Option 6	Favourable
RW 04 SID WEST A	Option 1A	Acceptable
	Option 3A	Favourable
	Option 5A	Preferred
	Option 9A	Rejected
RW 04 SID WEST B	Option 2B	Acceptable
	Option 4B	Preferred
	Option 6B	Favourable
	Option 8B	Rejected
RW 04/22 2,000ft Transitions (East)	Option 8	Preferred
	Option 22	Favourable
RW 04/22 2,000ft Transition (West)	Option 9	Preferred
	Option 12	Rejected
	Option 14	Rejected
	Option 16	Favourable

	Option 17	Acceptable
RW 04/22 2,500ft Transitions (East)	Option 1	Rejected
	Option 10	Preferred
	Option 19	Favourable
	Option 20	Acceptable
	Option 21	Rejected
RW 04/22 2,500ft Transitions (West)	Option 14	Favourable
	Option 16	Preferred
RW 04/22 2,500ft Transitions (Central)	Option 2B	Preferred

Table 4 IOA Results Summary

5 Qualitative Safety Assessment

5.1 CAP1616 Safety Assessment Requirements

A qualitative Safety Assessment is required for all options identified during Step 2A, and a detailed final safety assessment must be completed by the change sponsor prior to submission in Step 4B. STN is carrying out the safety assessment activities in accordance with CAP 760 [Ref 8], the separate guidance provided by the CAA for safety assessment.

The change sponsor shall develop a full four-part Safety Case iteratively throughout the CAP1616 [Ref 1] process which will be submitted to the CAA at Step 4B.

5.2 Safety Assessment Method

The Qualitative Safety Assessment uses the results of a formal Hazard Identification (HazID) workshop held on 11th January 2022, during which the hazards, causes and consequences relating to STN ACP design envelopes/areas were discussed. The meeting was attended by several ATC Subject Matter Experts from both STN and NATS alongside Airspace Project Managers/Consultants and an Aviation Safety Practitioner, who facilitated the workshop.

Due to the large number of options associated with this ACP, the HazID focused on assessing design envelopes/areas as opposed to individual design options. Further assessment will be conducted at Stage 3 and 4 of the CAP1616 process.

5.3 Safety Assessment Results – Non-Technical Summary

5.3.1 General

The HazID identified several dependencies and/or influencing factors that were common to all the IFP design options e.g., Loss of surveillance, loss of GNSS signal, corruption of AIP information. These are all well understood within the aviation community and there are various redundancy measures and procedures already in place.

5.3.2 Departures

Design Envelope	High-level Safety Assessment
SID RW 22 WEST A	Several possible conflicts with London Luton traffic were identified. However, it is not clear whether these would occur below 7,000ft, or above 7,000ft which would be outside the scope of this ACP. That said, it is acknowledged as a possible hazard affecting the wider London airspace modernisation programme. Furthermore, mitigations such as tactical intervention by ATC could be put in place. Leading on from this, possible

	unknown interaction with the wider enroute network is acknowledged but cannot be determined at this time. In addition, it was identified that due to the dispersion of traffic departing STN, a degree of tactical intervention may be required to maintain safe separations standards. The design process may also help to mitigate this hazard to 'as low as reasonably practicable'. This is very specific to exact aircraft routing combinations.
SID RW 22 WEST B	Several possible conflicts with London Luton traffic were identified. However, it is not clear whether these would occur below 7,000ft, or above 7,000ft which would be outside the scope of this ACP. That said, it is acknowledged as a possible hazard affecting the wider London airspace modernisation programme. Furthermore, mitigations such as tactical intervention by ATC could be put in place. Leading on from this, possible unknown interaction with the wider enroute network is acknowledged but cannot be determined at this time. In addition, it was identified that due to the dispersion of traffic departing STN, a degree of tactical intervention may be required to maintain safe separations standards. The design process may also help to mitigate this hazard to 'as low as reasonably practicable'. This is very specific to exact aircraft routing combinations.
SID RW 22 SOUTH-WEST	Possible conflict with London Luton, London City, Heathrow, London Biggin Hill and RAF Northolt traffic was identified. Procedure design and ATC tactical intervention could act as mitigations in these instances but could increase complexity, leading to a possible increase in ATCO workload. Leading on from this, possible unknown interaction with the wider enroute network is acknowledged, but at this time, this cannot be determined. Some of the design options within this envelope consist of an 8% climb gradient. This may not be achievable by some aircraft that operate at STN, resulting in potential conflicts with other aircraft. To mitigate this, climb gradient requirements could be published. In addition, it was identified that due to the dispersion of traffic departing STN, a degree of tactical intervention may be required to maintain safe separations standards. The design process may also help to mitigate this hazard to 'as low as is reasonably practicable'. This is very specific to exact aircraft routing combinations.
SID RW 22 SOUTH	Possible conflict with London Luton, London Southend, Heathrow and RAF Northolt traffic was identified. Procedure design and ATC tactical intervention could act as mitigations in these instances but could increase

	complexity, leading to a possible increase in ATCO workload. Leading on from this, possible unknown interaction with the wider enroute network is acknowledged, but at this time, this cannot be determined. Some of the design options within this envelope consist of an 8% climb gradient. This may not be achievable by some aircraft that operate at STN, resulting in potential conflicts with other aircraft. To mitigate this, climb gradient requirements could be published.
SID RW 22 SOUTH-EAST	Possible conflict with London Luton, London City, London Southend, Heathrow and RAF Northolt traffic was identified. Procedure design and ATC tactical intervention could act as mitigations in these instances but could increase complexity, leading to a possible increase in ATCO workload. Leading on from this, possible unknown interaction with the wider enroute network is acknowledged, but at this time, this cannot be determined. In addition, it was identified that due to the dispersion of traffic departing STN, a degree of tactical intervention may be required to maintain safe separations standards. The design process may also help to mitigate this hazard to 'as low as reasonably practicable'. This is very specific to exact aircraft routing combinations.
SID RW 22 EAST	Possible conflict with London Luton, London City, London Southend and Heathrow traffic was identified. Procedure design and ATC tactical intervention could act as mitigations in these instances but could increase complexity, leading to a possible increase in ATCO workload. Leading on from this, possible unknown interaction with the wider enroute network is acknowledged, but at this time, this cannot be determined. In addition, it was identified that due to the dispersion of traffic departing STN, a degree of tactical intervention may be required to maintain safe separations standards. The design process may also help to mitigate this hazard to 'as low as reasonably practicable'. This is very specific to exact aircraft routing combinations.
SID RW 22 NORTH-EAST	Possible conflict with London Luton, London Southend and Cambridge traffic was identified. Procedure design and ATC tactical intervention could act as mitigations in these instances but could increase complexity, leading to a possible increase in ATCO workload. Leading on from this, possible unknown interaction with the wider enroute network is acknowledged, but at this time, this cannot be determined. In addition, it was identified that due to the dispersion of traffic departing STN, a degree of tactical intervention may

	be required to maintain safe separations standards. The design process may also help to mitigate this hazard to 'as low as reasonably practicable'. This is very specific to exact aircraft routing combinations. Furthermore, possible interaction with the existing STN ABBOT hold was identified; therefore, ATC tactical intervention may be required to maintain safe separation between departing and arriving aircraft. Procedure design constraints act as an additional mitigation in this instance.
SID RW 22 NORTH	Possible conflict with London Luton and Cambridge traffic was identified (although the conflict with Cambridge traffic was deemed to be outside controlled airspace). Procedure design and ATC tactical intervention could act as mitigations in these instances but could increase complexity, leading to a possible increase in ATCO workload. Leading on from this, possible unknown interaction with the wider enroute network is acknowledged, but at this time, this cannot be determined. In addition, it was identified that due to the dispersion of traffic departing STN, a degree of tactical intervention may be required to maintain safe separations standards. The design process may also help to mitigate this hazard to as low as is reasonably practical. This is very specific to exact aircraft routing combinations. At this time, there is an additional unknown hazard relating to interactions with military traffic operating in the vicinity of RAF Mildenhall/RAF Lakenheath. The design process may also help to mitigate this hazard to 'as low as reasonably practicable'. This is very specific to exact aircraft routing combinations. ATC tactical intervention could also be applied. Furthermore, design options within this envelope are likely to conflict with the STN missed approach procedure. This increases complexity, leading to a possible increase in ATCO workload as ATC tactical intervention may be required. An additional hazard bespoke to this design envelope is containment within Controlled Airspace. Although this design envelope is contained within Controlled Airspace, some design options will soon run outside controlled airspace as they leave the designated procedure. ATC tactical intervention or additional instructions on the AIP could act as mitigations for this.
SID RW 04 SOUTH	Possible conflict with London Luton, London Southend, Heathrow and RAF Northolt traffic was identified. Procedure design and ATC tactical intervention could act as mitigations in these instances but could increase

	complexity, leading to a possible increase in ATCO workload. Leading on form this, possible unknown interaction with the wider enroute network is acknowledged, but at this time, this cannot be determined. Some of the design options within this envelope consist of an 8% climb gradient. This may not be achievable by some aircraft that operate at STN, resulting in potential conflicts with other aircraft. To mitigate this, climb gradient requirements could be published.
SID RW 04 SOUTH-EAST	Possible conflict with London Luton, London Southend, Heathrow, London City and RAF Northolt traffic was identified. Procedure design and ATC tactical intervention could act as mitigations in these instances but could increase complexity, leading to a possible increase in ATCO workload. Leading on form this, possible unknown interaction with the wider enroute network is acknowledged, but at this time, this cannot be determined. In addition, it was identified that due to the dispersion of traffic departing STN, a degree of tactical intervention may be required to maintain safe separations standards. The design process may also help to mitigate this hazard to 'as low as reasonably practicable'. This is very specific to exact aircraft routing combinations.
SID RW 04 EAST	Possible conflict with London Luton, London Southend, Heathrow, London City traffic was identified. Procedure design and ATC tactical intervention could act as mitigations in these instances but could increase complexity, leading to a possible increase in ATCO workload. Leading on form this, possible unknown interaction with the wider enroute network is acknowledged, but at this time, this cannot be determined. In addition, it was identified that due to the dispersion of traffic departing STN, a degree of tactical intervention may be required to maintain safe separations standards. The design process may also help to mitigate this hazard to 'as low as reasonably practicable'. This is very specific to exact aircraft routing combinations. Furthermore, possible interaction with the existing STN ABBOT hold was identified, therefore, ATC tactical intervention may be required to maintain safe separation between departing and arriving aircraft. Procedure design constraints act as an additional mitigation in this instance.
SID RW 04 NORTH-EAST	Possible conflict with London Luton, London Southend, Heathrow, London City, Cambridge and RAF Northolt traffic was identified. Procedure design and ATC tactical intervention could act as mitigations in these instances but could increase complexity, leading to a possible increase in

	ATCO workload. Leading on form this, possible unknown interaction with the wider enroute network is acknowledged, but at this time, this cannot be determined. In addition, it was identified that due to the dispersion of traffic departing STN, a degree of tactical intervention may be required to maintain safe separations standards. The design process may also help to mitigate this hazard to 'as low as reasonably practicable'. This is very specific to exact aircraft routing combinations. Furthermore, possible interaction with the existing STN ABBOT hold was identified, therefore, ATC tactical intervention may be required to maintain safe separation between departing and arriving aircraft. Procedure design constraints act as an additional mitigation in this instance.
SID RW 04 NORTH	Possible conflict with London Luton and Cambridge traffic was identified. Procedure design and ATC tactical intervention could act as mitigations in these instances but could increase complexity, leading to a possible increase in ATCO workload. Leading on form this, possible unknown interaction with the wider enroute network is acknowledged, but at this time, this cannot be determined. At this time, there is an additional unknown hazard relating to interactions with military traffic operating in the vicinity of RAF Mildenhall/RAF Lakenheath. The design process may also help to mitigate this hazard to as low 'as reasonably practicable'. This is very specific to exact aircraft routing combinations. ATC tactical intervention could also be applied. An additional hazard bespoke to this design envelope is containment within Controlled Airspace. Although this design envelope is contained within Controlled Airspace, some design options will soon run outside controlled airspace as they leave the designated procedure. ATC tactical intervention or additional instructions on the AIP could act as mitigations for this. In addition, it was identified that due to the dispersion of traffic departing STN, a degree of tactical intervention may be required to maintain safe separations standards. The design process may also help to mitigate this hazard to as low as is reasonably practical. This is very specific to exact aircraft routing combinations.
SID RW 04 WEST A	Possible conflict with London Luton traffic was identified. Procedure design and ATC tactical intervention could act as mitigations in these instances but could increase complexity, leading to a possible increase in ATCO workload. Leading on form this, possible unknown

	interaction with the wider enroute network is acknowledged, but at this time, this cannot be determined. In addition, it was identified that due to the dispersion of traffic departing STN, a degree of tactical intervention may be required to maintain safe separations standards. The design process may also help to mitigate this hazard to 'as low as reasonably practicable'. This is very specific to exact aircraft routing combinations.
SID RW 04 WEST B	Possible conflict with London Luton traffic was identified. Procedure design and ATC tactical intervention could act as mitigations in these instances but could increase complexity, leading to a possible increase in ATCO workload. Leading on form this, possible unknown interaction with the wider enroute network is acknowledged, but at this time, this cannot be determined. In addition, it was identified that due to the dispersion of traffic departing STN, a degree of tactical intervention may be required to maintain safe separations standards. The design process may also help to mitigate this hazard to as low 'as reasonably practicable'. This is very specific to exact aircraft routing combinations.

Table 5 STN Departures High-level Safety Assessment

5.3.3 Arrivals/Transitions

Design Area	High-level Safety Assessment
RW 22 WEST	Possible conflict with STN proposed SIDs. Given this, there is a potential for a loss of horizontal and/or vertical separation requiring ATC tactical intervention, causing an increase in ATCO workload. The design process itself is also a mitigation in this instance as procedures could be designed with the appropriate horizontal/vertical separation standards.
RW 22 EAST	Possible conflict with STN proposed SIDs. Given this, there is a potential for a loss of horizontal and/or vertical separation requiring ATC tactical intervention, causing an increase in ATCO workload. The design process itself is also a mitigation in this instance as procedures could be designed with the appropriate horizontal/vertical separation standards.
RW 04 WEST	Possible conflict with STN proposed SIDs. Given this, there is a potential for a loss of horizontal and/or vertical separation requiring ATC tactical intervention, causing an increase in ATCO workload. The design process itself is also a mitigation in this instance as procedures could be

	designed with the appropriate horizontal/vertical separation standards.
RW 04 EAST	Possible conflict with STN proposed SIDs. Given this, there is a potential for a loss of horizontal and/or vertical separation requiring ATC tactical intervention, causing an increase in ATCO workload. The design process itself is also a mitigation in this instance as procedures could be designed with the appropriate horizontal/vertical separation standards.
RW 22 IAP 3,000ft FAF	With specific reference to the proposed IAP involving a FAF at 3,000ft for RW 22, the nominal track extends outside controlled airspace. This may result in a potential for a loss of horizontal/vertical separation with aircraft operating in uncontrolled airspace. ATC tactical innervation is a mitigation in this instance but would increase ATCO workload. A further mitigation would be to expand the scope of the STN ACP to request additional airspace to provide full containment.
RW 04 IAP 3,000ft FAF	Due to the location of the RW 04 IAP 3,000ft FAF, it is likely to conflict with London City traffic that is usually at the same point in space at a similar altitude in today's operation. This may lead to a loss of horizontal/vertical separation which could be mitigated by ATC tactical intervention. In turn, this might cause an increase in ATCO workload.

6 Noise Methodology

6.1 Overview

CAP1616 requires change sponsors to assess the potential noise impact of any proposal being put forward, using a range of indicators. The level of assessment expected varies according to the scale of the changes being proposed and the stage of the change process that has been reached.

At this stage, Stage 2, the number of options to be assessed is significant and the level of refinement immature. CAP1616 therefore does not require the change sponsor to go into a full level of detail for every route option on the 'comprehensive list of viable options'. Instead, the scale of assessment should be proportionate, and the appraisal must as a minimum, contain qualitative assessments of the different options.

In the IOA, overflight of Population and Residential Buildings has been used to determine whether a specific route option has the potential to impose a positive or negative impact. However, it is accepted that overflight is not the appropriate metric to establish the impact of noise exposure on people. Full environmental assessment including noise contours will be created at Stage 3 of the ACP. The production of LAeq contours will facilitate stakeholders to understand any potential impact of the proposed changes.

6.2 Noise Modelling Category

The CAA's CAP2091 document describes the 'minimum acceptable level of sophistication of noise modelling' that can be used to provide the CAA with the outputs they require to carry out certain of their statutory duties, including airspace change.

Five noise modelling categories are established – Category A to Category E. Category A being the most sophisticated and Category E, the least.

As part of our Stage 2 submission CAP2091 requires us to set out and justify the noise modelling category we will adopt in this ACP and to advise which category Stansted currently falls into. This will be a component of the analyses that we shall apply in relation to subsequent stages of ACP.

Since Stansted has been designated for noise purposes by the Secretary of State, the airport is assigned to the highest (Category A) standard. Consistent with this, all noise modelling outputs provided to the CAA in support of this ACP, will also be modelled to the Category A standard.

6.3 Design Principle Application

To ensure consistency with the DPE, overflight metrics have been used within the IOA to provide an indication of the number of people overflown compared to the baseline and each route option.

To achieve this, the same analysis conducted in the DPE has been used in the IOA. With regard to qualitatively assessing potential noise impact, STN has utilised populations and residential buildings overflown to make a clear comparison to the baseline scenario. STN has used the Definition of Overflight criteria set out in CAP1498 [Ref 7] to conduct this assessment.

CAP1498 recognises that an aircraft does not have to pass directly overhead, to be considered an overflight. Instead, overflight should be defined to include aircraft that pass over and to the side of an observer. The distance that an aircraft can be to the side and still considered an overflight is set using an elevation angle. An aircraft flying directly overhead would be at an elevation angle of 90°. An aircraft on the ground would be at an elevation angle of 0°.

CAP1616 recommends the use of 48.5° as an elevation angle. This is because for an aircraft to give a noise level approximately 3dB lower than if it had flown directly overhead, it would need to be at an elevation angle of 48.5°. A difference of 3dB is widely accepted as the smallest difference between two noise levels that the average person can perceive.

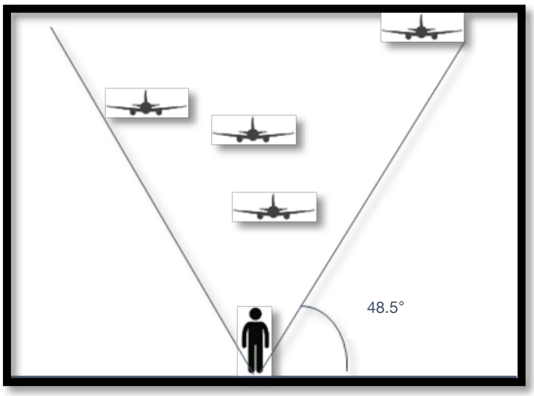

Figure 16 48.5°Overflight Cone

Alternatively, if we look at this from an aircraft's perspective. All locations within the cone are 'overflown'. STN has taken each individual route option from our comprehensive list of viable options and assessed it against the above overflight definition.

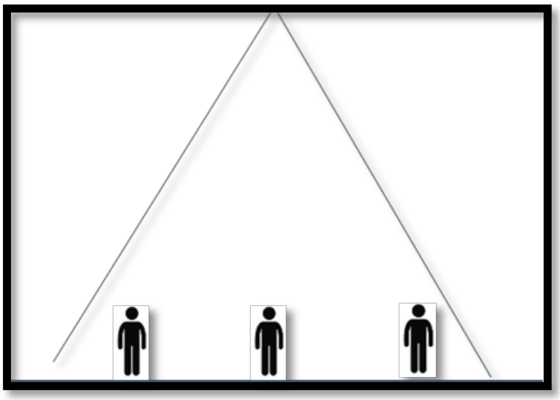

Figure 17 Overflight Cone

7 Design Options Shortlist

7.1 Shortlist of Options Taken Forward

Table 6 below presents the Short List of options carried forward to Stage 3.

Design Envelope	Option	Status
RW 22 SID WEST A	Option 6A	Favourable
	Option 7A	Preferred
	Option 9A	Acceptable
RW 22 SID WEST B	Option 2B	Favourable
	Option 8B	Preferred
	Option 11B	Acceptable
RW 22 SID SOUTH-WEST	Option 3	Preferred
	Option 5	Acceptable
	Option 6	Favourable
RW 22 SID SOUTH	Option 2	Acceptable
	Option 3	Favourable
	Option 6	Preferred
RW 22 SID SOUTH-EAST	Option 2	Acceptable
	Option 3	Preferred
	Option 5	Favourable
RW 22 SID EAST	Option 1	Preferred
	Option 2	Favourable
	Option 3	Acceptable
RW 22 SID NORTH	Option 5	Favourable
	Option 7	Acceptable
	Option 8	Preferred

RW 22 SID NORTH-EAST	Option 3	Favourable
	Option 4	Preferred
RW 04 SID SOUTH	Option 3	Acceptable
	Option 4	Preferred
	Option 5	Favourable
RW 04 SID SOUTH-EAST	Option 1	Favourable
	Option 3	Acceptable
	Option 4	Preferred
RW 04 SID EAST	Option 1	Acceptable
	Option 4	Favourable
	Option 5	Preferred
RW 04 SID NORTH-EAST	Option 4	Acceptable
	Option 7	Preferred
	Option 8	Favourable
RW 04 SID NORTH	Option 3	Preferred
	Option 4	Acceptable
	Option 6	Favourable
RW 04 SID WEST A	Option 1A	Acceptable
	Option 3A	Favourable
	Option 5A	Preferred
RW 04 SID WEST B	Option 2B	Acceptable
	Option 4B	Preferred
	Option 6B	Favourable
RW 04/22 2,000ft Transitions (East)	Option 8	Preferred
	Option 22	Favourable
	Option 9	Preferred

RW 04/22 2,000ft Transitions (West)	Option 16	Favourable
	Option 17	Acceptable
RW 04/22 2,500ft Transitions (East)	Option 10	Preferred
	Option 19	Favourable
	Option 20	Acceptable
RW 04/22 2,500ft Transitions (West)	Option 14	Favourable
	Option 16	Preferred
RW 04/22 2,500ft Transitions (Central)	Option 2B	Preferred

Table 6 Shortlist of Options Taken Forward

To summarise, Table 7 below shows the number of Preferred, Favourable and Acceptable route options. In total 66 route options (Departures and Arrivals/Transitions) are being taken through to Stage 3.

Assessment Outcome	Departures	Arrivals	Total
Preferred	15	10	25
Favourable	15	8	23
Acceptable	14	4	18
Total	**44**	**22**	**66**

Table 7 Shortlist Summary

8 Next Steps

Consistent with the requirements of Step 2A of CAP1616, we have undertaken a design process to identify a comprehensive list of route options. In Step 2A, these route options have been evaluated against the design principles that we identified through stakeholder engagement in Stage 1. This work is reported separately in the Design Options Report (DOR) [Ref 2] and the Design Principles Evaluation (DPE) [Ref 3]. Those that best align with the design principles were carried forward in the process to Step 2B.

Route options carried forward to Step 2B have been subject to an initial appraisal. The findings of that appraisal are set out in this IOA and the accompanying assessment tables.

The IOA is the first of three appraisals required under CAP1616 and, subject to the approval of the CAA, we will now consider the shortlisted options identified in the IOA in greater detail as part of Stage 3. This further assessment will increasingly make use of quantitative data and will explore local factors in greater detail than the level of assessment has allowed to date. The next stages in our appraisal will be guided by the requirements set out in CAP1616, including the metrics set out in Appendix E [Ref 1].

In setting out our shortlist of route options, we have benefitted from extensive engagement with stakeholders and the general public. Among the stakeholders were other sponsors of airspace change. We can therefore be confident that our proposals are consistent with the emerging proposals from other change sponsors, in so far as they are known at this time. However, these separate but dependant airspace changes will continue to mature, and it will be important for us to understand how proposals from other airports within our LTMA cluster might interact with the proposals for STN and how collectively our developing route options are best integrated into the network at higher altitudes. We will continue to work with other change sponsors, including NATS, so that our decisions are informed by the best available information and consistent with the developing national masterplan. If required, we will review the work we have undertaken to date to reflect emerging information.

The next logical step in considering airspace change is for individual route options to be combined into operating networks. This will support ongoing engagement and, in turn, will allow for a more detailed evaluation against the Design Principles N2, D and E. These consider noise respite, demand and efficiency respectively.

In addition, as the shortlisted route options are combined into operating networks For example, they may prove to be incompatible with other route options, may conflict with the proposals from other change sponsors or may result in a higher cumulative impact. This may mean that certain route options will be discounted, because they are highly unlikely to perform as well as other options. As such, they would not be taken forward to the full options appraisal or public consultation at Stage 3. Consistent with the developing national masterplan, we recognise that 'trade-offs will be identified by ACP sponsors during the development of the initial and full options appraisals (Stages 2B and 3A of the CAP1616 process) and in collaboration with ACOG when assessing the combined and net impacts of interdependent options'.

Our Efficiency design principle states that we will seek to minimise the amount of controlled airspace we require, which seeks to ensure that the needs of other airspace users are considered. However, because of the potential for routes to be refined or amended, as referred to above, it would be premature to define future CAS requirements at this stage. As such, we will identify Controlled Airspace (CAS) requirements for groups of options during Stage 3. All stakeholders will be provided with an indication of the CAS requirements within our Step 3C Consultation material, and the comments received will be taken into account and considered as part of the consultation analysis activities in Step 3D. More details of this approach are provided in the DOR at section 4.5.

Further refinement of route options whereby certain options are not to be appraised fully at Stage 3 will be fully explained in preparing for Stage 3. We will ensure that affected stakeholders are afforded the opportunity to provide feedback prior to the full options appraisal.

9 References

Ref 1. CAP1616 – Airspace Change – Guidance on the regulatory process for changing the notified airspace design and planned and permanent redistribution of air traffic, and on providing airspace information (CAA)

Ref 2. STN Design Options Report (London Stansted Airport)

Ref 3. STN Design Principles Evaluation (London Stansted Airport)

Ref 4. The Green Book – Appraisal and evaluation in central government (UK Government)

Ref 5. WebTAG (UK Government)

Ref 6. CAP1616a - Airspace Change: Environmental requirements technical annex (CAA)

Ref 7. CAP1498 – Definition of Overflight (CAA)

Ref 8. CAP760 - Guidance on the Conduct of Hazard Identification, Risk Assessment and the Production of Safety Cases: For Aerodrome Operators and Air Traffic Service Providers (CAA)

Ref 9. Air Navigation Guidance 2017 (UK Government)

Ref 10. UK Aeronautical Information Publication (NATS)

Ref 11. Air Quality Management Areas (UK Government – DEFRA)

Ref 12. Conservation of Habitat & Species Regulations 2010 (UK Government)

A1 Initial Options Appraisal Full Analysis Table

Figure 18 below shows an example of an IOA Full Analysis Table completed for RW 22 WEST departures. The change sponsor has created one document contained the Full Analysis Tables for Departures and one document containing the Full Analysis Tables for Arrivals/Transitions. These can be found on the CAA Airspace change portal.

MAG STN ACP - INITIAL OPTIONS APPRAISAL - FULL ANALYSIS TABLE

Departure Envelope: SID RWY 22 WEST

Group	Impact	Level of Analysis	DO NOTHING BASELINE'	OPTION 1A	OPTION 6A	OPTION 7A	OPTION 9A
Communities	Noise impact on health and quality of life	Initial Options Appraisal: Qualitative	In terms of today's operation, the WEST design envelope is entirely based around the existing UTAVA and NUGBO SIDs. To provide the most representative use of the baseline scenario, the overflight analysis conducted on this SID was based on the modal tracks in 2019 as opposed to the lateral track published on the UK AIP. Furthermore, to provide an authentic comparison, the modelling was carried out based on a 6% climb gradient rather than 3.3% as per the published SID. This provides a more realistic comparison when compared to today's operation. It must also be acknowledged that an element of radar vectoring is required to maintain safe separation distances. Based on the above, it has been determined that the existing UTAVA SID overflies a 3,628 people and a total of 1,511 residential buildings. Meanwhile, the NUGBO SID overflies 7,923 people and a total of 3,512 residential buildings.	Option 1A is an RNAV replication of the current UTAVA SID which incorporates a 6% climb gradient. Based on the change sponsors analysis, Option 1A overflies 3,693 people and a total of 1,528 residential buildings. When compared to the baseline scenario, in terms of population and residential buildings overflown, Option 1A performs worse than the existing UTAVA SID and is therefore considered to be of dis-benefit.	Option 6A is an RNAV1 option based on the current UTAVA SID which incorporates a 6% climb gradient. Based on the change sponsors analysis, Option 6A overflies 2,883 people and a total of 1,424 residential buildings. When compared to the baseline scenario, in terms of population and residential buildings overflown, Option 6A performs better than the existing UTAVA SID and is therefore considered to be beneficial.	Option 7A is an RNP1 option based on the current UTAVA SID which incorporates a 6% climb gradient. Based on the change sponsors analysis, Option 7A overflies 2,416 people and a total of 1,206 residential buildings. When compared to the baseline scenario, in terms of population and residential buildings overflown, Option 7A performs better than the existing UTAVA SID and is therefore considered to be beneficial.	Option 9A is an RNAV1 option bas UTAVA SID which incorporates a 6 Based on the change sponsors an overflies 3,051 people and a total buildings. When compared to the terms of population and residenti overflown, Option 9A performs bet UTAVA SID and is therefore consid
Communities	Air Quality	Initial Options Appraisal: Qualitative	With regards to air quality, the existing UTAVA/NUGBO SIDs does not directly overfly any AQMAs. Given the 6% climb gradient included within the Do Nothing scenario, the impact of aircraft below 1,000ft with regards to local air quality is limited to areas within the immediate area surrounding the airport.	As per the baseline scenario, Option 1A does not directly overfly any AQMAs. Furthermore, as per CAP 1616 (para B74), due to mixing and dispersion, the impact on air quality above 1,000ft is likely to be insignificant. There are areas within the immediate area surrounding the airport that will be overflown below 1,000ft, however, for safety reasons, this is unavoidable. Therefore, overall, when compared to the baseline scenario, this option is deemed to be of equal benefit.	As per the baseline scenario, Option 6A does not directly overfly any AQMAs. Furthermore, as per CAP 1616 (para B74), due to mixing and dispersion, the impact on air quality above 1,000ft is likely to be insignificant. There are areas within the immediate area surrounding the airport that will be overflown below 1,000ft, however, for safety reasons, this is unavoidable. Therefore, overall, when compared to the baseline scenario, this option is deemed to be of equal benefit.	As per the baseline scenario, Option 7A does not directly overfly any AQMAs. Furthermore, as per CAP 1616 (para B74), due to mixing and dispersion, the impact on air quality above 1,000ft is likely to be insignificant. There are areas within the immediate area surrounding the airport that will be overflown below 1,000ft, however, for safety reasons, this is unavoidable. Therefore, overall, when compared to the baseline scenario, this option is deemed to be of equal benefit.	As per the baseline scenario, Opti directly overfly any AQMAs. Furthe (para B74), due to mixing and disp air quality above 1,000ft is likely t There are areas within the immed the airport that will be overflown however, for safety reasons, this i Therefore, overall, when compare scenario, this option is deemed t

Figure 18 IOA Full Analysis Table Example (RW 22 WEST Departures)