ROYAL AIR FORCE NORTHOLT

AIRSPACE CHANGE PROPOSAL (ACP-2018-66)
CAP 1616 STAGE 2
STEP 2B – INITIAL OPTIONS APPRAISAL

Roles

Action	Role	Date
Produce	RAF Northolt ACP Team	1st October 2022
Review	DAATM	13th October 2022
Approve	RAF Northolt Stn Cdr	18th October 2022

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Acronym	Term	Description
AAL	Above Aerodrome Level	
ACOG	Airspace Change Organising Group	Established in 2019 at the request of the Department for Transport and Civil Aviation Authority to coordinate the delivery of key elements of the UK's Airspace Modernisation Strategy.
ACP	Airspace Change Proposal	To carry out any permanent change to the published airspace, the Civil Aviation Authority (CAA) requires the change sponsor to carry out an airspace change proposal in accordance with CAP1616.
AIP	Aeronautical Information Publication	A publication which contains details of regulations, procedures, and other information pertinent to the operation of aircraft in the country to which it relates.
AMS	Airspace Modernisation Strategy	UK Government has tasked the aviation industry to modernise airspace in the whole of the UK. The long-term strategy of the CAA and the UK Government is called the Airspace Modernisation Strategy (AMS). The AMS identifies fifteen initiatives to modernise airspace. Its CAA document reference number is CAP1711.
AMSL	Above Mean Sea Level	Aircraft being described at an altitude above mean seal level (rather than a height above ground level).
ANSP	Air Navigation Service Provider	An organisation that provides the service of managing the aircraft in flight or on the manoeuvring area of an and which is the legitimate holder of that responsibility.
AONB	Area of Outstanding Natural Beauty	A designated exceptional landscape whose distinctive character and natural beauty are precious enough to be safeguarded in the national interest.
-	Approach Transition / arrival transition	The part of a PBN arrival route, defined to either RNAV1 or RNP1 standard, between the last part of the hold and the final approach path to the runway.
ATC	Air traffic control	Air traffic control (ATC) is a service provided which directs aircraft on the ground and through a given section of controlled airspace, and can provide advisory services to aircraft in non-controlled airspace. The primary purpose of ATC worldwide is to prevent collisions, organise and expedite the flow of air traffic, and provide information and other support for pilots.

ATCO	Air traffic control officer	A military air traffic controller.
ATZ	Aerodrome Traffic Zone	An airspace of defined dimensions established around an aerodrome for the protection of aerodrome traffic.
	Baseline	An expression used to indicate the status, impacts and operation environment in the absence of any change against which to compare the change.
CAA	Civil Aviation Authority	The UK Regulator for aviation matters.
CAP1616	Civil Aviation Publication 1616	The airspace change process regulated by the CAA.
CAS	Controlled Airspace	Generic term for the airspace in which an air traffic control service is provided as standard; note that there are different sub classifications of airspace that define the air traffic services available in defined classes of controlled airspace.
-	Centreline	The nominal track for a published route.
-	Concentration	Refers to a density of aircraft flight paths over a given location, this generally refers to high density where tracks are not spread out; this is the opposite of Dispersal.
CCO	Continuous Climb Operations	An aircraft operating technique facilitated by the airspace and procedures design and assisted by appropriate ATC procedures, allowing the execution of a flight profile optimised to the performance of aircraft, leading to significant economy of fuel and environmental benefits in terms of noise and emissions reduction.
CDO	Continuous Descent Operations	An aircraft operating technique in which an arriving aircraft descends from an optimal position with minimum thrust and avoids level flight to the extent permitted by the safe operation of the aircraft and compliance with published procedures and ATC instructions.
-	Conventional navigation	The historic navigation standard where aircraft fly with reference to ground-based radio navigation aids.
-	Conventional route	Routes defined to the conventional navigation standard, i.e., using ground-based radio navigation beacons to determine their position.
CTA	Control Area	Controlled airspace extending upwards from a specified limit above the earth. Control Areas are situated above the

		Aerodrome Traffic Zone (ATZ) and afford protection over a larger area to a specified upper limit.
CTR	Control Zone	Controlled airspace extending upwards from the surface of the earth to a specified upper limit. Aerodrome Control Zones afford protection to aircraft within the immediate vicinity of aerodromes.
db	Decibels	A unit used to measure the intensity of a sound (or the power level) of an electrical signal by comparing it with a given level on a logarithmic scale.
DER	Declared End of Runway	The very end of the runway where the Standard Instrument Departure starts from
-	Dispersal	Refers to the density of aircraft flight paths over a given location, this generally refers to lower density – tracks that are spread out; this is opposite of Concentration.
DVOR	Doppler Very high frequency Omni Range	A ground based navigational aid.
-	Easterly Operations	When a runway is operating such that aircraft are taking off and landing in an easterly direction.
-	Final Approach	The final part of an arrival flight path that is directly lined up with the runway.
FAF	Final Approach Fix	The point at which the final approach segment of an Instrument Approach Procedure commences.
FASI	Future Airspace Implementation Strategy	Under the Government's Airspace Modernisation Strategy (AMS, ref 15) airports in the UK are required to update their airspace and routes in a coordinated way.
FL	Flight Level	The Altitude above sea-level in 100 feet units measured according to a standard atmosphere. A flight level is an indication of pressure, not of altitude. Only above the transition level (which depends on the local QNH (see below for definition) but is typically 4000 feet above sea level) are flight levels used to indicate altitude; below the transition level feet are used.
-	Flightpath	The track flown by aircraft when following a route, or when being directed by air traffic control.
	Freeflow	A term used when airports are not required to seek radar permission for a notified aircraft to depart.

ft	Feet	The standard measure for vertical distances used in air traffic control.
FUA	Flexible Use Airspace	Airspace, which is not solely designated for a single purpose, but can be allocated flexibly according to need, or switched entirely on/off according to a schedule or agreed process.
GA	General Aviation	All civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire. The most common type of GA activity is recreational flying by private light aircraft and gliders, but it can range from paragliders and parachutists to microlights, balloons, and private corporate jet flights.
IFP	Instrument Flight Procedures	A published procedure used by aircraft flying in accordance with the instrument flight rules, which is designed to achieve and maintain an acceptable level of safety.
ILS	Instrument Landing System	A very precise radio navigation system that provides guidance to aircraft to allow them to land on a runway, including at night or in poor visibility.
L_{Aeq}		The most common international measure of noise, meaning, 'equivalent continuous sound level'. This is a measurement of sound energy over a period of time.
$L_{Aeq\ 16h}$		The A-weighted Leq measured over the 16 busiest daytime hours (0700-2300) is the normal time-period used to develop the Airport Noise Contours for day-time operations.
$L_{Aeq\ 8h}$		The A-weighted Leq measured over the 8 night-time hours (2300-0700) is the normal time-period used to develop the Airport Noise Contours for night-time operations.
MAA	Military Aviation Authority	The UK Regulator for Military aviation matters.
MID	Military Instrument Departure	Similar to a SID; this is a route for departures to follow straight after take-off, however, unlike a SID a MID does not connect to an en-route system.
NAP	Noise Abatement Procedures	Noise abatement procedures are designed to minimise exposure of residential areas to aircraft noise, while ensuring safety of flight operations.

NATS	National Air Traffic Services	The main air navigation service provider in the UK.
NATS NERL	NATS En-Route Limited	NATS NERL - The UK's licenced air traffic service provider for the en-route airspace (upper network) that connects airports with each other, and with the airspace of neighbouring states.
nm	Nautical Mile	Aviation measures distances in nautical miles. One nautical mile (nm) is 1852 metres. One road mile ('statute mile') is 1609 metres, making a nautical mile about 15% longer than a statute mile.
-	Network Airspace / Upper network	En-route airspace above 7000ft in which NATS has accountability for safe and efficient air traffic services for aircraft travelling between the UK airports and the airspace of neighbouring states.
PANS OPS	Procedures for Air Navigation Services Aircraft Operations	PANS-OPS is contained in an ICAO Document 8168 which sets out the design criteria and rules for instrument flight procedures which include approach and departure procedures.
PAR	Precision Approach Radar	An ATCO interpreted precision approach aid designed to provide lateral and vertical guidance to an aircraft pilot during final approach to the runway.
PBN	Performance Based Navigation	Referred to as PBN; a generic term for modern standards for aircraft navigation capabilities including satellite navigation (as opposed to 'conventional' navigation standards).
QNH	Regional atmospheric pressure at sea level	Aerodrome QNH is the observed pressure at an aerodrome elevation corrected for temperature and reduce to mean sea level, using the International Civil Aviation Organisation (ICAO) formula.
RMA	Radar Manoeuvring Area	An ATC operational area articulated as a volume of airspace by the ANSP. It facilitates the close-in radar vectoring by ATC that is required to take the aircraft safely from a holding stack and established onto final approach.
RNAV / RNAV 1	aRea NaVigation	This is a generic term for a particular specification of Performance Based Navigation. The suffix '1' denotes a requirement that aircraft can navigate to with 1nm of the centreline of the route 95% or more of the time. In practice the accuracy is much greater than this.

RNP-RF	Required Navigation Performance – Radius to fix	An advanced navigation specification under the PBN umbrella. The RF means Radius to Fix, where airspace designers can set extremely specific curved paths to a greater accuracy than RNAV1.
RNP APCH	Required Navigation – Performance Approach	A type of PBN approach with varying degrees of accuracy in comparison to ILS, that does not rely on ground-based navigation aids.
	Runway Direction	A runway is described using 2 numbers and these are the first 2 numbers of a compass heading with the final rounded up number 0 removed. E.g., Runway 07 indicates a heading of 070 degrees.
SID	Standard Instrument Departure	Usually abbreviated to SID; this is a route for departures to follow straight after take-off.
	Stack/Holding Stack	Racetrack patterns in the sky where aircraft fly in circles waiting for a slot to land.
TC	Terminal Control	A NERL Air Traffic Control function conducted from Swanwick handling traffic below 24,500 feet, primarily flying to or from London's airports.
TMA	Terminal Manoeuvring Area (Terminal Airspace)	An aviation term to describe a designated area of controlled airspace surrounding a major airport or cluster of airports where there is a high volume of traffic; a large part of the airspace above London and the southeast is defined as terminal airspace (or Terminal Manoeuvring Area – TMA). This is the airspace that contains all the arrival and departure routes for London Heathrow, London Gatwick, London Stansted, London Luton, London City, and RAF Northolt, from around 2000-3000ft up to approximately 20,000ft.
VFR	Visual Flight Rules	Visual Flight Rules (VFR) are the rules that govern the operation of aircraft in Visual Meteorological Conditions (VMC) (conditions in which flight solely by visual reference is possible).
VMC	Visual Meteorological Conditions	Visual meteorological conditions (VMC) are the meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than specified minima.
-	Vector / vectoring	A tactical instruction given to a pilot from ATC which directs an aircraft off the published route structure.

-	Westerly operation	When a runway is operating such that aircraft are taking off and landing in a westerly direction.

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Introduction

Royal Air Force Station Northolt is the RAF's strategic London airfield. It is located just outside South Ruislip in West London and it is used by both military and civilian aircraft. As the closest military airfield to Central London, it plays a vital role in the RAF's support to national security, as well as providing an airhead for government and VIP moves in and out of the Capital. RAF Northolt is part of Number 2 Group, a higher headquarters based at RAF High Wycombe.

RAF Northolt is the home of 32 (The Royal) Squadron, which currently operates the Envoy, a Falcon 900LX and the Leonardo Grand New AW109SP helicopter. The Envoy came into Military Service on 1st June 2022 replacing the BAe146 which was retired on 31st March 2022. The aircraft provide the backbone of government and military VIP moves in and out of London. RAF Northolt enables frequent flights for the Prime Minister, senior ministers, and senior military commanders, often at short notice, which requires flexibility by both the airfield and 32 (The Royal) Squadron.

RAF Northolt has also been used as a temporary base for various aircraft types in matters of national security. Notably, this was seen during the London Olympics in 2012 when four Typhoon fighter aircraft were based to provide the Combat Aircraft element of the national security plan to the major international event. RAF Northolt is also required to accommodate regular movements by larger military transport aircraft (C17, A400M and C130) and other military rotary assets including Chinook, Merlin, and Puma, in support of Defence and wider governmental activity. There is no forecast or cap with regards to military movements.

RAF Northolt's commercial flying takes place between 0800-2000 Mon-Fri, 0800-1500 Sat and 1200-1900 Sun and is capped at 12,000 movements per annum. The type of civilian aircraft that normally use RAF Northolt varies considerably and ranges from the Super King Air to the Falcon 8X however, civil movements remain under strict terms and conditions which specifically limit operating hours and the number of passengers and exclude Scheduled Commercial Operations. The aircraft operators serve The Royal Family, International Heads of State, Governments and visiting military forces as well as the business community. There are no scheduled flights or chartered airline operations. There are no plans to increase or decrease either the number of moves per annum or the hours of commercial activity.

Airspace Modernisation and RAF Northolt's ACP

Airspace Modernisation Strategy (AMS)

In 2018, the CAA released a Civil Aviation Publication (CAP) 1711: Airspace Modernisation Strategy (AMS), in response to a directive for modernisation set out by the UK Government. The strategy sets out the "*ends, ways and means*" to achieve Airspace Modernisation in the UK, with a focus on airspace design, and new operational and technological concepts. The strategy includes a "*macro-level co-ordinated implementation plan (an airspace change Masterplan) detailing which interdependent airspace changes are deemed necessary and when*".

One of the most important initiatives required to achieve the AMS objective is known as FASI (Future Airspace Strategy Implementation). 22 airports in the UK comprise FASI and RAF Northolt is one of them. The FASI initiative is considered the UK's Airspace Change National Infrastructure Programme (the Programme). The Programme encompasses the requirement to fundamentally redesign the National Airspace System at lower altitudes and in the terminal airspace that serves commercial air transport across the busiest regions of the UK, making the most of the capabilities of modern aircraft and satellite-based navigation technology. These airspace design projects are sponsored by the 22 airports (for the local arrival and departure routes below 7000ft) and by NERL (for the airspace structures and route network above 7000ft).

Due to its location within the London Terminal Manoeuvring Area (LTMA), RAF Northolt is conducting an Airspace Change Proposal (ACP) to meet the requirements of the AMS. The ACP is being conducted in accordance with the Civil Aviation Authority's (CAA) CAP1616 and the UK's Airspace Masterplan.

CAP1616 and RAF Northolt's ACP

CAP1616 sets out the seven stages all airports must move through to ensure a thorough, considered, and transparent airspace change process. The Airspace Masterplan, overseen by the Airspace Change Organising Group (ACOG), sets out a collaborative approach to integrating the multiple ACPs under a single airspace initiative.

RAF Northolt completed Stage 1 of CAP1616 at the end of July 2019, when the CAA approved the Design Principles that will be used to develop and evaluate design options over the course of the ACP. Details of RAF Northolt Stage 1 submission can be found on the CAA's Airspace Change Portal. RAF Northolt then commenced Stage 2; Develop and Assess after CAA approval to progress through the Define gateway (see diagram below).

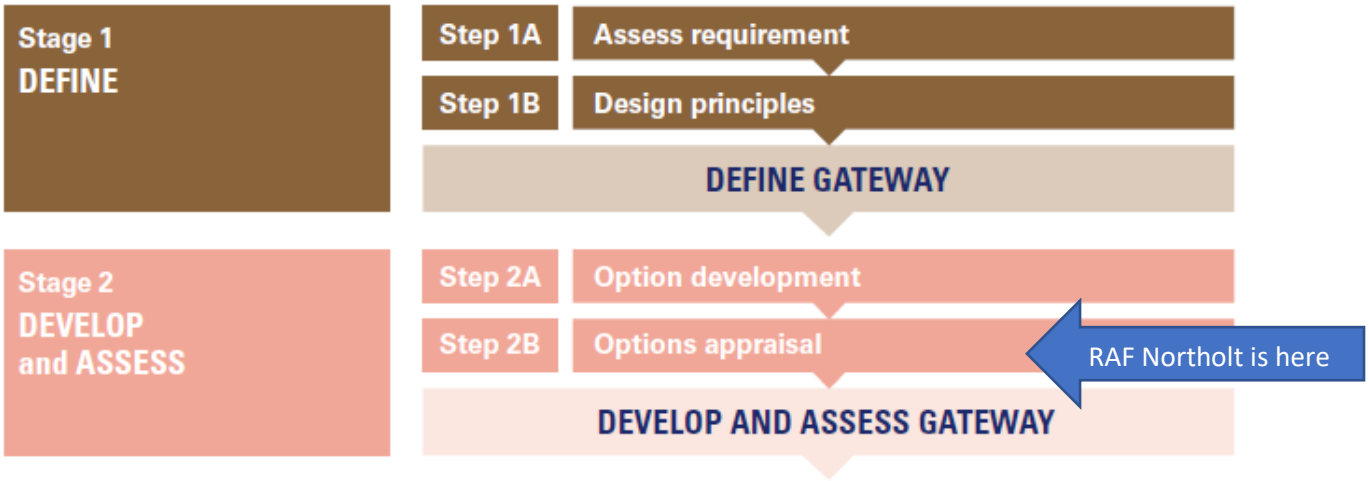


Figure 1: CAP1616 Timeline – Initial Stage summary

As part of Step 2A, RAF Northolt developed a comprehensive list of options before testing the options with the same stakeholders engaged as part of Step 1B. Following this, the options progressed to a Design Principle Evaluation (DPE) where each option was assessed against each Design Principle. The outcome of the DPE was a shortlist of options that have progressed to this Initial Options Appraisal (Step 2B). Full details of the options development and evaluation undertaken as part of Step 2A are published on the CAA's Airspace Change Portal.

This Initial Options Appraisal (IOA)

RAF Northolt are now at Step 2B 'Options appraisal'. At Step 2B an Airspace Change Sponsor is required to undertake an Initial Options Appraisal (IOA) which is the first of three phases of options appraisal as part of CAP1616. The following sections of the document initially describe the options under assessment and the baseline option, followed by explaining the methodology used to assess each option, and then the IOA outcome. At the end of the document it is explained, based on the IOA, the options which RAF Northolt intends to take forward to Stage 3 'Consult' and the preferred option(s).

Alongside this IOA document there is a Technical Appendix (Step 2B Appendix B) which provides further details of the noise and CO_2 appraisals, including noise contours, noise data, and track length assessments. This can be found on the CAA's Airspace Change Portal.

UK Airspace Change Masterplan Iteration 2

The number, complexity and overlapping scope of the individual airspace ACPs needed to deliver the Programme requires a strategic coordination mechanism in the form of a single joined up implementation plan or Masterplan. In their capacity as co-sponsors of the AMS, the Department for Transport and CAA commissioned NERL to create the Masterplan. The Masterplan is a high-level coordinated implementation plan of a series of individual airspace design changes that need to be developed in coordination to achieve the range of benefits that modernisation can deliver.

Airspace modernisation is a long and complex process. Larger ACPs with many interdependencies can take several years longer to develop than smaller ones with fewer interactions. Therefore, ACOG proposed (and the co-sponsors accepted) that the final Masterplan is developed through a series of iterations. The iterative approach recognises that different information and levels of detail will be available at different times. ACOG may have an insufficient level of detail about some ACPs to make firm conclusions and need to make assumptions that are refined in later iterations. It also means that the Masterplan remains flexible and responsive to accommodate the evolving context for airspace modernisation, such as changes arising from the AMS review, new policy directions or unanticipated events.

ACOG envisages a minimum of four iterations of the Masterplan. The iterations broadly align with the regulatory gateways of the CAP1616 process. Each iteration must be accepted separately into the AMS, except Iteration 1, which was a high-level plan that has already been assessed and published[1].

The purpose of Iteration 2 is to provide a system-wide view of the scope of the constituent ACPs and identify the potential interdependencies between the proposals. The assessment of the interdependencies between the constituent ACPs remains at a high level in Iteration 2 because most of the sponsors were yet to produce a comprehensive list of airspace design options at the time of its creation.

The Masterplan becomes, together with the CAP1616 process, the legal basis against which individual airspace change decisions are made by the CAA. Therefore, the CAA's decisions on airspace change proposals will need to ensure that there is no misalignment with the Masterplan. The CAA must apply its airspace change decisions in accordance with the Masterplan and therefore in the best interests of the overall Airspace System and not just in the interests of the individual ACP sponsor.

The timeline and sequencing of the Masterplan ACPs is a complex issue. It is not considered feasible for all the constituent ACPs in the Programme to be developed and deployed at the same time. The Masterplan takes a modular approach to deployment and requires coordination and strong programme management discipline to mitigate the risks of design conflicts, technical misalignments, and a lack of transparency for external stakeholders. To help with this, the Masterplan has placed each of the ACPs into a regional cluster and Iteration 2 places RAF Northolt in the 'LTMA regional cluster' alongside Biggin Hill, Bournemouth, Heathrow, Gatwick, London City, Manston, London Luton Airport, Southampton, Southend, and Stansted airports.

[1] Airspace Masterplan Iteration One (Southern UK): co-sponsor assessment, CAA CAP 1884, February 2021.

Large scale ACPs are usually difficult to develop and deploy because of the complexity of the existing airspace design, the intensity of the current operation and the potential impacts on communities, the environment and other airspace users. The Masterplan ACPs bring additional deployment challenges associated with airspace design interdependencies and the widespread introduction of Performance Based Navigation (PBN) routes, which will replace well established ATC procedures based on controller vectoring with the comparatively new concept of systemisation. Other factors being equal, the greater the complexity of the existing airspace design, and the more interdependencies, the more difficult the ACPs will be to deploy.

Iteration 2 advises that that the LTMA cluster will require a minimum of three separate 'core LTMA' deployment windows to implement the full set of proposed changes (within the LTMA) because of the very large size, high complexity, and extensive interdependencies of the constituent ACPs.

The deployment timescales for each individual ACP within a cluster are determined by the size, complexity and interdependencies of the proposal and a series of important programme planning assumptions regarding the activities that controllers and operators must conduct to prepare for changes to the airspace structure and route network.

As a result, Iteration 3 has identified that core LTMA deployments that include Heathrow, must be divided into a minimum of three windows, separated by 12-month intervals and cannot begin before Spring 2027. Noting RAF Northolt's dependencies on Heathrow, Luton, London City and to a lesser extent Stansted (that are explored more in the Step 2A document), this means that any change to RAF Northolt's route structure that has dependencies on Heathrow and other LTMA airports are not expected before this date. RAF Northolt's deployment date could therefore be somewhere between 2027 and 2029, subject to the wider programme remaining on track.

Outside of the core of the LTMA cluster, Iteration 2 states there may be opportunities for some portions of the ACPs to be implemented in advance of the core LTMA deployment sequence. The potential airspace design conflicts and enablers that exist between the LTMA ACPs will likely result in sponsors having to 'split' their ACPs (the first part for the early deployment and the second part for the core LTMA deployment). Any ACP 'split' would require CAA endorsement and must demonstrate that the early part of the deployment will not unreasonably constrain the options associated with the core LTMA deployments later. Some LTMA ACP sponsors may also be able to proceed with smaller, targeted portions of their ACPs that are independent of all other proposals. Each sponsor would need to consider their needs and benefits individually before deciding on what approach to take regarding the potential to split their ACPs in service of an earlier deployment. An 'Early LTMA Deployment window' has been identified within the Masterplan for Spring 2026 where such independent LTMA ACPs could enter operational service.

RAF Northolt's Potential Interdependencies Identified within Iteration 2

The Masterplan identifies the interdependencies between the constituent ACPs based on an analysis of the broad sections of airspace where a flight path could 'conceivably be positioned' below 7000ft within the scope of each proposal. Based on this broad assessment, the Masterplan identifies that RAF Northolt has potential dependencies with flight paths to and/or from Heathrow, Luton, London City and possibly Stansted airports. The IOA assessments provide further details of these potential interdependencies.

Overview of Options under Assessment

RAF Northolt's Step 2A comprehensive list of options included 15 options and a 'Do Nothing' scenario. As part of Step 2A, RAF Northolt undertook a DPE where each option was evaluated against each Design Principle. This was the first opportunity to shortlist options. The outcome of the Step 2A DPE was that some options were discontinued including the baseline 'Do Nothing' scenario. Further details of this can be found in the Step 2A submission document on the CAA's Airspace Change Portal.

Although the baseline 'Do Nothing' scenario did not progress as an option, CAP1616 requires the baseline scenario to be appraised in this IOA as it provides a means of testing the options against the current day operations to better understand and highlight the benefits and impacts of each new option. The baseline will also continue to be appraised as part of the Full Options Appraisal and Final Options Appraisal at Stage 3 and Stage 4.

The following section summarises the airspace change options RAF Northolt has taken through to this IOA. More information about how RAF Northolt have developed and evaluated these options is available in the Step 2A submission document on the CAA's Airspace Change Portal. The Initial Options Appraisal section of this document and the technical appendix (published on the CAA's Airspace Change Portal) also contains larger images and more details of each option.

Understanding RAF Northolt's Options

This section sets out RAF Northolt's List of Options at Step 2B of the Airspace Change Process. Each option has a description of what it is trying to achieve and, for the purposes of enabling analysis in the IOA, a range of illustrative route centrelines. However, whilst there is currently a large range of illustrative centrelines, the final centreline(s) for each option could, and most probably will, still vary from those shown as options are refined throughout the project.

Some considerations when reviewing RAF Northolt's Options taken into Step 2B:

- The illustrative route centrelines are being used to provide a provisional indication of a range of impacts and benefits within each design envelope. RAF Northolt does not consider each illustrative track an individual option at this time as that would not be manageable, rather an option is based on the design envelope within which the illustrative tracks sit. However, the large number of illustrative tracks help RAF Northolt to explore the art of the possible within each option.

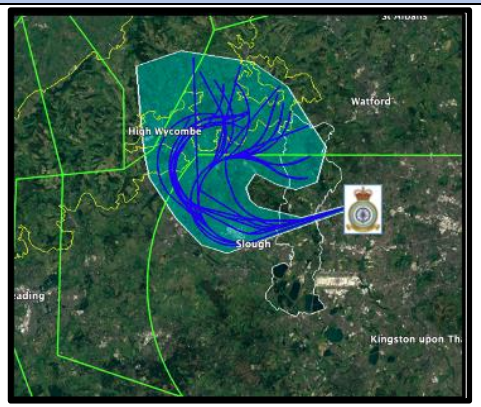
- The design envelopes provide a strong indication of where the final flight paths will be positioned however, it is still possible that part of the solution could sit outside of the envelopes. RAF Northolt is not excluding any movement outside of these envelopes in Stage 3 if necessary (for example to be operationally viable or reduce CO_2).

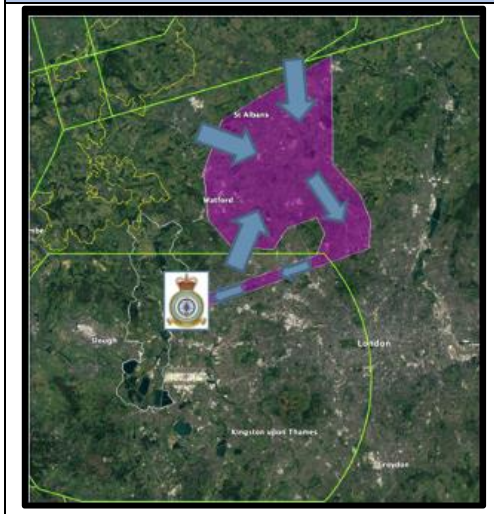
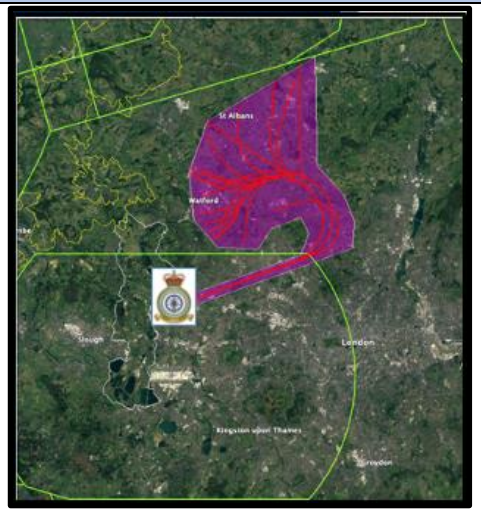
- All the illustrative track lengths assume Continuous Climb Operations/Continuous Descent Operations (CCO/CDO) to/from 7000ft. However, it is highly likely that such profiles will not be available in the final solution due to constraints from other airports and the 6000ft Transition Altitude. Therefore, in the Stage 3 consultation, the 0-7000ft area is likely to extend beyond the illustrative tracks and design envelopes shown within Stage 2. At this time, RAF Northolt is unable

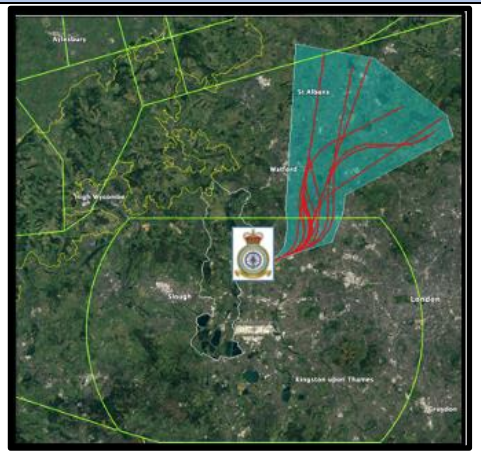
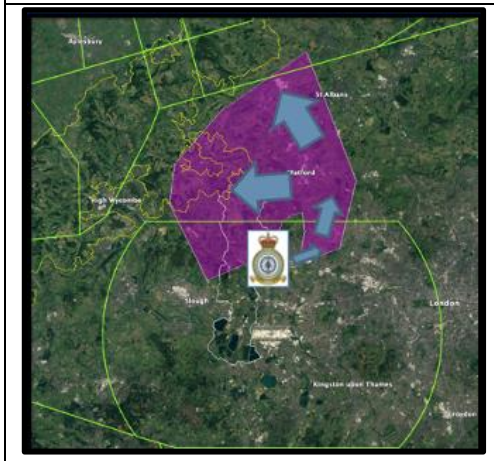
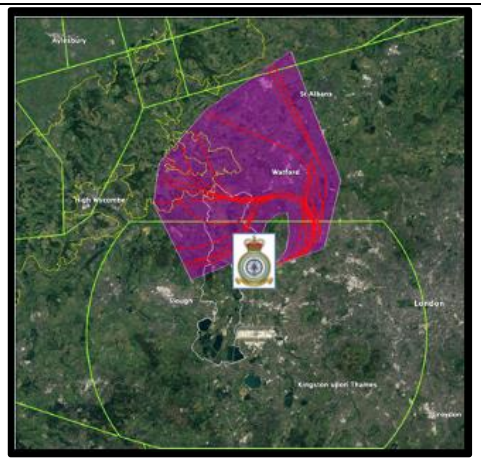
to predict what these profiles may look like, so the use of a pessimistic 7% climb gradient for departures helps to provide some realism on potential 7000ft points within the illustrations.

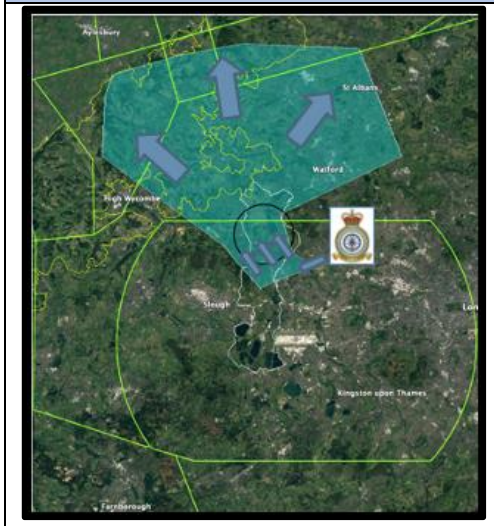
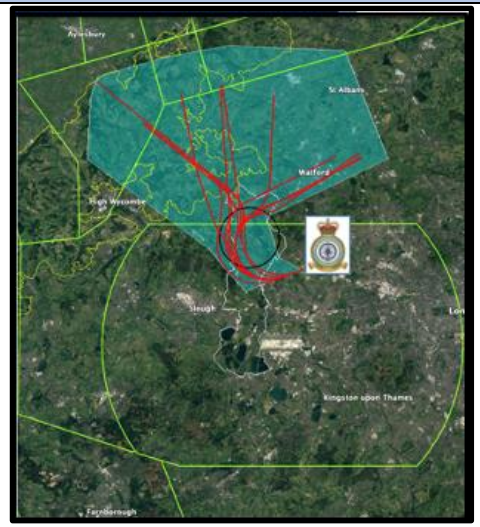
Route centreline refinement will be on the basis of integration with the wider airspace network below and above 7000ft, reacting to stakeholder engagement, increasing environmental and operational performance and in accordance with more detailed IFP design and validation in Stages 3 and 4. This refinement could potentially include merging some elements of different options into a final design solution if that is considered to provide greater benefit to RAF Northolt and the wider FASI programme. As an example, multiple arrivals routes may be combined from different design envelopes to optimally to serve different arrival directions. For departures there could be a combination of routes generated from the different design envelopes in the final option.

Options for the Initial Options Appraisal

Option Image (Broad directional flows shown with arrows)	Option Image (Illustrative Flight Paths)	Name	Description
		Easterly Arrivals Option 1: Approach from the north/north east	This option would see arrivals approach RAF Northolt from the north and/or northeast of the Station. There is scope to align tracks with the areas currently overflown with arrivals staying to the north of Slough with a short final approach or it may be possible to have a longer, more traditional final approach. The latter could introduce a dependency with Heathrow easterly arrivals.
		Westerly Arrivals Option 1: Approach from the northeast	This option would see arrivals approaching RAF Northolt from the northeast, BPK direction to join final approach at approximately 8-9nm, where the majority are currently vectored onto final approach. RAF Northolt would expect arrivals from the north and east (BNN/LAM) to use these tracks.

Option Image (Broad directional flows shown with arrows)	Option Image (Illustrative Flight Paths)	Name	Description
		Westerly Arrivals Option 2: Approach from the north, northwest and/or southwest	This option would see arrivals approach RAF Northolt from the north, northwest and/or southwest of the aerodrome. There is scope to align tracks with the areas currently overflown or it may be possible to have wider pattern onto final approach to reduce population overflown.
		Westerly Arrivals Option 4: Approach from the east	This option would see arrivals making an approach from the east to replicate the existing flow of traffic from the LAM direction.

Option Image (Broad directional flows shown with arrows)	Option Image (Illustrative Flight Paths)	Name	Description
		Easterly Departures Option 1: Depart to the northeast	This option would see departures from RWY07 turning to the north within c. 4nm from the end of the runway and joining the network in the approximate vicinity of BPK.
		Easterly Departures Option 2: Depart to the north and/or northwest	This option would see departures turning to the north shortly after departure to then track north and/or northwest.

Option Image (Broad directional flows shown with arrows)	Option Image (Illustrative Flight Paths)	Name	Description
		Westerly Departures Option 1: Turn north as soon as possible	Precisely replicating the existing first turn within PANS OPS could be challenging. This option would see a 'Turn at altitude' which means that the SID instruction would require aircraft to start the turn on reaching a particular altitude, rather than at a specific waypoint. This should result in an early turn, closer to today's turn, as a PBN waypoint can't be positioned close enough to replicate the existing turn. This is the earliest turn RAF Northolt would be able to do to replicate what happens today and keep away from Heathrow as much as possible. As a result, this option would see some dispersion on the ground because climb gradients vary, but slightly less certainty on exactly where the turn would be, which could generate issues assuring against Heathrow, depending on their final route structure. The illustrations suggest a delayed turn, some which avoid Denham ATZ, but that would be rare - with slow climbing aircraft only. These options would most likely not avoid the Denham ATZ and be more in keeping with what happens today at low altitude.

Option Image (Broad directional flows shown with arrows)	Option Image (Illustrative Flight Paths)	Name	Description
		Westerly Departures Option 2: Turn north at a fixed point (will be a later turn than Option 1)	This option would give more certainty about where departures turn north, although that turn would most likely be slightly later than in Option 1. With this option it would be possible to have a later turn than today which could avoid the Denham ATZ altogether, however this will bring the aircraft close to Heathrow, so the feasibility of this is not yet known.

Initial Options Appraisal Methodology

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

Defining the Baseline 'Do nothing' scenario

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

<table>
<tr><th colspan="2">Defining the 'Do nothing' pre-implementation baseline scenario</th></tr>
<tr><td>Year of implementation</td><td>At present the exact implementation date for the FASI-S airspace changes is unknown as the timeline for implementation will be dependent on a number of factors, including the airspace changes above 7000ft which form part of a separate ACP sponsored by NATS NERL. Current deployments of the LTMA within Masterplan Iteration 2 suggest an implementation date of not before 2027, however this will be subject to alignment with Masterplan Iteration 3. For this IOA, RAF Northolt will qualitatively describe the anticipated factors that are expected to impact the baseline based on implementation in 2027.</td></tr>
<tr><td>Movement numbers and Traffic Forecast</td><td>When selecting movement data to use as a representative year for typical RAF Northolt movements, as outlined in the Step 2A documentation, consideration was given to the drop in movements in 2018 and 2019 due to reduced operating hours and runway resurfacing works. There were also low movements in 2020 and 2021 due to COVID-19. Movement data from 2016 was therefore selected as a busy year which would represent the expected operation of the airspace immediately before implementation in 2027:

Table 1 2016 Movements and Modal Split
<table><tr><th>Year</th><th>RWY25</th><th>RWY07</th><th>Total</th></tr><tr><td>2016 Movements and assumed 2027 forecast</td><td>11,373</td><td>5089</td><td>16,462</td></tr><tr><td>2016 Modal Split</td><td>69%</td><td>31%</td><td></td></tr></table>
Owing to the uncertain nature of the aviation sector because of COVID-19, this approach to forecasting is considered proportionate at this stage of the CAP1616 process. When considering the future forecast (10 years after the year of implementation) within this IOA, given the number of options that form part of this appraisal, the qualitative nature of large</td></tr>
</table>

	parts of the appraisal, the forecast growth at RAF Northolt (see section below) and the methodology applied where quantified information has been used, it is not considered proportionate to also appraise all options against this future traffic scenario in Stage 2. As part of the Stage 3 Full Options Appraisal, RAF Northolt will fully quantitatively appraise the pre-implementation baseline and options for the year of implementation and future scenarios (plus 10 years).
Forecast Growth in air traffic	As a military aerodrome, RAF Northolt's movements will fluctuate and potentially surge in line with Government priorities and military basing decisions, therefore forecasts in growth are difficult to determine. 2016 was RAF Northolt's busiest year in the last decade. In that year overall commercial traffic movements accepted were also relatively close to the imposed annual commercial movement cap. The methodology applied to appraise each option as part of this IOA does not apply specific movement numbers; this will form part of the detailed quantitative noise and environmental modelling that will be undertaken as part of the Stage 3 Full Options Appraisal.
Fleet Mix	The range of military aircraft operating into RAF Northolt varies considerably in line with Government priorities. The Envoy and the 109AW are stationed at RAF Northolt and provide the backbone of government and military VIP moves in and out of London. The largest military types which visit RAF Northolt are the C-17 Globemaster, A400M Atlas, C-130 Hercules, and Airbus A319CJ large military airlift aircraft. A wide range of military helicopters including the larger Chinook also operate and as noted in the introduction, Typhoon fast jet aircraft were also based at RAF Northolt in 2012. As commercial aircraft accepted are limited to those carrying less than 19 passengers, they are predominantly small executive jets. For the purposes of this IOA some noise metrics have been generated using a standard AEDT (Aviation Environmental Design Tool) profile of an Envoy (Falcon) aircraft as this is permanently based at RAF Northolt and is also representative of the civilian commercial aircraft types accepted. As part of the Stage 3 Full Options Appraisal, RAF Northolt will provide a full fleet mix and apply this to the quantitative noise assessments.
Planned Developments	As part of the preparation for the baseline, planned developments in the area surrounding RAF Northolt have been identified so that they can be considered as part of appraisal of the benefits and impacts of each option. Details of this are shown in Appendix A.

Initial Options Appraisal Assessment Criteria

At Step 2B CAP1616 requires sponsors to carry out an initial appraisal of the benefits and impacts of each option, tested against the 'Do Nothing' baseline scenario. The purpose of this initial appraisal is to highlight the change to sponsors, stakeholders and the CAA and the relative differences between the impacts, both positive and negative, of each option. The initial appraisal is based around a qualitative assessment, although CAP1616 encourages sponsors to use as much analysis as reasonably possible at this stage.

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

Table 2 IOA Assessment Criteria (Based on CAP1616 Appendix E) and methodology

Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Partly quantitative, partly qualitative
A partly quantitative, partly qualitative assessment of changes to noise impacts compared with the 'Do Nothing' baseline. Whilst this appraisal is on the Option as a whole, RAF Northolt will use the differing illustrative flight paths within each option to consider the population counts within a 70dB SEL of a single aircraft (Falcon 900LX was chosen for this analysis) as well as population counts within overflight cones 0-7000ft (CAA definition 48.5˚) compared to those of the existing SID (conventional, before PBN replication) or typical route's centrelines. RAF Northolt will also qualitatively describe any anticipated changes to the Lowest Observable Adverse Effect Level contour (LOAEL). This will provide a range of counts within each option to use as likely indicators of the scale of noise impacts within an option. The 70dB SEL metric was selected as it offers a better indicator of noise effects than an overflight cone and is equivalent to a 60dB L_{AMax} single sound event (N60 contours form part of CAP1616 secondary noise metrics used when assessing noise impacts of airspace changes. As part of Stage 3 RAF Northolt will quantitative assess the N60 and N65 metrics). For a fair comparison for the overflight cones it is assumed a 7% climb gradient to/from 7000ft for all illustrative tracks including on the typical route centrelines (baseline). Whilst departures will be required to climb much more steeply than this, it is highly likely that CCO/CDO to/from 7000ft will not be available in the final solution due to constraints from other airports and the 6000ft Transition Altitude. Therefore, in the Stage 3 consultation, the 0-7000ft overflight cones are likely to extend beyond those used within Stage 2. At this time, there is an inability to predict what these profiles may look like, so the use of a pessimistic 7% climb gradient for departures helps to provide some realism on potential 7000ft points within the illustrations. The centreline overflight contours and SELs are based on a single event, i.e., one departure or one arrival using the CAA's 48.5˚ definition of overflight as defined in CAP1498. This departure is assumed to follow the SID route from 0-7000ft; therefore, this data does not consider any vectoring. The overflight and SEL counts only look at a single overflight along the procedure centreline, and therefore at this stage the data does not consider frequency of overflight. This will be quantified at Stage 3 Full Options Appraisal. The contours are generated using a standard AEDT (Aviation Environmental Design Tool) profile of a Falcon 900LX aircraft as it is a typical civilian aircraft operating to/from RAF Northolt. The data tables use the latest available CACI population data for 2021. When considering the centreline data for the arrivals baseline, it's important to note that a centreline for the existing arrivals prior to final approach does not actually exist as there are no defined tracks that connect the end of		

the Standard Arrival Routes (STARs) to the Instrument Approach procedures. Therefore, average tracks were created based on the areas most frequently overflown by arrivals in today's airspace arrangement for comparative purposes.

CAP2091

At this stage in the airspace change process, given RAF Northolt's options are not yet combined into full systems and are based on broader swathes with illustrative flight paths, L_{Aeq} contours have not yet been calculated, and instead RAF Northolt will qualitatively describe any anticipated changes to the LOAEL.

RAF Northolt does not have any planning conditions which requires them to generate and publish noise contours on an annual basis. However, The Noise and Vibration Division (NVDiv) of the Royal Air Force Centre of Aviation Medicine (RAFCAM) have generated noise contours for RAF Northolt using the Federal Aviation Administration's Aviation Environmental Design Tool (AEDT). In 2016, noise contours were generated for the following indices:

- L_{DEN} – 24 hour averaged noise metric with evening penalty of 5dB and night penalty of 10dB incorporated. (Published in 5dB bands between 45dB and 75dB)
- $L_{Aeq,16\,h}$ Day – 16 hour averaged noise metric[2]. (Published in 3dB bands between 54dB and 72dB)

(Please see the Stage 2A document on the CAA's Airspace Change Portal for further information about these contours).

When determining the CAP2091 category, the 45dB Lden contour is the closest indicator of the 51dB daytime LOAEL available at this stage. This has around 50,000 people located within the contour. The night-time exposure is expected to be much less given RAF Northolt's operating hours. 50,000 people is above the mandated minimum threshold of 25,000 and well below the maximum threshold of 200,000 for Category C and therefore RAF Northolt would expect to sit within the CAP 2091 Category C noise modelling requirements.

In Stage 3, when the LAeq contours are fully quantified this noise modelling category will be confirmed. When considering future forecast 10 years from implementation, given RAF Northolt's movement cap of 12,000 commercial movements and that in 2016 the station was operating close to this cap, it is not expected to see a change to noise modelling category. This will be confirmed at Stage 3 when full quantified noise modelling takes place.

Communities	Air Quality	Qualitative

A qualitative assessment of changes to local air quality compared with the do-nothing baseline. Due to the effects of mixing and dispersion, emissions of NOx, PM10 and PM2.5 from aircraft travelling above 1000ft are unlikely to have a significant impact on local air quality. The DfT's Air Navigation Guidance (2017) states that: "Studies have shown that NOx emissions from aviation related operations reduce rapidly beyond the immediate area around the runway. Therefore, the impact of airspace design on local air quality is generally negligible compared to changes in the volume of air traffic and that of the local transport infrastructures feeding the airport.". ICAO's Airport Air Quality Manual (International Civil Aviation Organization. Doc 9889 Airport Air Quality Manual. Second Edition, 2020. ICAO, Canada.) similarly states that 1000ft is the typical limiting altitude for ground-level NOx impacts from aircraft emissions.

If a local authority finds any places where the national air quality objectives are not likely to be achieved, it must declare an Air Quality Management Area (AQMA) there. Then the local authority will put together a plan to improve the air quality.

This qualitative assessment will highlight if there could be lateral flight path changes below 1000ft (compared to the baseline) which could therefore have an impact on Local Air Quality. It will also advise whether those changes could fall within an AQMA.

[2] While rare, RAF Northolt may authorise military night movements in line with Government priorities.

Wider Society	Greenhouse Gas Impact	Qualitative
Emissions of greenhouse gases arise from the combustion of aviation fuel and fuel burn and are therefore linked to track mileage. For this IOA RAF Northolt have estimated the differences in track miles between the baseline and each route which forms part of the options. Following engagement with NERL and Heathrow, it is currently assumed that RAF Northolt arrivals will continue to be handled from the network via the Heathrow approach function. The location of the Heathrow/RAF Northolt delay mechanism is not yet known but NERL have advised the direction of arrival into RAF Northolt's airspace is likely to be from the same, broad geographic regions as today. For this reason and in the absence of more definite locations at this stage, arrival tracks are based on qualitative estimates of an assumption they would route via the LAM/BNN/OCK/BIG directions, noting that the exact locations will be determined in Stage 3. For departures RAF Northolt have based a qualitative estimate on the option's direction compared to expected Network points such as CLN/CPT and TNT. CO_2 emissions as a result of the track mile changes have not been quantified, as the track miles are still crude estimates owing to network uncertainty. As part of the Full Options Appraisal (Step 3A), track mileage, fuel burn and the associated greenhouse gas impact will be appraised in further detail, including as part of the Cumulative Assessment Framework being developed by ACOG.		
Wider Society	Capacity/Resilience	Qualitative
A qualitative assessment of changes to airspace capacity and resilience compared with the do-nothing baseline. Capacity and resilience cover a wide range of considerations. For this evaluation there is a focus on delay caused by LTMA interactions, as an indicator of capacity and resilience. This qualitative assessment considers whether the option is expected to minimise or increase delay for RAF Northolt and/or other FASI airport operations.		
Wider Society	Biodiversity and Tranquillity	Qualitative
The effects of airspace change on ecology or biodiversity are expected to be minimal. CAA guidance states that "*In general, airspace change proposals are unlikely to have an impact upon biodiversity because they do not involve ground-based infrastructure. As such they are unlikely to have a direct impact that would engage the Birds or Habitats legislation.*". Though there is limited research available on the effects of aircraft noise on wildlife, there is some evidence that disturbance effects associated with aircraft can occur during take-off and landing where aircraft are below around 500m (~1640ft). [*Drewitt, A. (1999) Disturbance effects of aircraft on birds. English Nature Birds Network Information Note*]. The biodiversity assessment will highlight where changes to flight paths below 2000ft could change traffic patterns over Special Protection Areas (SPAs), Special Areas of Conservation (SACs), National Parks, RAMSAR and/or Sites of Special Scientific Interest (SSSI). CAP1616 outlines the consideration of impacts upon tranquillity 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 ACP's Design Principles. This IOA will qualitatively assess whether the option is likely to increase or decrease overflight of the Chilterns AONB as well as the Colne Valley Regional Park. Whilst the latter is not a National Park it has been highlighted by RAF Northolt's stakeholders as an area of significance.		
General Aviation	Access	Qualitative
A qualitative assessment of changes to GA access to controlled airspace compared with the 'Do Nothing' baseline. Assessment will consider the potential impact on adjacent GA airport operations and whether each option has potential to require more/less controlled airspace (CAS) and/or affect existing helicopter routes. RWY25 departure options will include an approximation of the height of a RAF Northolt departure as it crosses the lateral boundary of the Denham ATZ.		

General Aviation/ Commercial Airlines	Economic impact from increased effective capacity	Qualitative
A qualitative assessment of changes to GA and commercial airline economic impacts from increased effective capacity compared with the 'Do Nothing' baseline.		
General Aviation/ Commercial Airlines	Fuel Burn	Part quantitative, part qualitative
As the combustion of aviation fuel is linked to track mileage, for this IOA, RAF Northolt has estimated the differences in track miles between the baseline and each route which forms part of the options. Following engagement with NERL and Heathrow, there is an assumption that RAF Northolt arrivals will continue to be handled from the network via the Heathrow approach function. The location of the Heathrow/RAF Northolt delay mechanism is not yet known but NERL have advised the direction of arrival into RAF Northolt's airspace is likely to be from the same, broad geographic regions as today. For this reason and in the absence of more definite locations at this stage, arrival track qualitative estimates are based on an assumption that they would route via the LAM/BNN/OCK/BIG directions, noting that the exact locations will be determined in Stage 3. For departures, the qualitative estimate is based on the option's direction compared to expected Network points such as CLN/CPT and TNT. Whilst continuous climb and continuous descent operations to/from 7000ft are assumed, fuel burn/CO_2 benefit has not been assigned. This is due to the required dependencies on adjacent airports and the wider airspace design to realise CCO/CDO for RAF Northolt. Additionally, fuel burn changes in Kg as a result of the track mile changes have not been quantified, as the track miles are still unrefined estimates owing to network uncertainty. As part of the Full Options Appraisal (Step 3A), track mileage, fuel burn and the associated greenhouse gas impact will be appraised in further detail.		
Commercial airlines	Training costs	Qualitative
A qualitative assessment of changes to commercial airline training costs compared with the 'Do Nothing' baseline.		
Commercial airlines	Other costs	Qualitative
A qualitative assessment of changes to other relevant commercial airline costs compared with the 'Do Nothing' baseline.		
Airport/ANSP	Infrastructure costs	Qualitative
A qualitative assessment of changes to Air Navigation Service Provider (ANSP) infrastructure costs compared with the 'Do Nothing' baseline.		
Airport/ANSP	Operational costs	Qualitative
A qualitative assessment of changes to ANSP operational costs compared with the 'Do Nothing' baseline.		
Airport/ANSP	Deployment costs	Qualitative
A qualitative assessment of ANSP deployment costs compared with the 'Do Nothing' baseline.		
All	Safety	Qualitative
A qualitative safety assessment of each option which compares against the baseline.		
All	Interdependencies, conflicts, and trade-offs	Qualitative

An airspace change proposal at a Stage 2 Gateway in the CAP1616 process should specify any interdependencies with other airspace changes identified in Iteration 2 of ACOG's Airspace Change Masterplan. This IOA will take the information contained within the Masterplan document around potential areas of conflict/interdependencies and identify if the option falls within these areas. This will give an indication of whether there is the potential for trade-offs with other airspace change sponsors required during Stage 3 including an indication of whether the option is likely to increase/decrease chances of CCO/CDO.		
All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative
A qualitative assessment of how the design option strikes a balance, considering the AMS objectives of improved capacity, noise, and fuel/CO_2 and reduced CAS and increased airspace integration compared with the do-nothing baseline.		

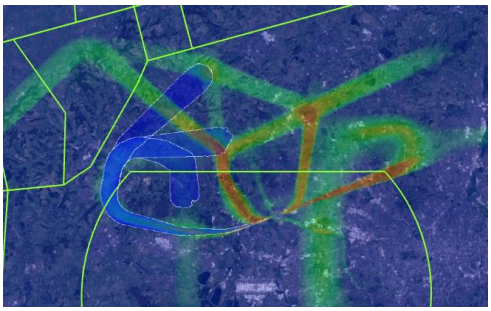
Initial Options Appraisal

The following tables outline RAF Northolt's Initial Options Appraisal (IOA) for each option and provide an assessment of the baseline scenario. The technical appendix, which is published on the CAA's Airspace Change Portal, provides larger versions of the images shown in this IOA.

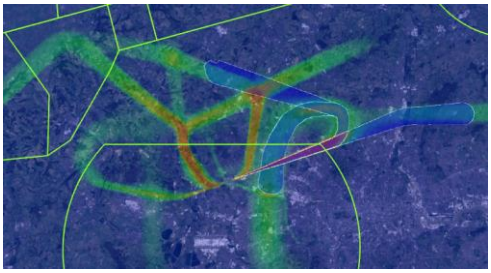
Baseline 'Do nothing' Scenario

Table 3 IOA: Baseline 'Do nothing' scenario

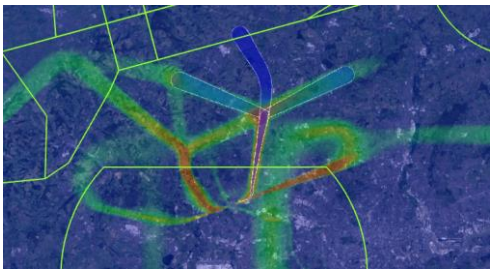
Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Partly quantitative, partly qualitative



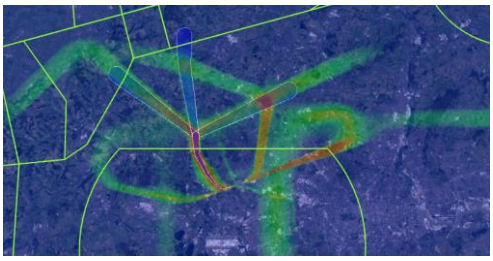
RWY 07 ARRVS	Total Population	SEL_70
Baseline (Average)	67806	54466
NORTH	78969	54391
EAST	63103	54391
SOUTH	61346	54616



RWY 25 ARRVS	Total Population	SEL_70
Baseline (Average)	316426	188979
NORTH	255478	187842
EAST	300755	188921
SOUTH	393045	190174



RWY 07 DEPS	Total Population	SEL_70
Baseline (Average)	48691	157118
NORTH EAST	38646	156891
NORTH	42239	156831
NORTH WEST	65188	157633

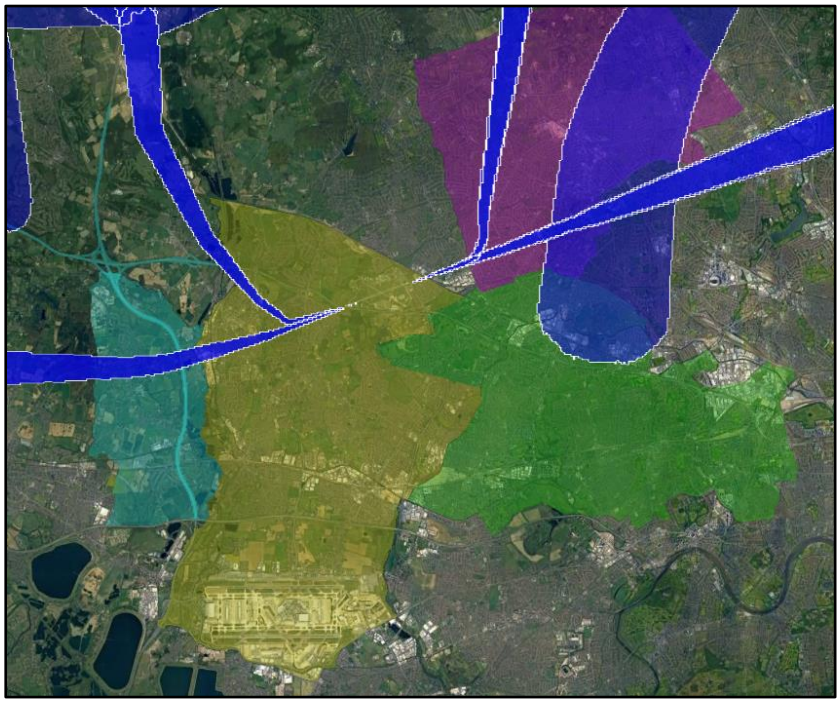


RWY 25 DEPS	Total Population	SEL_70
Baseline (Average)	41680	66500
NORTH WEST	17153	65856
NORTH	25764	65990
NORTH EAST	82122	67653

Please see the baseline description in the Step 2A document for further details of RAF Northolt's existing Airspace Environment.

Communities	Air Quality	Qualitative

RAF Northolt itself lies within the London Borough of Hillingdon Air Quality Management Area (AQMA) shown in yellow below although to the east of the station boundary is the London Borough of Harrow AQMA (purple) and to the southeast, the London Borough of Ealing AQMA (green) and to the west, the Buckinghamshire AQMA (cyan). RAF Northolt's flight paths below 1000ft fly through the Hillingdon, Buckinghamshire, and Harrow AQMAs. If this baseline system was retained, there would be no change to flight paths below 1000ft therefore local air quality impacts would not change.



Wider Society	Greenhouse Gas Impact	Qualitative

The same route lengths would be flown, and the same typical altitudes would be attained along the track. If the baseline design was retained, the same lateral, vertical, and longitudinal profiles would be flown, and greenhouse gas impacts would not change.

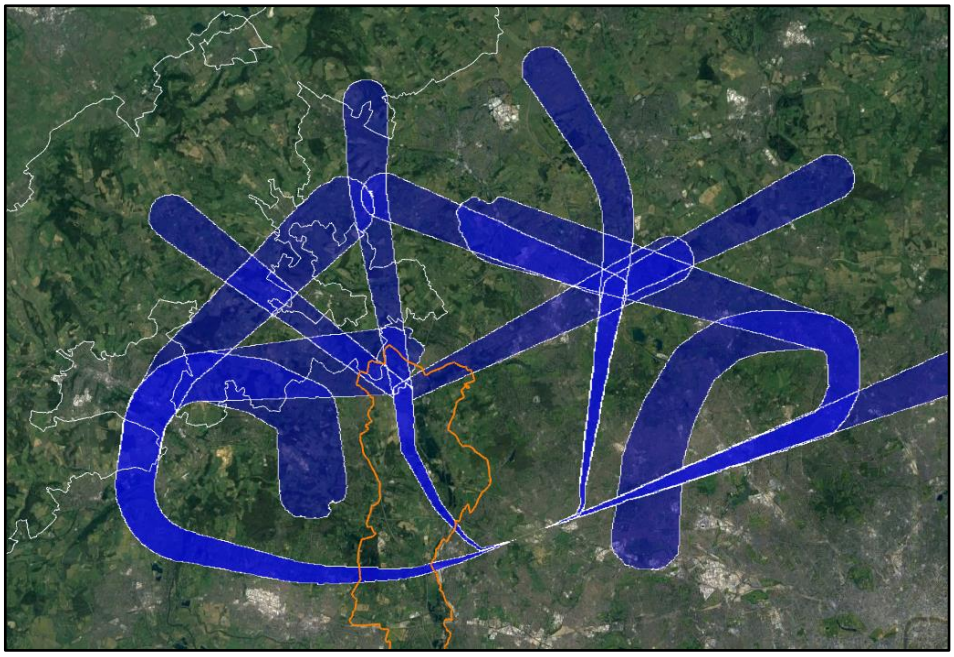
Wider Society	Capacity / Resilience	Qualitative

If the baseline design was retained there would be continued dependencies between RAF Northolt, Luton and London City and there could not expect to be any improvement in the delay generated by those dependencies for any of the three airports.

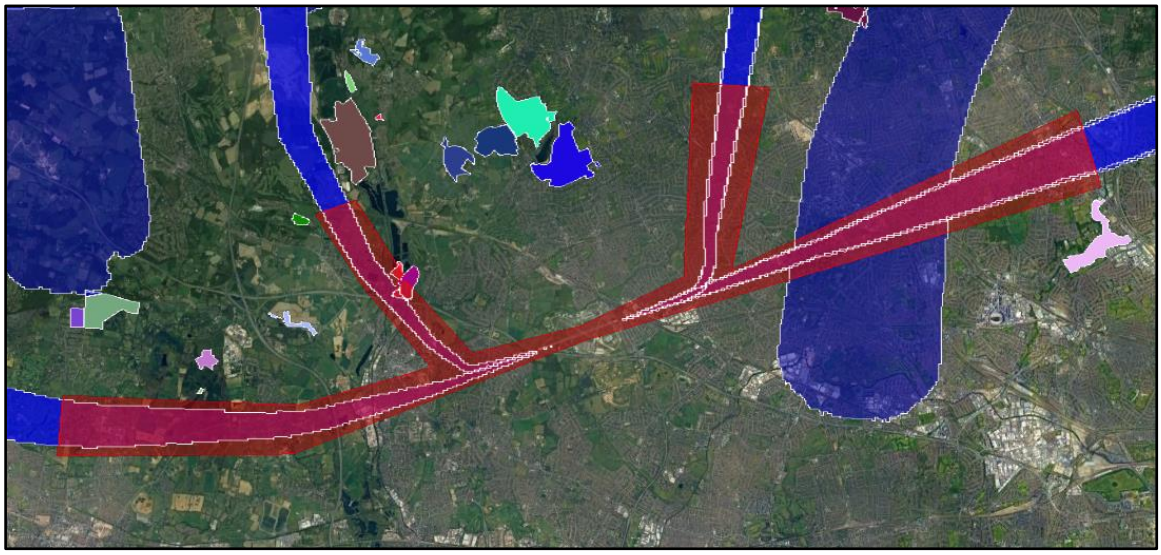
Wider Society	Biodiversity and Tranquillity	Qualitative

In terms of tranquillity, RAF Northolt's RWY07 arrivals overfly the Chilterns AONB (outlined in white in the diagram below) at c.3000ft and above and the Colne Valley Regional Park (orange) below 2000ft. RWY07 departures towards Henton (HEN) currently overfly the Chilterns AONB at c. 5000ft+.

RWY25 departures overfly the Colne Valley Regional Park at c.1000ft and above and departures to the northwest overfly the Chilterns AONB at c.3000ft and above. RWY25 arrivals from the northwest overfly the Chilterns AONB at c. 4-5000ft and above. If the baseline design was retained there would be no change to overflight of either the Colne Valley Regional Park or Chilterns AONB.



In terms of biodiversity, the image below shows the existing RAF Northolt flight paths highlighted in red to indicate operations 2000ft and below. The baseline centrelines currently overfly two SSSIs (Denham Lock Wood and Fray's Farm Meadows) below 2000ft which sits underneath the RWY25 SIDs.



General Aviation	Access	Qualitative
Airspace boundaries and/or the services provided by RAF Northolt Radar to General Aviation inside and outside CAS will not change. Impacts of RAF Northolt's operation on Denham Aerodrome will remain as it today with the Denham LFA staying at 1200ft. Please see the baseline description in the Step 2A document for further details of RAF Northolt's existing Airspace Environment.		
General Aviation / Commercial Airlines	Economic impact from increased effective capacity	Qualitative

There would be no opportunity to improve airspace capacity. If this baseline system was retained, RAF Northolt, Heathrow, Luton, and London City departures would continue to route to BPK and RAF Northolt and Luton departures to HEN. This would continue to rely on tactical intervention by London Terminal Control and RAF Northolt Radar and therefore not reduce their workload to enable airspace capacity improvements. There would be no change in economic impact for either GA or commercial operators.

General Aviation / Commercial Airlines	Fuel burn	Qualitative

The same route lengths would be flown, and the same typical altitudes would be attained along the track. If the baseline design was retained, the same lateral, vertical, and longitudinal profiles would be flown, and greenhouse gas impacts would not change. There would be no change in economic impact for either GA or commercial operators. The tables below show the typical track miles from the existing four arrival stacks to each runway and from each runway to three points within the upper airspace network.

	ARRIVALS			
	BIG	OCK	LAM	BNN
RWY 25	44	38	23	27
RWY07	55	40	48	24

	DEPARTURES		
	DAGGA	CPT	TNT
RWY 25	58	42	104
RWY07	52	48	104

CCO/CDO from/to RAF Northolt is currently heavily limited owing to interactions with routes to/from adjacent airports. Standard Instrument Departures have stepped climbs, some requiring level offs at 3000ft. Arrivals are often required to descend much earlier than ideal to descend below the four holding stacks to avoid being delayed by Heathrow traffic flows.

Commercial Airlines	Training costs	Qualitative

Flight procedures change worldwide with each AIRAC cycle and operators update their procedures accordingly, training if required. If this baseline system was retained, the same flight procedures would be used, and training cost impacts would not change.

Commercial Airlines	Other costs	Qualitative

As this option is already in operation, there are no other costs beyond business-as-usual maintenance anticipated as there will be no change.

Airport/ANSP	Infrastructure costs	Qualitative

As this option is already in operation, there are no infrastructure costs anticipated with no additional costs beyond business-as-usual maintenance as there will be no change.

Airport/ANSP	Operational costs	Qualitative

As this option is already in operation, there are no operational costs anticipated with no additional costs beyond business as usual as there will be no change.

Airport/ANSP	Deployment costs	Qualitative

As this option is already in operation, there are no deployment costs anticipated as there will be no change.

All	Safety	Qualitative

At current traffic levels, there are no safety concerns with the current arrangements at RAF Northolt. Future traffic growth across the LTMA could however result in increased complexity and workload for Air Traffic Controllers and pilots, which may lead to traffic levels within the LTMA being capped, or increased aircraft holding on the ground, to maintain safety.

All	Interdependencies, conflicts, and trade offs	Qualitative

As detailed in RAF Northolt Step 2A document, the proximity of major airports within the LTMA generate significant complexity and dependencies on one another, often resulting in delay and inefficient profiles. There are significant dependencies between RAF Northolt, Heathrow, Luton, and London City. The leading constraints to all these airports are the Heathrow arrival operation including its holding stacks and the Heathrow departures which are limited to 6000ft, underneath their own arrivals. Departures from RAF Northolt, Luton and London City and

are all prohibited from continuous climb due to Heathrow departures as well as Heathrow arrivals. In addition, there are dependencies between RAF Northolt, Luton, and London City departures, as their routes are not all vertically or laterally deconflicted, meaning each airport generates delays for one another. If this baseline system was retained, there would be no change to the existing interdependencies, conflicts, and trade-offs.		
All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative
CAP1711 describes the objective as: "*Deliver quicker, quieter, and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace*." Doing nothing will not align with the AMS. It will not enable any environmental benefits or maximise benefits from NERL's re-design of the LTMA and the redesign of adjacent airports such as Luton and London City. No change and therefore no ACP submission will not enable any potential reduction in the volumes of controlled airspace that currently contain RAF Northolt's IFPs.		

Easterly Arrivals Option 1: Approach from the north/northeast

Table 4 IOA: Easterly Arrivals Option 1: Approach from the north/northeast

Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Partly quantitative, partly qualitative

RWY 07 ARRVS ALL	Total Population	SEL_70
Baseline Average	67806	54466
Baseline Highest	78969	54616
Baseline Lowest	61346	54391
Track Average	87999	97169
Track Highest	127923	112968
Track Lowest	23357	42276

Those illustrative tracks that cater for a longer (c.8nm) final approach will increase total population numbers overflown 0-7000ft and double the number of people within a 70dB SEL. However, those illustrative tracks that remain north of Slough and join final approach in a similar location to today have potential to reduce the total population numbers overflown 0-7000ft and possibly reduce numbers within a 70 dB SEL.

There is potential on this option to affect the 2016 51dB (LOAEL) contour. Whilst the 2016 LAOEL doesn't extend out as far as the existing final approach joining point, the offset approaches that are being investigated have potential to move the LOAEL slightly further north.

Communities	Air Quality	Qualitative

There is potential for the lateral tracks of flight paths to be altered below 1000ft for RWY07 arrivals. This is due to the consideration of offset approaches which may be required depending on the type of approaches required into RAF Northolt. This option could therefore have an effect air quality and on the Buckinghamshire and Hillingdon AQMAs.

Wider Society	Greenhouse Gas Impact	Qualitative

The fuel burn assessment (see below) has anticipated that this option is likely to result in a similar order of magnitude of track miles below 7000ft as experienced in the baseline. There is an expectation to see a corresponding impact to greenhouse gas emissions. This will be explored in further detail in the Stage 3 Full Options Appraisal, along with methods to optimise trajectories.

Wider Society	Capacity / Resilience	Qualitative

Those illustrative tracks that join final approach at 7-8nm from RAF Northolt will be less than 3nm from Heathrow RWY09L final approach which would result in a dependency between Heathrow and RAF Northolt that could generate delay for both aerodromes. If safety assurances cannot be generated for independent operations, then it is likely RAF Northolt would not pursue such a joining point. Arrival tracks that stay closest to RAF Northolt are likely to have less interactions with routes to/from neighbouring airports and could therefore be expected to minimise delay for RAF Northolt and other airports. Note that RAF Northolt's existing arrival flight paths do not generate delays.

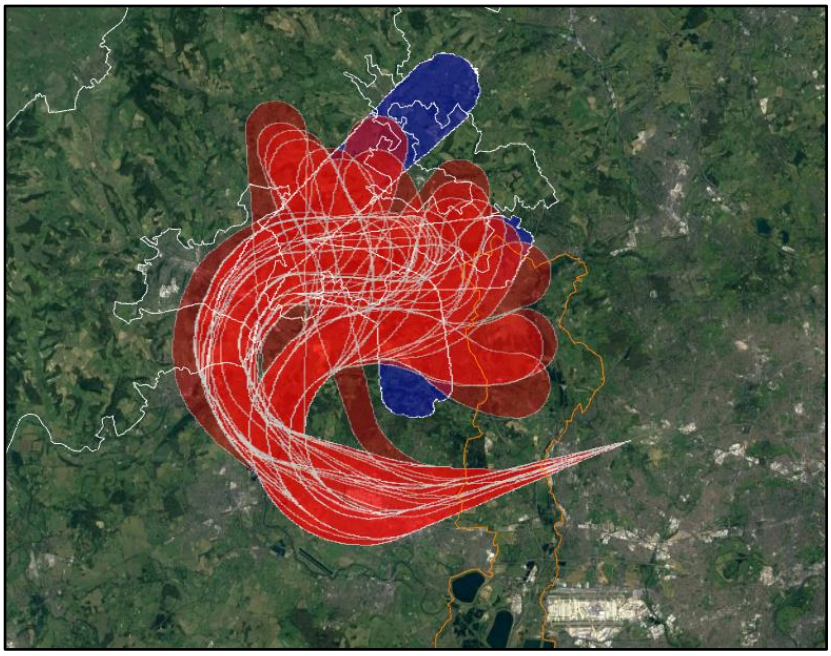
PBN transitions to both RNP APCH and ILS Instrument Approach Procedures (with common joining points between them where possible) have been investigated, however RAF Northolt does not currently have an ILS on RWY07.

Implementation of an ILS as well as RNP APCH procedures would significantly increase RAF Northolt's resilience and reduce chances of diversions in inclement weather.

Use of PBN arrival transitions will reduce the requirement for vectoring by RAF Northolt Radar which in turn reduces controller workload. This creates controller capacity to handle any non-standard scenarios or peaks in civil or military movements.

Wider Society	Biodiversity and Tranquillity	Qualitative

In terms of tranquillity, this option would continue to see RWY07 arrivals overfly Colne Valley Regional Park below 2000ft, at very similar heights to today. Should an offset approach be chosen, this could affect which part of the Park is overflown. This option could still see overflight of the Chilterns AONB although there are some illustrative tracks that avoid the AONB altogether however this would rely on a longer final approach flying over more people and potentially introducing a dependency on Heathrow RWY09 arrivals. If CDO performance could be improved than this could reduce the overflight of the AONB at lower altitude, but it is likely there will continue to be overflight of it.



In terms of biodiversity, none of the illustrative centrelines within this option overfly any SSSIs, RAMSAR sites, SACs, or SPAs below 2000ft.

General Aviation	Access	Qualitative

There is scope within this option to operate within the existing LTMA and London CTR volumes whilst avoiding Denham ATZ on arrival. Subject to no change or increase to the lateral dimensions of the London CTR, there is no expectation of degradation to the existing levels of CAS access. PBN Arrival transitions can be expected to reduce controller workload which could generate capacity when providing services outside CAS and access to delegated airspace within the London CTR. Should a longer final approach be adopted to RWY07 this has potential to affect the way helicopter traffic on H10 is tactically handled.

General Aviation / Commercial Airlines	Economic impact from increased effective capacity	Qualitative

The increased resilience through the implementation of RNP APCH, and potentially ILS, procedures to RWY07 could be expected to result in reduced delays and diversions which would present an economic benefit to commercial operators into RAF Northolt. This may also realise economic benefit through the reduced controller workload and associated increase in capacity for the RAF Northolt approach function as a result on PBN arrival transitions. Without a system-wide design it is not yet possible to determine wider economic impacts such as through reduced delays through systemisation and deconflicted routes.

It is anticipated this option will not have any economic impact to GA operations.

General Aviation / Commercial Airlines	Fuel burn	Qualitative

This option could service arrivals from all directions although some groups of illustrative tracks would not suit all arrivals owing to the disproportionate extra distances involved. Should a longer final approach to RWY07 be

RWY07	BIG	OCK	LAM	BNN
Do Nothing	55	40	48	24
GRP 1A	2	2	2	2
GRP 1B	N/A	N/A	N/A	0
GRP 1C	0	2	-1	0
GRP 1D	-2	-1	-2	4
GRP 1E	0	1	-1	2
GRP 1F	N/A	N/A	0	-2

desired this is likely to increase mileage for operators, whereas if the short final approach is retained, there is scope to slightly reduce track miles. Overall, and considering the uncertainty in the network positioning at this stage, this option is likely to result in a similar order of magnitude of track miles below 7000ft as experienced in the baseline. This is because RAF Northolt would expect to be able to optimise track placement within Stage 3. RAF Northolt does not predict a change in GA fuel burn assuming the arrivals can be contained within existing CAS.

Commercial Airlines	Training costs	Qualitative

Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required on a business-as-usual basis. This option is not anticipated to require any additional training costs for commercial airlines.

Commercial Airlines	Other costs	Qualitative

No other airline costs are foreseen with this option.

Airport/ANSP	Infrastructure costs	Qualitative

This option is not expected to change RAF Northolt's infrastructure, beyond the initial deployment phase which will require some systems engineering amendments. PBN transitions to both RNP APCH and ILS have been investigated, however RAF Northolt does not currently have an ILS on RWY07. Implementation of an ILS would incur cost but that would not be because of this ACP.

Airport/ANSP	Operational costs	Qualitative

This design option is not expected to change RAF Northolt's operational costs.

Airport/ANSP	Deployment costs	Qualitative

This option is expected to require air traffic controller training for the controllers and assistants located at RAF Northolt, RAF Northolt Radar, and London Terminal Control. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal, when appraising the shortlist of options and once further information is known about the network above 7000ft and interdependencies with adjacent airports and NERL.

All	Safety	Qualitative

The proximity to Heathrow RWY09L final approach will require detailed investigation. Within this option, illustrative tracks have been investigated that are expected to maintain 3nm radar separation from Heathrow RWY09L arrivals as well as tracks that do not. The latter would require an even more detailed safety investigation. It is expected that a PBN transition onto final approach will provide greater accuracy than today's PAR/SRA/Visual Approaches which could enhance safety.

The options are thought to be able to be contained within the existing CAS arrangements and is therefore unlikely to have any negative or positive safety impacts on GA.

Any PBN transitions to RWY07 will interact to some extent with routes to/from adjacent airports and will require Route Spacing Assurances in line with any guidance available in CAP1385.

All	Interdependencies, conflicts, and trade offs	Qualitative
All of RAF Northolt's options will have interdependencies, conflicts, and trade-offs with adjacent airports. Most notably Heathrow, Luton, London City and potentially Stansted as well as NERL. RWY07 arrivals today join final approach from the north and northeast as in this option although they are vectored by Heathrow Approach and then RAF Northolt Radar to a short final approach. Arrivals are usually descended lower than an ideal profile to deconflict from adjacent routes. This option would see use of PBN arrival transitions which would standardise their arrival pattern even more than today and offer reduced pilot and controller workload. Ideally vertical profiles will be improved compared to the baseline but inevitably there will need to be some trade-offs whether laterally and/or vertically from the ideal trajectory.		
All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative
CAP1711 describes the objective as: "*Deliver quicker, quieter, and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace*.". There is scope within this option to operate within the existing LTMA and London CTR volumes whilst avoiding White Waltham and Denham ATZs but depending on the final track alignment there is potential for the option to have an impact on other airspace users which would require compromises/trade-offs from RAF Northolt or other airspace users. PBN Arrival transitions can be expected to reduce controller workload which could generate capacity when providing services outside CAS and access to delegated airspace within the London CTR. There is scope within this option to operate without a Heathrow/RAF Northolt dependency however depending on the final track alignment there is potential for the option to have a dependency which could generate delay for both aerodromes. There are track alignments possible within this option which could better manage noise although early indications suggest similar track mileage for arrivals based on information available at this stage. It is not possible to understand if there could be reductions in track miles without the network and Heathrow designs.		

Westerly Arrivals Option 1: Approach from the northeast

Table 5 IOA: Westerly Arrivals Option 1: Approach from the northeast

Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Partly quantitative, partly qualitative

Option 1	Total Population	SEL_70
Baseline Average	316426	188979
Baseline Highest	393045	190174
Baseline Lowest	255478	187842
Track Average	143952	169473
Track Highest	168834	189303
Track Lowest	127906	166499

All the illustrative tracks within this option suggest a reduction in total population overflown 0-7000ft as well as a reduction in population numbers within a 70dB SEL. The SEL reduction compared to the baseline appears to be due to these tracks joining final approach just slightly closer to the runway compared to today.

It is unlikely that this option will affect the 2016 51dB LOAEL contour.

Communities	Air Quality	Qualitative
This option would not alter the lateral or vertical tracks of flight paths below 1000ft for RWY25 arrivals and this option is therefore not expected to influence Local Air Quality.		
Wider Society	Greenhouse Gas Impact	Qualitative
The fuel burn assessment (see below) anticipates that this option is likely to result in an increase in track miles below 7000ft as experienced in the baseline. There is an expectation to see a corresponding impact to greenhouse gas emissions. This will be explored in further detail in the Stage 3 Full Options Appraisal should this option progress, when optimised trajectories will be sought.		
Wider Society	Capacity / Resilience	Qualitative
The illustrative tracks have no specific characteristics which would minimise delay for RAF Northolt and/or adjacent FASI aerodromes however it would not be expected to increase delay compared to baseline levels so long as RAF Northolt's arrivals can be vertically deconflicted from adjacent airports' routes. Arrival tracks that stay closest to RAF Northolt are likely to have less interactions with routes to/from neighbouring airports and could therefore be expected to minimise delay for RAF Northolt and other airports. With arrivals from the northeast (BPK) direction, this may be challenging to achieve. Note that RAF Northolt's existing arrival flight paths do not generate delays.		

The addition of RNP APCH Instrument Approach Procedures to RWY25 to RAF Northolt's ILS procedures would significantly increase RAF Northolt's resilience and reduce chances of diversions in inclement weather.

Use of PBN arrival transitions will reduce the requirement for vectoring by RAF Northolt Radar which in turn reduces controller workload. This creates controller capacity to handle any non-standard scenarios or peaks in civil or military movements.

Wider Society	Biodiversity and Tranquillity	Qualitative

In terms of tranquillity, this option avoids overflight of AONBs and/or National Parks, as well as Colne Valley Regional Park. This may change subject to the direction of arrival from the LTMA Network design and ability to deliver CDO from 7000ft. In the absence of CDO from 7000ft, this option could still see overflight of the Chilterns AONB when positioning onto the arrival track from the northwest.
In terms of biodiversity, none of the illustrative centrelines within this option overfly any SSSIs, RAMSAR sites, SACs, or SPAs below 2000ft.

General Aviation	Access	Qualitative

Subject to the detailed final design of flight paths including approach angles, it cannot currently be determined that there will be 'no impact' to other airspace users due to uncertainty whether the PBN arrivals can be wholly contained within CAS. The existing 3.5˚ Glideslope enables arrivals to be kept inside existing CAS however this angle may not be possible for all types of approaches (e.g., Baro VNAV) so it's not yet clear if more CAS would be required. Subject to no change or increase to the lateral dimensions of the London CTR, degradation is not expected for the existing levels of CAS access. PBN Arrival transitions can be expected to reduce controller workload which could generate capacity when providing services outside CAS and access to delegated airspace within the London CTR. The option is not expected to have an impact on existing helicopter lanes.

General Aviation / Commercial Airlines	Economic impact from increased effective capacity	Qualitative

The increased resilience through the implementation of RNP APCH procedures to RWY25 could be expected to result in reduced delays and diversions in the event of ILS unserviceability which would present an economic benefit to commercial operators into RAF Northolt. Economic benefit may also be realised through the reduced controller workload and associated increase in capacity for the RAF Northolt approach function as a result of PBN arrival transitions. Without a system-wide design it is not yet possible to determine wider economic impacts such as through reduced delays through systemisation and deconflicted routes.

As detailed above, it cannot be confirmed whether the PBN arrivals can be wholly contained within CAS and whether a change to CAS dimensions is required which could have an economic impact on GA should that result in increased journey length in Class G airspace.

General Aviation / Commercial Airlines	Fuel burn	Qualitative

This option could service arrivals from the north (BNN) and east (LAM) directions. They would not suit arrivals from the south owing to the disproportionate extra distances involved. The existing baseline tracks are very direct from the existing 4 stacks and unless the new network arrival function is positioned to the northeast this option is likely to result in an increase in track miles below 7000ft compared to the baseline. It is unlikely that the new network arrival function is positioned to the northeast as this would be in the region expected to be used for Luton and/or Stansted traffic flows. There is no prediction in change to GA fuel burn assuming the arrivals can be contained within existing CAS.

RWY 25	BIG	OCK	LAM	BNN
Do Nothing	44	38	23	27
GRP 1A	N/A	N/A	9	9
GRP 1B	N/A	N/A	6	N/A
GRP 1C	N/A	N/A	9	12

Commercial Airlines	Training costs	Qualitative
Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required on a business-as-usual basis. This option is not anticipated to require any additional training costs for commercial airlines.		
Commercial Airlines	Other costs	Qualitative
No other airline costs are foreseen with this option.		
Airport/ANSP	Infrastructure costs	Qualitative
This option is not expected to change RAF Northolt's infrastructure, beyond the initial deployment phase which will require some systems engineering amendments.		
Airport/ANSP	Operational costs	Qualitative
This design option is not expected to change RAF Northolt's operational costs.		
Airport/ANSP	Deployment costs	Qualitative
This option is expected to require air traffic controller training for the controllers and assistants located at RAF Northolt, RAF Northolt Radar, and London Terminal Control. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal, when appraising the shortlist of options and once further information is known about the network above 7000ft and interdependencies with adjacent airports and NERL.		
All	Safety	Qualitative
The approach from the BPK region in this option is likely to increase interactions compared to today. However, no reasons have been identified as to why the tracks would be less safe than today subject to lateral and or vertical separation being achieved from other routes. Any PBN transitions to RWY25 will interact to some extent with routes to/from adjacent airports and will require Route Spacing Assurances in line with any guidance available in CAP1385. Subject to the detailed final design of flight paths including approach angles, it cannot currently be confirmed that there will be 'no impact' to other airspace users as RAF Northolt cannot yet be sure whether the PBN arrivals can be wholly contained within CAS. The existing 3.5˚ Glideslope enables arrivals to be kept inside existing CAS however this angle may not be possible for all types of approaches (e.g., Baro VNAV) so it's not yet clear if more CAS would be required. Any increase to CAS to the northeast of the existing London CTR boundary will require investigation of safety impacts to airspace users both inside and outside CAS.		
All	Interdependencies, conflicts, and trade offs	Qualitative
All of RAF Northolt's options will have interdependencies, conflicts, and trade-offs with adjacent airports. Most notably Heathrow, Luton, London City and potentially Stansted as well as NERL. RWY25 arrivals today join final approach from the north and northeast as in this option although they are vectored by Heathrow Approach and then RAF Northolt Radar to a c.7-8nm final. Arrivals are usually descended lower than an ideal profile to deconflict from adjacent routes. This option would see use of PBN arrival transitions which would standardise their arrival pattern even more than today and offer reduced pilot and controller workload. Ideally vertical profiles will be improved compared to the baseline but inevitably there will need to be some trade-offs whether laterally and/or vertically from the ideal trajectory. This option (compared to Option 2) may require more trade-off discussions as arrivals from the northeast (BPK) direction are likely to interact more with Luton, London City and possibly Stansted traffic.		
All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative
CAP1711 describes the objective as: "*Deliver quicker, quieter, and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.*". Subject to the detailed final design of IFPs and approach angle, RAF Northolt cannot yet say there will be 'no impact' to other airspace users. If there is, there may be ways to minimise it. PBN Arrival transitions can be		

expected to reduce controller workload which could generate capacity when providing services outside CAS and access to delegated airspace within the London CTR.

Tracks have no specific characteristics which would minimise delay for RAF Northolt and/or adjacent FASI aerodromes however it would not be expected to increase delay compared to baseline levels.

There are track alignments possible within this option which could better manage noise although early indications suggest arriving from a BPK direction is not likely to be optimal for CO_2 compared to today.

Westerly Arrivals Option 2: Approach from north, northwest and/or southwest

Table 6 IOA: Westerly Arrivals Option 2: Approach from north, northwest and/or southwest

Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Partly quantitative, partly qualitative

Option 2	Total Population	SEL_70
Baseline Average	316426	188979
Baseline Highest	393045	190174
Baseline Lowest	255478	187842
Track Average	179241	172818
Track Highest	377788	189303
Track Lowest	123946	166520

All the illustrative tracks within this option suggest a reduction in total population overflown 0-7000ft as well as a reduction in population numbers within a 70dB SEL. The SEL reduction compared to the baseline appears to be due to these tracks joining final approach just slightly closer to the runway compared to today.

It is unlikely that this option will affect the 2016 51dB LOAEL contour.

Communities	Air Quality	Qualitative
This option would not alter the lateral or vertical tracks of flight paths below 1000ft for RWY25 arrivals and this option is therefore not expected to influence Local Air Quality.		

Wider Society	Greenhouse Gas Impact	Qualitative
The fuel burn assessment (see below) has anticipated that this option is likely to result in a similar order of magnitude of track miles below 7000ft as experienced in the baseline. There is an expectation to see a corresponding impact to greenhouse gas emissions. This will be explored in further detail in the Stage 3 Full Options Appraisal should this option progress where optimises trajectories will be sought.		

Wider Society	Capacity / Resilience	Qualitative
The illustrative tracks have no specific characteristics which would minimise delay for RAF Northolt and/or adjacent FASI aerodromes however it would not be expected to increase delay compared to baseline levels so long as RAF Northolt's arrivals can be vertically deconflicted from adjacent airports' routes. Arrival tracks that stay closest to RAF Northolt are likely to have less interactions with routes to/from neighbouring airports and could therefore be expected to minimise delay for RAF Northolt and other airports. Note that RAF Northolt's existing arrival flight paths do not generate delays. The addition of RNP APCH Instrument Approach Procedures to RWY25 to RAF Northolt's ILS procedures would significantly increase RAF Northolt's resilience and reduce chances of diversions in inclement weather.		

Use of PBN arrival transitions will reduce the requirement for vectoring by RAF Northolt Radar which in turn reduces controller workload. This creates controller capacity to handle any non-standard scenarios or peaks in civil or military movements.

Wider Society	Biodiversity and Tranquillity	Qualitative

In terms of tranquillity, this option avoids overflight of AONBs and/or National Parks, as well as Colne Valley Regional Park. This may change subject to the direction of arrival from the LTMA Network design and ability to deliver CDA from 7000ft. In the absence of CDA from 7000ft, this option could still see overflight of the Chilterns AONB when positioning onto the arrival track from the northwest.
In terms of biodiversity, none of the illustrative centrelines within this option overfly any SSSIs, RAMSAR sites, SACs, or SPAs below 2000ft.

General Aviation	Access	Qualitative

Subject to the detailed final design of flight paths including approach angles, it cannot yet be said that there will be 'no impact' to other airspace users as there is uncertainty as to whether the PBN arrivals can be wholly contained within CAS. The existing 3.5˚ Glideslope enables arrivals to be kept inside existing CAS however this angle may not be possible for all types of approaches (e.g., Baro VNAV) so it's not yet clear if more CAS would be required. Subject to no change or increase to the lateral dimensions of the London CTR, degradation to the existing levels of CAS access would not be expected. PBN Arrival transitions can be expected to reduce controller workload which could generate capacity when providing services outside CAS and access to delegated airspace within the London CTR. The option is not expected to have an impact on existing helicopter lanes.

General Aviation / Commercial Airlines	Economic impact from increased effective capacity	Qualitative

The increased resilience through the implementation of RNP APCH procedures to RWY25 could be expected to result in reduced delays and diversions in the event of ILS unserviceability which would present an economic benefit to commercial operators into RAF Northolt. Economic benefit could be realised through the reduced controller workload and associated increase in capacity for the RAF Northolt approach function as a result on PBN arrival transitions. Without a system-wide design it is not yet possible to determine wider economic impacts such as through reduced delays through systemisation and deconflicted routes.

As detailed above, it cannot currently be confirmed whether the PBN arrivals can be wholly contained within CAS and so it is unknown if a change to CAS dimensions is required which could have an economic impact on GA should that result in increased journey length in Class G airspace.

General Aviation / Commercial Airlines	Fuel burn	Qualitative

This option could service arrivals from the north (BNN) and south (OCK/BIG) directions. They would not suit arrivals from the east (LAM) owing to the disproportionate extra distances involved. Overall, and considering the uncertainty in the network positioning at this stage, this option is likely to result in a similar order of magnitude of track miles below 7000ft as experienced in the baseline. This is because it would be expected to optimise track placement within Stage 3. A change in GA fuel burn is not predicted, assuming the arrivals can be contained within existing CAS.

RWY 25	BIG	OCK	LAM	BNN
Do Nothing	44	38	23	27
GRP 2A	0	0	N/A	N/A
GRP 2B	3	2	N/A	-1
GRP 2C	N/A	N/A	N/A	0

Commercial Airlines	Training costs	Qualitative

Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required on a business-as-usual basis. This option is not anticipated to require any additional training costs for commercial airlines.

Commercial Airlines	Other costs	Qualitative
No other airline costs are foreseen with this option.		
Airport/ANSP	Infrastructure costs	Qualitative
This option is not expected to change RAF Northolt's infrastructure, beyond the initial deployment phase which will require some systems engineering amendments.		
Airport/ANSP	Operational costs	Qualitative
This design option is not expected to change RAF Northolt's operational costs.		
Airport/ANSP	Deployment costs	Qualitative
This option is expected to require air traffic controller training for the controllers and assistants located at RAF Northolt, RAF Northolt Radar, and London Terminal Control. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal, when appraising the shortlist of options and once further information is known about the network above 7000ft and interdependencies with adjacent airports and NERL.		
All	Safety	Qualitative
The illustrative tracks that approach from the north in this option is likely to increase interactions with Luton compared to today. However, no reasons have been identified as to why the tracks would be less safe than today subject to lateral and or vertical separation being achieved from other routes. Any PBN transitions to RWY25 will interact to some extent with routes to/from adjacent airports and will require Route Spacing Assurances in line with any guidance available in CAP1385. Keeping approaches as close to RAF Northolt as possible will reduce these interactions. Subject to the detailed final design of flight paths including approach angles, it cannot yet be confirmed that there will be 'no impact' to other airspace users as it is uncertain whether the PBN arrivals can be wholly contained within CAS. The existing 3.5˚ Glideslope enables arrivals to be kept inside existing CAS however this angle may not be possible for all types of approaches (e.g., Baro VNAV) so it is not yet clear if more CAS would be required. Any increase to CAS to the northeast of the existing London CTR boundary will require investigation of safety impacts to airspace users both inside and outside CAS.		
All	Interdependencies, conflicts, and trade offs	Qualitative
All of RAF Northolt's options will have interdependencies, conflicts, and trade-offs with adjacent airports. Most notably Heathrow, Luton, London City and potentially Stansted as well as NERL. RWY25 arrivals today join final approach from the north and northeast as in this option although they are vectored by Heathrow Approach and then RAF Northolt Radar to a c.7-8nm final approach. Arrivals are usually descended lower than an ideal profile to deconflict from adjacent routes. This option would see use of PBN arrival transitions which would standardise their arrival pattern even more than today and offer reduced pilot and controller workload. Ideally vertical profiles will be improved compared to the baseline but inevitably there will need to be some trade-offs whether laterally and/or vertically from the ideal trajectory.		
All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative
CAP1711 describes the objective as: "*Deliver quicker, quieter, and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace*.". Subject to the detailed final design of IFPs and approach angle, it cannot be determined at this stage whether there will be 'no impact' to other airspace users. If there is, there may be ways to minimise it. There is scope in this option to keep the arrival track tight and close to RAF Northolt and reduce impacts on other airspace users but subject to the final positioning and requirements of the Network and Heathrow arrival function, there could also be scope for compromises/trade-offs from RAF Northolt or other airspace users. PBN Arrival transitions can be expected to reduce controller workload which could generate capacity when providing services outside CAS and access to delegated airspace within the London CTR.		

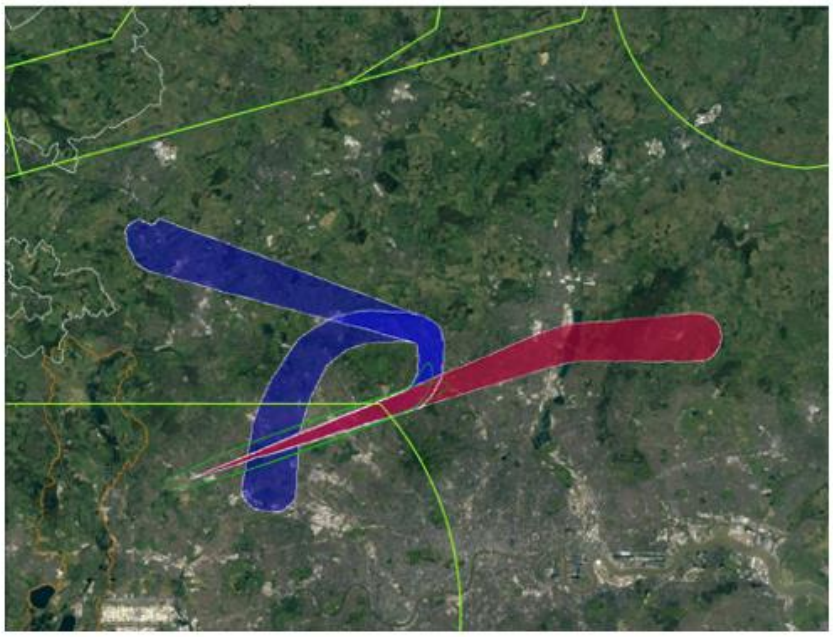
Tracks have no specific characteristics which would minimise delay for RAF Northolt and/or adjacent FASI aerodromes however it would not be expected to increase delay compared to baseline levels.

There is scope to keep track mileage for arrivals like today within this option. Understanding if there could be reductions in track miles is not possible without the network and Heathrow designs. There is scope to reduce total population or reduce newly overflown or reduce overflight by multiple routes but probably not all three.

Westerly Arrivals Option 4: Approach from the east

Table 7 IOA: Westerly Arrivals Option 4: Approach from the east

Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Partly quantitative, partly qualitative



GROUP 4A	Total Population	SEL_70
Baseline Average	316426	188979
Baseline Highest	393045	190174
Baseline Lowest	255478	187842
Track Average	300755	188921
Track Highest	300755	188921
Track Lowest	300755	188921

Compared to the arrival statistics for the average RWY25, this illustrative track shows a reduction in total population overflown 0-7000ft and similar numbers within a 70dB SEL contour. Although this track exists today, the concentration from PBN compared to a vectored arrival could be expected to reduce total population overflown 0-7000ft but probably wouldn't affect a 70dB SEL.

It is unlikely that this option will affect the 2016 51dB LOAEL contour.

Communities	Air Quality	Qualitative
This option would not alter the lateral or vertical tracks of flight paths below 1000ft for RWY25 arrivals and this option is therefore not expected to influence Local Air Quality.		
Wider Society	Greenhouse Gas Impact	Qualitative
The fuel burn assessment (see below) has anticipated that this option is likely to result in a similar order of magnitude of track miles below 7000ft as experienced in the baseline. RAF Northolt expects to see a corresponding impact to greenhouse gas emissions. This will be explored in further detail in the Stage 3 Full Options Appraisal should this option progress where optimised trajectories will be sought.		
Wider Society	Capacity / Resilience	Qualitative
The illustrative track has no specific characteristics which would minimise delay for adjacent FASI aerodromes due to decreased interactions with adjacent airport's routes. However, this option would not be expected to increase delay compared to baseline levels so long as RAF Northolt's arrivals can be vertically deconflicted from adjacent airports' routes. Note that RAF Northolt's existing arrival flight paths do not generate delays. The addition of RNP APCH Instrument Approach procedures to RWY25 to RAF Northolt's ILS procedures would significantly increase resilience and reduce chances of diversions in inclement weather.		

Use of PBN arrival transitions will reduce the requirement for vectoring by RAF Northolt Radar which in turn reduces controller workload. This creates controller capacity to handle any non-standard scenarios or peaks in civil or military movements.

Wider Society	Biodiversity and Tranquillity	Qualitative

In terms of tranquillity, this option avoids overflight of AONBs and/or National Parks, including Colne Valley Regional Park.
In terms of biodiversity, none of the illustrative centrelines within this option overfly any SSSIs, RAMSAR sites, SACs, or SPAs below 2000ft

General Aviation	Access	Qualitative

Subject to the detailed final design of flight paths including approach angles, it cannot yet be determined that there will be 'no impact' to other airspace users as it is not confirmed whether the PBN arrivals can be wholly contained within CAS. The existing 3.5˚ Glideslope enables arrivals to be kept inside existing CAS however this angle may not be possible for all types of approaches (e.g., Baro VNAV) so it's not yet clear if more CAS would be required. Subject to no change increase to the lateral dimensions of the London CTR, RAF Northolt would not expect any degradation to the existing levels of CAS access. PBN Arrival transitions can be expected to reduce controller workload which could generate capacity when providing services outside CAS and access to delegated airspace within the London CTR. The option is not expected to have an impact on existing helicopter lanes.

General Aviation / Commercial Airlines	Economic impact from increased effective capacity	Qualitative

The increased resilience through the implementation of RNP APCH procedures to RWY25 could be expected to result in reduced delays and diversions in the event of ILS unserviceability which would present an economic benefit to commercial operators into RAF Northolt. Economic benefit may also be realised through the reduced controller workload and associated increase in capacity for the RAF Northolt approach function as a result on PBN Arrival transitions. Without a system-wide design it is not yet possible to determine wider economic impacts such as through reduced delays through systemisation and deconflicted routes.

As detailed above, it cannot be determined whether the PBN arrivals can be wholly contained within CAS and so it is unknown if a change to CAS dimensions is required which could have an economic impact on GA should that result in increased journey length in Class G airspace.

General Aviation / Commercial Airlines	Fuel burn	Qualitative

This option could service arrivals from the east (LAM) but would not suit arrivals from the north and south owing to the disproportionate extra distances involved. Overall, and considering the uncertainty in the network positioning at this stage, this option is likely to result in a similar order of magnitude of track miles below 7000ft as experienced in the baseline. A change in GA fuel burn is not predicted, assuming the arrivals can be contained within existing CAS.

RWY 25	BIG	OCK	LAM	BNN
Do Nothing	44	38	23	27
4A	N/A	N/A	0	N/A

Commercial Airlines	Training costs	Qualitative

Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required on a business-as-usual basis. This option is not anticipated to require any additional training costs for commercial airlines.

Commercial Airlines	Other costs	Qualitative

No other airline costs are foreseen with this option.

Airport/ANSP	Infrastructure costs	Qualitative

This option is not expected to change RAF Northolt's infrastructure, beyond the initial deployment phase which will require some systems engineering amendments.		
Airport/ANSP	Operational costs	Qualitative
This design option is not expected to change RAF Northolt's operational costs.		
Airport/ANSP	Deployment costs	Qualitative
This option is expected to require air traffic controller training for the controllers and assistants located at RAF Northolt, RAF Northolt Radar, and London Terminal Control. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal, when appraising the shortlist of options and once further information is known about the network above 7000ft and interdependencies with adjacent airports and NERL.		
All	Safety	Qualitative
This option is likely to interact with London City in a similar way as today. However, no reasons have been identified as to why the tracks would be less safe than today subject to lateral and or vertical separation being achieved from their routes and Heathrow RWY27 arrivals. Any PBN transitions to RWY25 will interact to some extent with routes to/from adjacent airports and will require Route Spacing Assurances in line with any guidance available in CAP1385. Subject to the detailed final design of flight paths including approach angles, it cannot yet be said that there will be 'no impact' to other airspace users as it cannot be confirmed whether the PBN arrivals can be wholly contained within CAS. The existing 3.5˚ Glideslope enables arrivals to be kept inside existing CAS however this angle may not be possible for all types of approaches (e.g., Baro VNAV) so it is not yet clear if more CAS would be required. Any increase to CAS to the northeast of the existing London CTR boundary will require investigation of safety impacts to airspace users both inside and outside CAS.		
All	Interdependencies, conflicts, and trade offs	Qualitative
All of RAF Northolt's options will have interdependencies, conflicts, and trade-offs with adjacent airports. Most notably Heathrow, Luton, London City and potentially Stansted as well as NERL. RWY25 arrivals today via LAM join final approach from the east as in this option although they are vectored by Heathrow Approach and then RAF Northolt Radar to a straight-in final approach. Arrivals are usually descended lower than an ideal profile to deconflict from adjacent routes. This option would see use of PBN arrival transitions which would standardise their arrival pattern even more than today and offer reduced pilot and controller workload. Ideally vertical profiles will be improved compared to the baseline but inevitably there will need to be some trade-offs whether laterally and/or vertically from the ideal trajectory. Of note, this option could require trade-off discussions with London City.		
All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative
CAP1711 describes the objective as: "*Deliver quicker, quieter, and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.*". There is potential for the option to require an adjustment to the dimension of the London CTR to contain the arrival, but this is not yet certain. As this illustrative track is in line with the existing swathe, no further impact on other airspace users would be expected, subject to the statement above. This option could require trade-offs with London City northbound SIDs. PBN Arrival transitions can be expected to reduce controller workload which could generate capacity when providing services outside CAS and access to delegated airspace within the London CTR. The illustrative track has no specific characteristics which would minimise delay for adjacent FASI aerodromes due to decreased interactions with adjacent airport's routes. However, the option would not be expected to increase delay compared to baseline levels. Track mileage for this arrival is expected to be like today however it does go over densely populated areas whilst minimising numbers newly overflown.		

Easterly Departures Option 1: Depart to the northeast

Table 8 IOA: Easterly Departures Option 1: Depart to the northeast

Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Partly quantitative, partly qualitative

Option 1	Total Population	SEL_70
Baseline Average	48691	157118
Baseline Highest	65188	157633
Baseline Lowest	38646	156831
Track Average	69495	192739
Track Highest	97302	211471
Track Lowest	40946	158012

All the illustrative tracks within this option show an increase in total population numbers overflown 0-7000ft apart from one track which has a small reduction. All the tracks show an increase in the 70db SEL. The SEL increase would suggest that a change could be seen to the 51dB LOAEL with this option. The later turn could see the LOAEL extend further east with an increase in population numbers within the LOAEL. Consequently, to minimise this increase, the turn should be as close as possible as in the baseline.

Communities	Air Quality	Qualitative
This option could alter the lateral or vertical tracks of flight paths below 1000ft, and this option could therefore have an impact on air quality and the Harrow AQMA.		
Wider Society	Greenhouse Gas Impact	Qualitative
The fuel burn assessment (see below) has anticipated that this option is likely to result in a similar order of magnitude of track miles below 7000ft as experienced in the baseline although they could increase for some routes. Therefore, there is an expectation to see a corresponding impact to greenhouse gas emissions. This will be explored in further detail in the Stage 3 Full Options Appraisal should this option progress where optimised trajectories will be sought.		
Wider Society	Capacity / Resilience	Qualitative
As detailed in the Stage 2A document, the interaction between RAF Northolt, Luton and London City's departure routes generates significant delay. This is due to the inability to procedurally deconflict all flight paths in different runway configurations. This is further hampered by Heathrow departures being limited to 6000ft by their own arrivals meaning RAF Northolt, Luton and London City are procedurally held down at 5000ft and below. Creating capacity in the airspace and reducing delays is dependent on designs from all the adjacent airports and NERL in the airspace above 7000ft. In the absence of detailed designs from all sponsors at this time, it is not possible to		

assess if this option will result in deconflicted routes thereby reducing delays. However, systemisation will reduce the requirement for vectoring by RAF Northolt Radar which in turn reduces controller workload. This creates controller capacity to handle any non-standard scenarios or peaks in civil or military movements.

This option has no specific characteristics which would minimise delay for RAF Northolt and/or adjacent FASI aerodromes however it would not be expected to increase delay compared to baseline levels as multiple interactions around the BPK area are expected in a future design.

Wider Society	Biodiversity and Tranquillity	Qualitative

This option avoids overflight of AONBs and/or National Parks, including Colne Valley Regional Park. This may change subject to where in the LTMA network northbound departures need to route and the ability to deliver CCO to 7000ft. In the absence of CCO to 7000ft, this option could still see overflight of the Chilterns AONB when positioning towards the north/TNT region.
In terms of biodiversity, none of the illustrative centrelines within this option overfly any SSSIs, RAMSAR sites, SACs, or SPAs below 2000ft.

General Aviation	Access	Qualitative

This design option is anticipated to be contained within existing CAS. A slightly later turn to the north would help ensure CAS containment. There is no expectation of any change to the existing levels of CAS access. The option is not expected to have an impact on existing helicopter lanes.

General Aviation / Commercial Airlines	Economic impact from increased effective capacity	Qualitative

Without a system-wide design it is not yet possible to determine wider economic impacts such as through reduced delays through systemisation and deconflicted routes.

RAF Northolt do not anticipate that this option will have any economic impact to GA operations.

General Aviation / Commercial Airlines	Fuel burn	Qualitative

This option could service departures to the north (TNT) and east/southeast (DAGGA) directions. They would not suit departures to the west (CPT) owing to the disproportionate extra distances involved. Overall, and considering the uncertainty in the network positioning at this stage, this option is likely to result in a similar order of magnitude (but potentially slightly higher) track miles below 7000ft as experienced in the baseline. This is because RAF Northolt expects to be able to optimise track placement within Stage 3. No change is predicted in GA fuel burn as the departures are anticipated to be contained within existing CAS.

RWY 07	DAGGA	CPT	TNT
Do Nothing	52	48	104
GRP 1A	2	N/A	1
GRP 1B	0	N/A	N/A
GRP 1C	3	N/A	5
GRP 1D	-1	N/A	N/A

Commercial Airlines	Training costs	Qualitative

Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required on a business-as-usual basis. This option is not anticipated to require any additional training costs for commercial airlines.

Commercial Airlines	Other costs	Qualitative

No other airline costs are foreseen with this option.

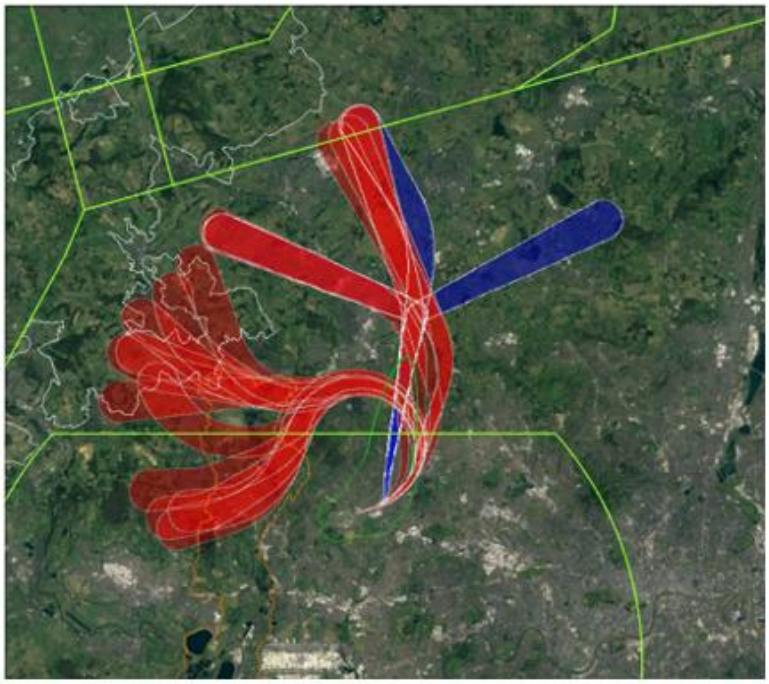
Airport/ANSP	Infrastructure costs	Qualitative

This option is not expected to change RAF Northolt's infrastructure, beyond the initial deployment phase which will require some systems engineering amendments.		
Airport/ANSP	Operational costs	Qualitative
This design option is not expected to change RAF Northolt's operational costs.		
Airport/ANSP	Deployment costs	Qualitative
This option is expected to require air traffic controller training for the controllers and assistants located at RAF Northolt, RAF Northolt Radar, and London Terminal Control. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal, when appraising the shortlist of options and once further information is known about the network above 7000ft and interdependencies with adjacent airports and NERL.		
All	Safety	Qualitative
If the departures turn north in a similar location as today (close to RAF Northolt), it could be expected to maintain or potentially reduce lateral interaction with future Heathrow northbound SIDs. A later turn could be possible, but this is subject to Heathrow SID positioning. Any lateral interaction with a delayed turn on RAF Northolt's SIDs is likely to be at a lower altitude than today which could require additional safety assurances. Any SIDs from RWY07 will continue to interact to some extent with routes to/from adjacent airports and will require Route Spacing Assurances in line with any guidance available in CAP1385. To avoid increasing CAS, steep climb gradients will continue to be required for RWY07 departures. Should there be a new, earlier interaction with Heathrow's new SIDs, the risk of a level bust will be a key consideration.		
All	Interdependencies, conflicts, and trade offs	Qualitative
All of RAF Northolt's options will have interdependencies, conflicts, and trade-offs with adjacent airports. Most notably Heathrow, Luton, London City and potentially Stansted as well as NERL. RWY07 departures today are restricted from CCO due to Heathrow, Luton, and London City interactions. Ideally vertical profiles will be improved compared to the baseline but inevitably there will need to be some trade-offs whether laterally and/or vertically from the ideal trajectory as well as considering free-flow departures. This option is highly likely to require trade-off discussions with London City, Luton, and Heathrow.		
All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative
CAP1711 describes the objective as: "*Deliver quicker, quieter, and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.*". Steep climb gradients would be used like today to ensure CAS containment although a slightly later turn would provide more track length, requiring a slightly shallower gradient to remain inside CAS. It is likely that RAF Northolt SIDs tracking to the northeast will continue to interact with London City, RAF Northolt arrivals and Heathrow traffic and compromises/trade-offs from RAF Northolt or those other airports will be required. This option has no specific characteristics that would reduce interactions with adjacent FASI aerodromes as multiple interactions around the BPK area are expected in a future design. The option is not expected to significantly change fuel burn and greenhouse gas emissions compared to the baseline. If RAF Northolt can largely replicate the existing centreline, that would appear to offer the lowest population overflown however at this stage of the ACP the exact track of such a departure cannot be chosen but will be subject to the trade-off deliberations in Stage 3. PBN and systemisation would be expected to reduce total numbers overflown overall as well as hopefully enabling capacity.		

Easterly Departures Option 2: Depart to the north and/or northwest

Table 9 IOA: Easterly Departures Option 2: Depart to the north and/or northwest

Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Partly quantitative, partly qualitative



Option 2	Total Population	SEL_70
Baseline Average	48691	157118
Baseline Highest	65188	157633
Baseline Lowest	38646	156831
Track Average	55749	192665
Track Highest	83088	201012
Track Lowest	34368	171624

The illustrative tracks within this option show that it may be possible to reduce total population numbers overflown 0-7000ft although many of the tracks show an increase. All the tracks show an increase in the 70db SEL. This SEL increase would suggest that a change could be seen to the 51dB LOAEL with this option. The later turn could see the LOAEL extend further east with an increase in population numbers within the LOAEL. Consequently, to minimise this increase, the turn should be as close as possible as in the baseline.

Communities	Air Quality	Qualitative
This option could alter the lateral or vertical tracks of flight paths below 1000ft, and this option could therefore have an impact on air quality and the Harrow AQMA.		
Wider Society	Greenhouse Gas Impact	Qualitative
The fuel burn assessment (see below) has anticipated that this option is likely to result in a similar order of magnitude of track miles below 7000ft as experienced in the baseline. Therefore, there is an expectation to see a corresponding impact to greenhouse gas emissions. This will be explored in further detail in the Stage 3 Full Options Appraisal should this option progress where optimised trajectories will be sought.		
Wider Society	Capacity / Resilience	Qualitative
As detailed in the Stage 2A document, the interaction between RAF Northolt, Luton and London City's departure routes generates significant delay. This is due to the inability to procedurally deconflict all flight paths in different runway configurations. This is further hampered by Heathrow departures being limited to 6000ft by their own arrivals meaning RAF Northolt, Luton and London City are procedurally held down at 5000ft and below. Creating capacity in the airspace and reducing delays is dependent on designs from all the adjacent airports and NERL in the airspace above 7000ft. In the absence of detailed designs from all sponsors at this time, it is not possible to assess if this option will result in deconflicted routes thereby reducing delays. However, systemisation will reduce		

the requirement for vectoring by RAF Northolt Radar which in turn reduces controller workload. This creates controller capacity to handle any non-standard scenarios or peaks in civil or military movements.

This option does have some specific characteristics which would minimise delay for RAF Northolt and/or adjacent FASI aerodromes: Those illustrative tracks which track to the west over the Chilterns AONB could be expected to remain laterally clear from London City and Heathrow departures to a greater extent than today and from London City and Luton's shortlisted options. However, such tracks could increase complexity for RAF Northolt Radar slightly as these departure tracks would be more likely to conflict with RAF Northolt RWY07 arrivals.

Wider Society	Biodiversity and Tranquillity	Qualitative

Some of the illustrative track still would overfly the Chilterns AONB and Colne Valley Regional park below 7000ft even if CCO to 7000ft is available. Groups 2A and 2B would increase overflight of Colne Valley. Whilst Groups 2C and 2D avoid the Chilterns AONB below 7000ft, this assumes CCO. In the absence of CCO to 7000ft, all illustrative tracks in this option could still see overflight of the Chilterns AONB when positioning towards the west/CPT region.

In terms of biodiversity, none of the illustrative centrelines within this option overfly any SSSIs, RAMSAR sites, SAC, or SPAs below 2000ft.

General Aviation	Access	Qualitative

This design option is anticipated to be contained within existing CAS. A slightly later turn to the north would help ensure CAS containment. No change is expected to the existing levels of CAS access. The option is not expected to have an impact on existing helicopter lanes.

General Aviation / Commercial Airlines	Economic impact from increased effective capacity	Qualitative

Without a system-wide design it is not yet possible to determine wider economic impacts such as through reduced delays through systemisation and deconflicted routes.

It is anticipated that this option will not have any economic impact to GA operations.

General Aviation / Commercial Airlines	Fuel burn	Qualitative

This option could service departures to the north (TNT) and west (CPT) directions. They would not suit departures to the east/southeast (DAGGA) owing to the disproportionate extra distances involved. Overall, and considering the uncertainty in the network positioning at this stage, this option is likely to result in a similar order of magnitude of track miles below 7000ft as experienced in the baseline. This is because there is an expectation to be able to optimise track placement within Stage 3. No change is predicted in GA fuel burn as it is anticipated the departures can be contained within existing CAS.

RWY 07	DAGGA	CPT	TNT
Do Nothing	52	48	104
GRP 2A	N/A	4	N/A
GRP 2B	N/A	-1	3
GRP 2C	N/A	0	3
GRP 2D	N/A	N/A	0

Commercial Airlines	Training costs	Qualitative

Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required on a business-as-usual basis. This option is not anticipated to require any additional training costs for commercial airlines.

Commercial Airlines	Other costs	Qualitative

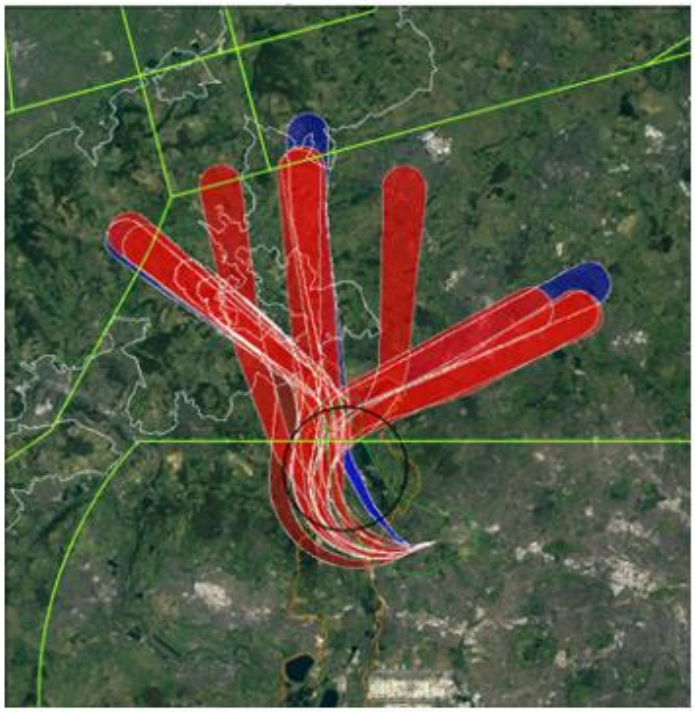
No other airline costs are foreseen with this option.

Airport/ANSP	Infrastructure costs	Qualitative
This option is not expected to change RAF Northolt's infrastructure, beyond the initial deployment phase which will require some systems engineering amendments.		
Airport/ANSP	Operational costs	Qualitative
This design option is not expected to change RAF Northolt's operational costs.		
Airport/ANSP	Deployment costs	Qualitative
This option is expected to require air traffic controller training for the controllers and assistants located at RAF Northolt, RAF Northolt Radar, and London Terminal Control. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal, when appraising the shortlist of options and once further information is known about the network above 7000ft and interdependencies with adjacent airports and NERL.		
All	Safety	Qualitative
If the departures turn north in a similar location as today (close to RAF Northolt), it could be expected to maintain or potentially reduce lateral interaction with future Heathrow northbound SIDs. A later turn could be possible, but this is subject to Heathrow SID positioning. Any lateral interaction with a delayed turn on RAF Northolt's SIDs is likely to be at a lower altitude than today which could require additional safety assurances. Those tracks that turn to the west (Groups 2A and 2B) have potential to reduce interactions with Heathrow and London City departures however they could then come into proximity with Heathrow arrivals. Any SIDs from RWY07 will continue to interact to some extent with routes to/from adjacent airports and will require Route Spacing Assurances in line with any guidance available in CAP1385. To avoid increasing CAS, steep climb gradients will continue to be required for RWY07 departures. Should there be a new, earlier interaction with Heathrow's new SIDs, the risk of a level bust will be a key consideration.		
All	Interdependencies, conflicts, and trade offs	Qualitative
All of RAF Northolt's options will have interdependencies, conflicts, and trade-offs with adjacent airports. Most notably Heathrow, Luton, London City and potentially Stansted as well as NERL. RWY07 departures today are restricted from CCO due to Heathrow, Luton, and London City interactions. Ideally vertical profiles will be improved compared to the baseline but inevitably there will need to be some trade-offs whether laterally and/or vertically from the ideal trajectory as well as considering free-flow departures. This option is highly likely to require trade-off discussions with Luton, Heathrow and possibly London City.		
All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative
CAP1711 describes the objective as: "*Deliver quicker, quieter, and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.*". Assuming steep climb gradients can ensure CAS containment then impact on GA is no worse than today. Any departure from RAF Northolt to the northwest is going to require compromises/trade-offs from RAF Northolt or adjacent FASI airports. There is scope within this option to reduce low level interactions with Heathrow, Luton and London City which could enable free flow operations, reduce delay, and increase capacity. However, the ability to do this is depends on the overall wider LTMA design and could come at the expense of longer track miles for RAF Northolt departures. There is scope within this option to reduce interactions with adjacent airports but at the expense of extra track miles and there is also scoped to have similar fuel burn and greenhouse gas emissions compared to the baseline, but interactions could be like today. Subject to the final track alignments and trade-off discussions, the number of people newly overflown would vary. RAF Northolt expect a reduction in total population overflown due to PBN, but the routes could still overfly densely populated areas.		

Westerly Departures Option 1: Turn north as soon as possible

Table 10 IOA: Westerly Departures Option 1: Turn north as soon as possible

Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Partly quantitative, partly qualitative



Option 1	Total Population	SEL_70
Baseline Average	41680	66500
Baseline Highest	82122	67653
Baseline Lowest	17153	65856
Track Average	37373	76713
Track Highest	94736	80495
Track Lowest	16379	69653

The illustrative tracks within this option show it is possible to reduce the total population overflown 0-7000ft. However, all the tracks show in increase in population within a 70dB SEL. This SEL increase would suggest that a change could be seen to the 51dB LOAEL with this option. The later turn could see the LOAEL extend further west with an increase in population numbers within the LOAEL. Consequently, to minimise this increase, the turn should be as close as possible as in the baseline.

Communities	Air Quality	Qualitative
This option could alter the lateral or vertical tracks of flight paths below 1000ft, and this option could therefore have an impact on air quality and the Hillingdon AQMA.		

Wider Society	Greenhouse Gas Impact	Qualitative
The fuel burn assessment (see below) has anticipated that this option is likely to result in a similar order of magnitude of track miles below 7000ft as experienced in the baseline. Therefore, there is expectation to see a corresponding impact to greenhouse gas emissions. Should this option progress, this will be explored in further detail, and optimised trajectories will be sought in the Stage 3 Full Options Appraisal.		

Wider Society	Capacity / Resilience	Qualitative
As detailed in the Step 2A document, the interaction between RAF Northolt, Luton and London City's departure routes generates significant delay. This is due to the inability to procedurally deconflict all flight paths in different runway configurations. This is further hampered by Heathrow departures being limited to 6000ft by their own arrivals meaning RAF Northolt, Luton and London City are procedurally held down at 5000ft and below. Creating capacity in the airspace and reducing delays is dependent on designs from all the adjacent airports and NERL in the airspace above 7000ft. In the absence of detailed designs from all sponsors at this time, it is not possible to		

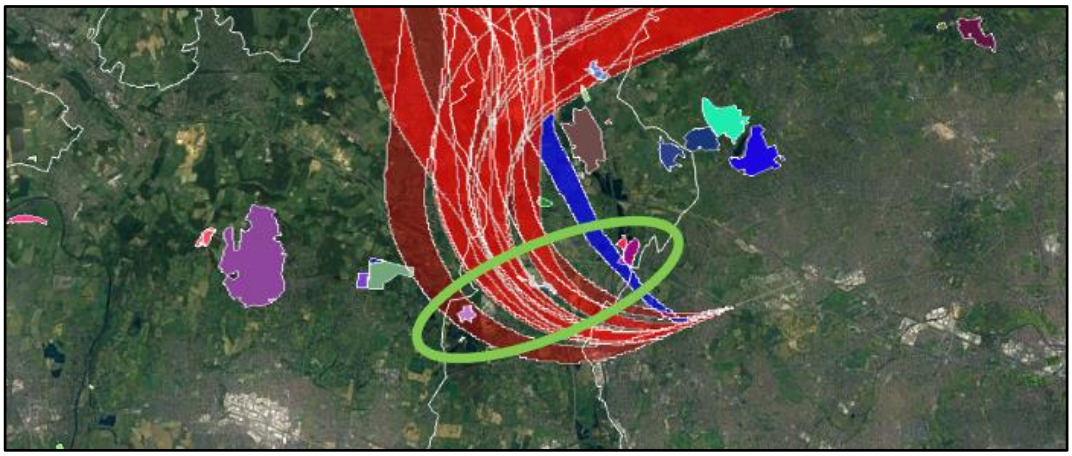
assess if this option will result in deconflicted routes thereby reducing delays. However, systemisation will reduce the requirement for vectoring by RAF Northolt Radar which in turn reduces controller workload. This creates controller capacity to handle any non-standard scenarios or peaks in civil or military movements.

This option has no specific characteristics which would minimise delay for RAF Northolt and/or adjacent FASI aerodromes however it would not be expected to increase delay compared to baseline levels as RAF Northolt expect there still to be multiple interactions around the BNN area in a future design. Routing to the south of BPK would decrease conflictions with Luton although this may come at the expense of being held down at low altitude by Heathrow SIDs and being closer to London City SIDs.

Wider Society	Biodiversity and Tranquillity	Qualitative

This option would continue to see overflight of the Chilterns AONB and Colne Valley Regional Park. The parts of Colne Valley Regional Park overflown could change, as could the height of RAF Northolt's departures. There are some illustrative tracks (Group 1C) that completely avoid the Chilterns AONB and it may be possible to have a northbound departure that also avoids the AONB but that relies of CCO to 7000ft.

In terms of tranquillity, RWY25 departures are currently the only options that could affect overflight of SSSIs, RAMSAR sites, SACs, or SPAs below 2000ft. Within this option, a later initial turn than today could move overflight to different Biodiversity receptors, as illustrated below within the Green oval.



General Aviation	Access	Qualitative

This design option is anticipated to be contained within existing CAS. A slightly later turn to the north would help ensure CAS containment. Change to the existing levels of CAS access is not expected. The option is not expected to have an impact on existing helicopter lanes.

In terms of the effect on Denham's operation, any turn later than today is likely to have a positive impact. The table below shows the heights that aircraft following today's SID centrelines would cross the Denham ATZ boundary at with different rates of climb. The current SID requires a 10.3% climb gradient to remain within CAS. However, it is important to note that this option assumes a turn at altitude and the same 700ft altitude as today. The illustrative tracks show the effect on the point of turn given lower rates of climb in achieving the 700ft point but that would be rare, with slow climbing aircraft only. In reality, aircraft achieving higher rates of climb would meet the 700ft point earlier than what is shown with the conservative illustrative tracks, and these options would most likely not avoid Denham and be more in keeping with what happens today at low altitude and therefore may not benefit the Denham operation.

	Height at Denham ATZ	
Option 1	7% Climb	10% Climb
Baseline	1050	1500
Average of those that penetrate	1600	2300

General Aviation / Commercial Airlines	Economic impact from increased effective capacity	Qualitative

Without a system-wide design it is not yet possible to determine wider economic impact, such as through reduced delays through systemisation and deconflicted routes.

This option of an early turn at altitude is likely to have no economic impact on Denham or wider GA operations.

General Aviation / Commercial Airlines	Fuel burn	Qualitative

This option could service departures to the north (TNT) and west (CPT) directions. They would not suit departures to the east/southeast (DAGGA) owing to the disproportionate extra distances involved. Overall, and considering the uncertainty in the network positioning at this stage, this option is likely to result in a similar order of magnitude of track miles below 7000ft as experienced in the baseline. A change in GA fuel burn is not predicted, as there is an anticipation that departures can be contained within existing CAS.

RWY 25	DAGGA	CPT	TNT
Do Nothing	58	42	104
GRP 1A	N/A	1	0
GRP 1B	N/A	N/A	0
GRP 1C	0	N/A	N/A

Commercial Airlines	Training costs	Qualitative

Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required on a business-as-usual basis. This option is not anticipated to require any additional training costs for commercial airlines.

Commercial Airlines	Other costs	Qualitative

No other airline costs are foreseen with this option.

Airport/ANSP	Infrastructure costs	Qualitative

This option is not expected to change RAF Northolt's infrastructure, beyond the initial deployment phase which will require some systems engineering amendments.

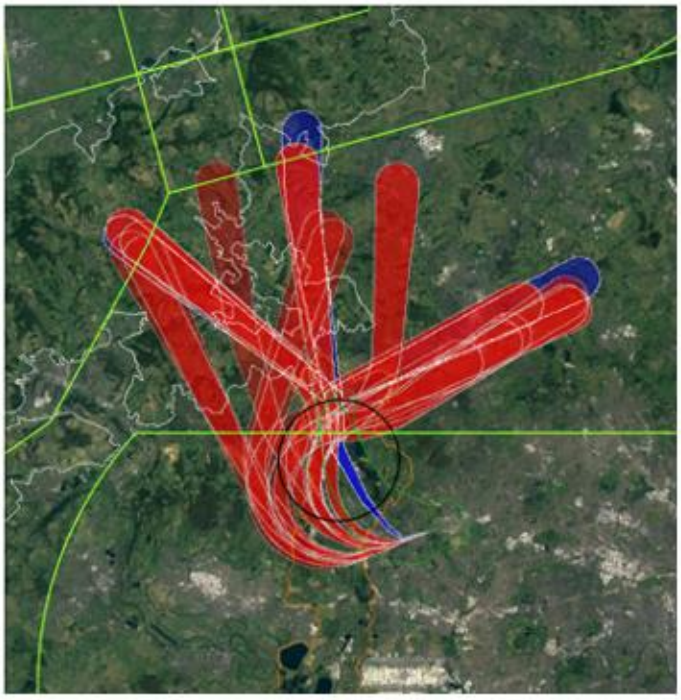
Airport/ANSP	Operational costs	Qualitative

This design option is not expected to change RAF Northolt's operational costs.		
Airport/ANSP	Deployment costs	Qualitative
This option is expected to require air traffic controller training for the controllers and assistants located at RAF Northolt, RAF Northolt Radar, and London Terminal Control. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal, when appraising the shortlist of options and once further information is known about the network above 7000ft and interdependencies with adjacent airports and NERL.		
All	Safety	Qualitative
The turn at altitude within this option would give slightly less certainty on exactly where the turn would be which could generate issues assuring against Heathrow's new SIDS depending on their final route structure, especially if it moves closer to RAF Northolt. The illustrations suggest a delayed turn, some which avoid Denham ATZ but that would be rare – especially with slow climbing aircraft that reach the turn altitude later. In reality, these options would most likely not avoid Denham and be more in keeping with what happens today at low altitude. The interactions with any possible future Heathrow SIDs and Heathrow's 27R Missed Approach because of a later or variable turn will require close investigations, as well as consideration of any impact to Denham's operation. To avoid increasing CAS, steep climb gradients will continue to be required for RWY25 departures. Should there be a new, earlier interaction with Heathrow's new SIDs, the risk of a level bust will be a key consideration. Any SIDs from RWY25 will continue to interact to some extent with routes to/from adjacent airports and will require Route Spacing Assurances in line with any guidance available in CAP1385.		
All	Interdependencies, conflicts, and trade offs	Qualitative
All of RAF Northolt's options will have interdependencies, conflicts, and trade-offs with adjacent airports. Most notably Heathrow, Luton, London City and potentially Stansted as well as NERL. RWY25 departures today are restricted from CCO due to Heathrow, Luton, and London City interactions. Ideally vertical profiles will be improved compared to the baseline but inevitably there will need to be some trade-offs whether laterally and/or vertically from the ideal trajectory as well as considering free-flow departures. This option is highly likely to require trade-off discussions with Luton, Heathrow and possibly London City.		
All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative
CAP1711 describes the objective as: "*Deliver quicker, quieter, and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.*". An early first turn to the north in keeping with today would continue to interact with Denham in a similar way to today which requires Denham to stay within an LFA within the ATZ. Likewise, any turn that is even slightly later than today could interact more closely with Heathrow. Steep climb gradients would be used like today to ensure CAS containment, hopefully avoiding more CAS. Departures to the northwest, north and northeast are likely to interact with Heathrow, Luton, and London City options. Compromises/trade-offs from RAF Northolt or those other airports will be required. This option has no specific characteristics that would minimise delay for RAF Northolt and/or adjacent FASI aerodromes however it would not be expected to increase delay compared to baseline levels as RAF Northolt expect there still to be multiple interactions with Heathrow, Luton and London City routes in a future design which will not be able to be overcome with a 6000ft Transition Altitude. The option is not expected to significantly change fuel burn and greenhouse gas emissions compared to the baseline. If RAF Northolt can largely replicate the existing centrelines, that would appear to offer the lowest population overflown however at this stage of the ACP the exact track of such a departure cannot be chosen but will be subject to the trade-off deliberations in Stage 3. PBN and systemisation would be expected to reduce total numbers overflown overall and generate capacity.		

Westerly Departures Option 2: Turn north at a fixed point (will be a later turn than Option 1)

Table 11 IOA: Westerly Departures Option 2: Turn north at a fixed point (will be a later turn than Option 1)

Group	Impact	Level of Analysis
Communities	Noise impact on health and quality of life	Partly quantitative, partly qualitative



Option 2	Total Population	SEL_70
Baseline Average	41680	66500
Baseline Highest	82122	67653
Baseline Lowest	17153	65856
Track Average	39318	78426
Track Highest	94736	81341
Track Lowest	10382	72794

The illustrative tracks within this option show it is possible to reduce the total population overflown 0-7000ft. However, all the tracks show in increase in population within a 70dB SEL. This SEL increase would suggest that a change to the 51dB LOAEL could be seen with this option. The later turn could see the LOAEL extend further west with an increase in population numbers within the LOAEL. Consequently, to minimise this increase, the turn should be as close as possible as in the baseline.

Communities	Air Quality	Qualitative

This option could alter the lateral or vertical tracks of flight paths below 1000ft, and this option could therefore have an impact on air quality and the Hillingdon AQMA.

Wider Society	Greenhouse Gas Impact	Qualitative

The fuel burn assessment (see below) has anticipated that this option is likely to result in a similar order of magnitude of track miles below 7000ft as experienced in the baseline. Therefore, there is an expectation to see a corresponding impact to greenhouse gas emissions. This will be explored in further detail in the Stage 3 Full Options Appraisal should this option progress where optimised trajectories will be sought. It is important to note that track extensions to completely avoid the Denham ATZ (if technically feasible due to Heathrow) are more likely to result in an increase in emissions.

Wider Society	Capacity / Resilience	Qualitative

As detailed in the RAF Northolt's Step 2A document, the interaction between RAF Northolt, Luton and London City's departure routes generates significant delay. This is due to the inability to procedurally deconflict all flight paths in different runway configurations. This is further hampered by Heathrow departures being limited to 6000ft by their own arrivals meaning RAF Northolt, Luton and London City are procedurally held down at 5000ft and below. Creating capacity in the airspace and reducing delays is dependent on designs from all the adjacent

airports and NERL in the airspace above 7000ft. In the absence of detailed designs from all sponsors at this time, it is not possible to assess if this option will result in deconflicted routes thereby reducing delays. However, systemisation as a whole will reduce the requirement for vectoring by RAF Northolt Radar which in turn reduces controller workload. This creates controller capacity to handle any non-standard scenarios or peaks in civil or military movements.

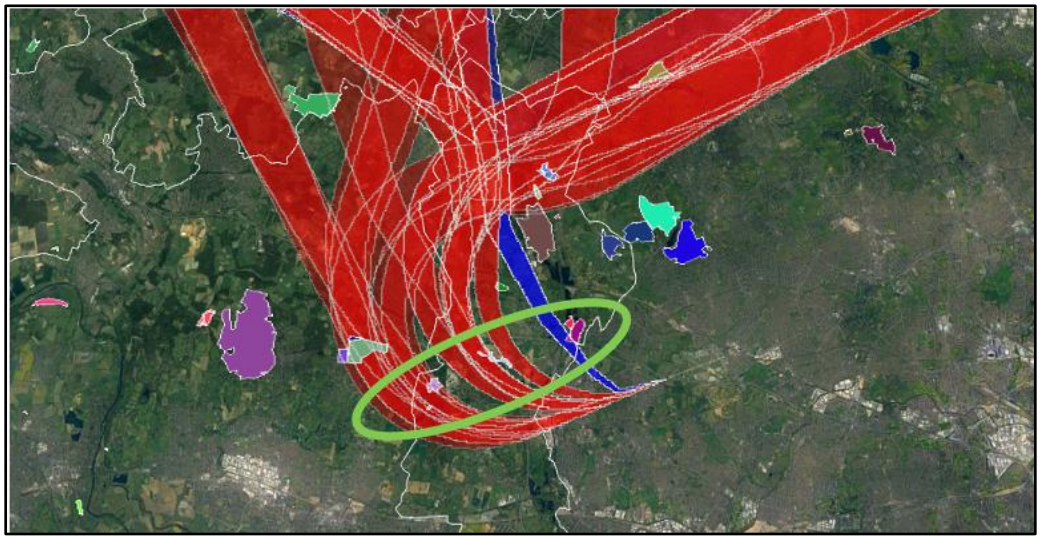
This option has no specific characteristics which would minimise delay for RAF Northolt and/or adjacent FASI aerodromes however it would not be expected to increase delay compared to baseline levels as RAF Northolt expect there still to be multiple interactions around the BNN area in a future design. Routing to the south of BPK would decrease conflictions with Luton although this may come at the expense of being held down at low altitude by Heathrow SIDs and being closer to London City SIDs.

This assessment assumes that a delayed turn to the north (compared to today) can be procedurally deconflicted from Heathrow's future operation and does not generate a dependency. In the event of such a dependency between Heathrow and RAF Northolt, it is likely this option would be discontinued.

Wider Society	Biodiversity and Tranquillity	Qualitative

This option would continue to see overflight of the Chilterns AONB and Colne Valley Regional Park. The parts of Colne Valley Regional Park could change as could the height of RAF Northolt's departures. There are some illustrative tracks that completely avoid the Chilterns AONB and it may be possible to have a northbound departure that also avoids the AONB but that relies of CCO to 7000ft.

In terms of tranquillity, RWY25 departures are currently the only options that could affect overflight of SSSIs, RAMSAR sites, SACs, or SPAs below 2000ft. Within this option, a later initial turn than today could move overflight to different Biodiversity receptors, as illustrated below within the green oval.



General Aviation	Access	Qualitative

This design option is anticipated to be contained within existing CAS. A slightly later turn to the north would help ensure CAS containment. Change to the existing levels of CAS access is not expected. The option is not expected to have an impact on existing helicopter lanes.

In terms of the effect on Denham's operation, any turn later than today is likely to have a positive impact. The table below shows the heights that aircraft following today's SID centrelines would cross the Denham ATZ boundary at with different rates of climb. The current SID requires a 10.3% climb gradient to remain within CAS. The illustrative tracks show the effect of locating the first turn waypoint in different locations. The later the turn, the higher aircraft will be when crossing the Denham ATZ boundary and some illustrative tracks avoid the ATZ altogether. This option which uses a turn at a waypoint rather than an altitude is likely to result in a later turn than today which would be of benefit to Denham. However, as explained in the safety assessment below, a later turn will only be possible with changes to the Heathrow operation.

	Height at Denham ATZ	
Option 2	7% Climb	10% Climb
Baseline	1050	1500
Average of those that penetrate	2150	3100

General Aviation / Commercial Airlines	Economic impact from increased effective capacity	Qualitative

Without a system-wide design it is not yet possible to determine wider economic impacts such as through reduced delays through systemisation and deconflicted routes.

This option of slightly later turn than in the baseline could have a positive impact on Denham's operation although it is not yet known if this could be transposed to an economic benefit. This option is not anticipated to have any economic impact to wider GA operations.

General Aviation / Commercial Airlines	Fuel burn	Qualitative

This option could service departures to the north (TNT), east/southeast (DAGGA) and west (CPT) directions. Overall, and considering the uncertainty in the network positioning at this stage, this option is likely to result in a similar order of magnitude of track miles below 7000ft as experienced in the baseline. This is because optimised track placement would be expected within Stage 3 although it must be noted that track extensions to completely avoid the Denham ATZ (if technically feasible due to Heathrow) are more likely to result in an increase in emissions. A change in GA fuel burn is not predicted, as there is an expectation that the departures can be contained within existing CAS.

RWY 25	DAGGA	CPT	TNT
Do Nothing	58	42	104
GRP 2A	N/A	1	0
GRP 2B	N/A	N/A	0
GRP 2C	0	N/A	N/A
GRP 2D	N/A	2	3
GRP 2E	5	N/A	N/A

Commercial Airlines	Training costs	Qualitative

Flight procedures are updated or introduced worldwide as part of an AIRAC cycle. As part of this cycle, airlines update their procedures accordingly and undertake training if required on a business-as-usual basis. This option is not anticipated to require any additional training costs for commercial airlines.

Commercial Airlines	Other costs	Qualitative

No other airline costs are foreseen with this option.

Airport/ANSP	Infrastructure costs	Qualitative

This option is not expected to change RAF Northolt's infrastructure, beyond the initial deployment phase which will require some systems engineering amendments.		
Airport/ANSP	Operational costs	Qualitative
This design option is not expected to change RAF Northolt's operational costs.		
Airport/ANSP	Deployment costs	Qualitative
This option is expected to require air traffic controller training for the controllers and assistants located at RAF Northolt, RAF Northolt Radar, and London Terminal Control. The scale and nature of this training requires further exploration as part of the Stage 3 Full Options Appraisal, when appraising the shortlist of options and once further information is known about the network above 7000ft and interdependencies with adjacent airports and NERL.		
All	Safety	Qualitative
This option would give more certainty about where departures turn north although that turn would most likely be slightly later than in the baseline. With this option it would be possible to have a later turn than today which could avoid the Denham ATZ altogether which could enhance safety for Denham, however this will bring the aircraft close to Heathrow so the feasibility of this is not yet known. Any later turn than today could generate issues assuring against Heathrow's new SIDS, depending on their final route structure especially if it moves closer to RAF Northolt. The interactions with Heathrow SIDs and Heathrow's RWY27R Missed Approach because of a later or variable turn will require close investigations, as well as consideration of any impact to Denham's operation. To avoid increasing CAS, steep climb gradients will continue to be required for RWY25 departures. Should there be a new, earlier interaction with Heathrow's new SIDs, the risk of a level bust will be a key consideration. Any SIDs from RWY25 will continue to interact to some extent with routes to/from adjacent airports and will require Route Spacing Assurances in line with any guidance available in CAP1385.		
All	Interdependencies, conflicts, and trade offs	Qualitative
All of RAF Northolt's options will have interdependencies, conflicts, and trade-offs with adjacent airports. Most notably Heathrow, Luton, London City and potentially Stansted as well as NERL. RWY25 departures today are restricted from CCO due to Heathrow, Luton, and London City interactions. Ideally vertical profiles will be improved compared to the baseline but inevitably there will need to be some trade-offs whether laterally and/or vertically from the ideal trajectory as well as considering free-flow departures. This option is highly likely to require trade-off discussions with Luton, Heathrow and possibly London City. Of note, any delayed turn for RWY25 departures to avoid Denham ATZ could result in closer proximity to Heathrow traffic (subject to their design) which could result in constrained CCO for RAF Northolt departures.		
All	Performance against the vision and parameters/strategic objectives of the AMS	Qualitative
CAP1711 describes the objective as: "*Deliver quicker, quieter, and cleaner journeys and more capacity for the benefit of those who use and are affected by UK airspace.*". A later first turn to the north to reduce interaction with Denham would provide them with more flexibility and potentially a larger LFA. However, such a turn could interact more closely with Heathrow. Completely avoiding the ATZ may not be possible as it depends on Heathrow interactions including their Missed Approach. Steep climb gradients would be used like today to ensure CAS containment, but a later turn could cater for a shallower gradient. Departures to the northeast are likely to interact with Heathrow, Luton, and London City options. Compromises/trade-offs from RAF Northolt or those other airports will be required.		

This option has no specific characteristics that would minimise delay for RAF Northolt and/or adjacent FASI aerodromes however it would not be expected to increase delay compared to baseline levels.

Departures to the north do not appear to offer significant track mileage reductions as today's northbound tracks are already quite direct. From RWY25 population density is quite low excluding Watford and Amersham. It may be possible to avoid Amersham with a future design. Delaying the first turn will result in overflight of new communities. PBN and systemisation would be expected to reduce total numbers overflown overall and generate capacity.

IOA Summary and Conclusion

IOA Conclusion

The Initial Options Appraisal has not resulted in the discontinuation of any of the design options progressed from the Step 2A DPE. It also does not consider combinations of design options to form systems (easterly and westerly arrivals and departures) which are required for Full Options Appraisal analysis. As outlined throughout the IOA, RAF Northolt shares many dependencies with Heathrow Airport as well as Luton, London City, Stansted and NERL. RAF Northolt anticipate that during Stage 3 and ahead of the Full Options Appraisal, options from Step 2B will be matured into a full system proposal which integrates with the wider network. It is this system which will be the subject of an aligned, public consultation exercise.

Compromises and trade-offs may be necessary between sponsors. These will be guided by the advice and tools provided by the Airspace Change Organising Group (ACOG), the independent team tasked with coordinating the redesign of the UK's airspace.

The UK Airspace Modernisation Strategy (AMS) allows for any design options discontinued at Stage 2 to be reintroduced at Stage 3 if necessary, during the Masterplan integration process where multiple ACP sponsors are all at the same stage, and it will be possible for a wider holistic overview to be considered.

Preferred Option(s)

Owing to the dependencies on other ACPs, there is not yet enough certainty to make a statement on RAF Northolt's preferred option(s).

Information to collect as part of the Full Options Appraisal

The IOA involves primarily qualitative analysis of each option against the baseline although RAF Northolt have supplemented the appraisal with some quantitative data. The Full Options Appraisal builds upon the IOA, using primarily quantitative analysis.

RAF Northolt plans to collect the following data and undertake the additional assessments as part of the Full Options Appraisal assessment and following this assessment RAF Northolt will outline the options that it intends to be taken to Consultation:

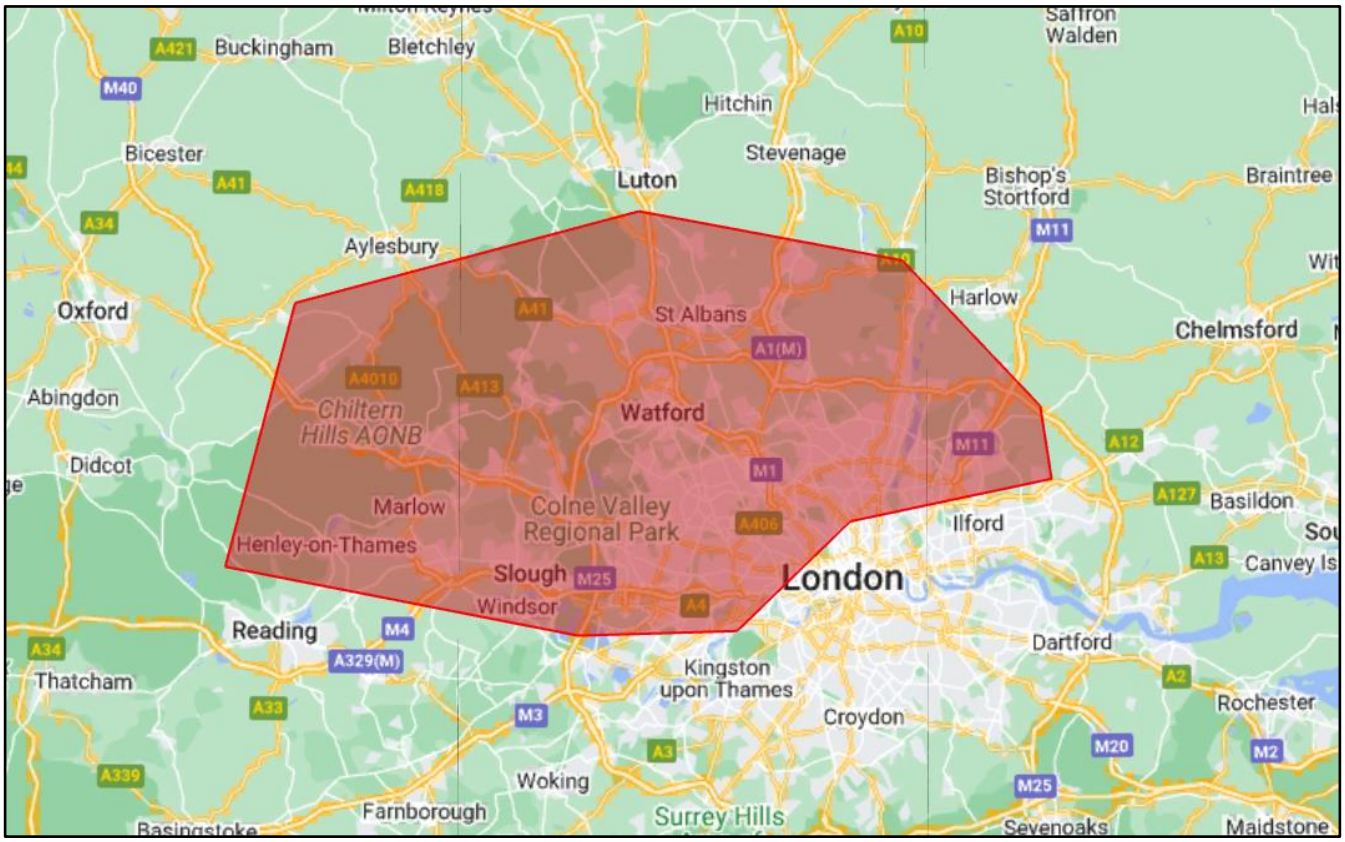
- Quantify the baseline year (pre-implementation and 10 years post implementation)
- Quantitative LAeq contours, population counts and size (km^2)
- WebTAG assessment
- Quantitative overflight contours that detail frequency of overflight and cumulative impacts from arrivals/departures and other airports
- Detailed track length comparison
- Detailed fuel burn and equivalent CO_2 emissions data
- Further information around interdependencies with the NERL network and neighbouring airports

- ATC deployment / training costs
- Quantitative capacity information
- Quantified CAS requirements

Impacted Audiences

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

The following figure shows the area that bounds all of RAF Northolt's options at the end of Stage 2 as well as encompassing existing operations up to 7000ft. RAF Northolt will use this mapping as a starting point to identify impacted audiences and ensure that this is considered when developing the consultation strategy at Stage 3. RAF Northolt are aware that other factors will also need to be considered when identifying the audience such as other noise metrics, changes to controlled airspace etc and RAF Northolt will ensure these are also factored in.



Next steps

The Stage 3 Gateway Assessment date is yet to be set. This date will be set once an agreed deployment plan, within the accepted Masterplan is known.

Appendix A: Planned Developments

	Local Authority/County Council	Location of Development	Type of Development	Size	Status (if known)	Anticipated Completion Date (if known)	Planning Portal Link	Further Information
A	Buckinghamshire	Minerva Way, Beaconsfield	Housing	350	Under Construction	2026/27	17/01763/OUT	
B		Gorelands Lane, Chalfont St Giles	Housing	306	Under Construction	2029/30	CH/2014/1964/FA	
C		Denham Green, UB9 5HR	Housing	105	Not Started	2024/25	PL/19/4261/PNO	
D		Huntercombe Lane, South Burnham	Housing	165	Under Construction	2024/25	PL/19/2305/FA	
E		Pinewood Studios	Sound Stage	N/A	Unknown	Unknown	PL/20/3179/FA	
F		Gerrards Cross, SL9 8SZ	Hotel		Not Started	Unknown	PL/20/4405/FA	
G		National Society for Epilepsy, SL9 0LE	Extra Bedrooms	58	Not Started	Unknown	CH/2017/2258/FA	
H		Lake End Road, SL4 6QS	Specialist School		Unknown	Unknown	PL/20/3014/FA	
I	Brent	Grand Union, Alperton	Redevelopment Area	3300+	On-going (6 phases)	Last phase 2038		Brochure

J	Camden	Gospel Oak	Housing	71	Proposed	Unknown		Camden Expands
K	Dacorum	Chesham Road, Bovingdon	Housing	40	Allocated	2025/26		
L		London Road, Hemel Hempstead	Housing	441	Awaiting decision	2029/30		
M		Two Waters Road, Hemel Hempstead	Housing	25	Allocated	2026/27		
N		Frogmore Road, Hemel Hempstead	Housing	150	Allocated	2030/31		
O		Garden Scene Nursery, Chipperfield	Housing	15	Under Construction	2023/24		
P		Hempstead Road, Kings Langley	Housing	26	Awaiting decision	2024/25		
Q		Ebberns Bathrooms, Hemel Hempstead	Housing	28	Awaiting decision	2025/26		
R		The Bobsleigh, Bovingdon	Housing	60	Awaiting decision	20245/25		
S		Symbio Place, Hemel Hempstead	Housing	178	Pre-application	2025/26		
T	Ealing	Perceval House, Uxbridge Road	Mixed Use	447 homes +		2025		Link
U	Enfield	Meridian Water Site	Mixed Use	10,000	Under Construction	20-year project		Meridian Water
V	Epping Forest	Sterling House, IG10 3TS	Housing	129	Not Started	Unknown	EPF/1960/18	
W		Epping, CM16 7JU	Housing	184	Under Construction	2033	EPF/0917/21	
X		Borders Lane, IG10 3SA	Housing	139	Under Construction	2033	EPF/2905/19	
Y	Haringey	Crescent Road, N22 7RX	Housing	33	Awaiting decision	Unknown	Link	
Z		Kerswell Close, N15 5RP	Housing	25	Awaiting decision	Unknown	Link	
A1		Lordship Lane, N22 5LE	Housing	17	Awaiting decision	Unknown	Link	
B1	Harrow	Wealdstone, Harrow	Mixed Use	1500+	Unknown	10-year project		Article
C1	Hertsmere	Borehamwood, WD6 1FX	Film & TV production		Under Construction	2022		
D1		WD6 1WA	Housing	1500	Under Construction	2027	Plan	
E1	Hillingdon	Yiewsley, UB7 7QE	Housing	105	Undecided	Unknown	Application	
F1	Slough	Slough, SL1 3UF	Housing	100	Pre-application	2026/27		
G1		Petersfield Avenue, Slough	Housing	100	Unknown	2029/30		
H1		Farnham Road, Slough	Housing	100	Unknown	Unknown		

I1		Bath Road, Slough, SL1 4AA	Housing	106	Under Construction	2022/3		
J1	Three Rivers	Warner Bros Studios, Leavesden	New stages		Permission Granted	Unknown		
K1		Croxley Gree, WD3 3JJ	Housing	160	Under Construction	Unknown		
L1	Waltham Forest	Fellowship Square, Walthamstow	Regeneration	433	In Phase 2	Unknown		Link
M1		The Mall, Walthamstow	Regeneration	500	Approved	Unknown		Link
N1	Watford	Thomas Sawyer Way, Watford	Housing & Residential Care	500+	Under Construction	Unknown		
O1		St Albans Road, WD25 9NN	Housing	250+	Under Construction	Unknown		
P1	Windsor & Maidenhead	Maidenhead Golf Club	Housing	2000+	Not Started	Unknown		Link
Q1		Nicholsons Quarter	Mixed Use	650	Approved	Unknown		Link