ROYAL AIR FORCE NORTHOLT

AIRSPACE CHANGE PROPOSAL (ACP-2018-66)
CAP 1616 STAGE 2
STEP 2A - OPTIONS DEVELOPMENT

Roles

Action	Role	Date
Produce	RAF Northolt ACP Team	1st October 2022
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Approve	RAF Northolt Station Commander	18th October 2022

Drafting and Publication History

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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.
-	Flight-path	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., RWY07 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 1 Jun 22 replacing the BAe146 which was retired on 31 Mar 22. 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 at RAF Northolt to provide the Combat Aircraft element of the national security plan to this 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 12000 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 at RAF Northolt.

Airspace Modernisation

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. This FASI initiative is considered the UK's Airspace Change National Infrastructure Programme (the Programme). The Programme encompasses the requirement to fundamentally redesign the National Airspace System at lower altitudes and in the terminal airspace that serves commercial air transport across the busiest regions of the UK, making the most of the capabilities of modern aircraft and satellite-based navigation technology. These airspace design projects are sponsored by the 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.

The CAP1616 sets out the 7 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. RAF Northolt has commenced Stage 2; Develop and Assess after CAA approval to progress through the Define gateway (see diagram below).

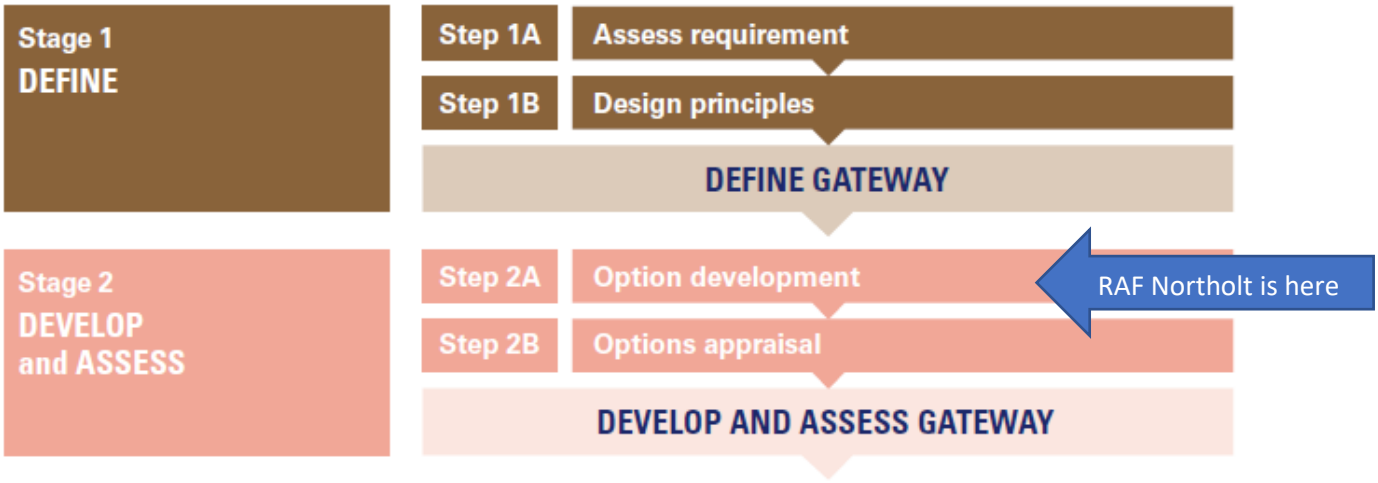

Figure 1: CAP1616 Timeline – Initial Stage summary

Aim

The aim of the RAF Northolt ACP is to meet the requirements for modernisation set out in the AMS, aligned with the UK's Airspace Masterplan. Additionally, RAF Northolt will work with other interdependent airports, as part of the FASI-South initiative, to ensure that the airspace modernisation is fit for purpose.

The purpose of this Stage 2A document is to set out how RAF Northolt has developed a comprehensive list of design options and how it has examined and evaluated the methodology used to develop these design options with its stakeholders. It will then set out how the design options have responded to an evaluation against the Design Principles approved by the CAA in Step 1B.

The RAF Northolt ACP process and associated documentation can be found on the CAA Airspace Change Portal – RAF Northolt ACP.

Summary of Completed Stages

RAF Northolt commenced this ACP in 2018 with the Statement of Need and participated in an Assessment Meeting with the CAA in early 2019. This concluded Step 1A of the ACP. The following link is to the accepted Statement of Need.

Step 1B Design Principles were developed with identified stakeholders. The aim of the Design Principles is to provide high-level criteria that the proposed airspace design options should meet. They also provide a means of analysing the impact of different design options and a framework for choosing between or prioritising options. The following is a link to the accepted Design Principles.

For ease of reference, the RAF Northolt Design Principles are replicated in Table *1*. Design Principles 1 and 2 are prioritised above all others. There is no priority accorded to the remaining Design Principles.

	Approved Design Principles
1	Must be safe.
2	Must ensure continuation of military and governmental operational activity.
3	Should minimise impact on other airspace users.
4	Should facilitate design using modern navigational technology.
5	Should facilitate operational efficiencies to maximise benefits to as many stakeholders as possible.
6	Should minimise fuel and greenhouse gases.
7	Should minimise the impact of aircraft noise by:
	a. Minimising the number of people newly overflown.
	b. Minimising the total number of people affected by noise.
	c. Where possible minimise overflight of communities with multiple routes.

Table 1: Stage 1 CAA Approved Design Principles

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 CAP 1616 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 CAP 1616 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,

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

Heathrow, Gatwick, London City, Manston, London Luton Airport, Southampton, Southend, and Stansted airports.

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 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 here in this 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. With this in mind, 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. This is expected, as explained in the next section of this document.

RAF Northolt's Existing Airspace Arrangements (Baseline)

Local Geography

RAF Northolt is located 13 miles (20.92km) west of Central London and 5.5 miles (8.87km) north-northeast of London Heathrow Airport.

To the west is the Colne Valley Regional Park and beyond that is the Chilterns AONB. There are also multiple areas of dense population within the local vicinity of RAF Northolt such as Uxbridge, Hillingdon, Slough, Ickenham, Ruislip, South Harrow, Rayners Lane, Harrow, and Pinner.

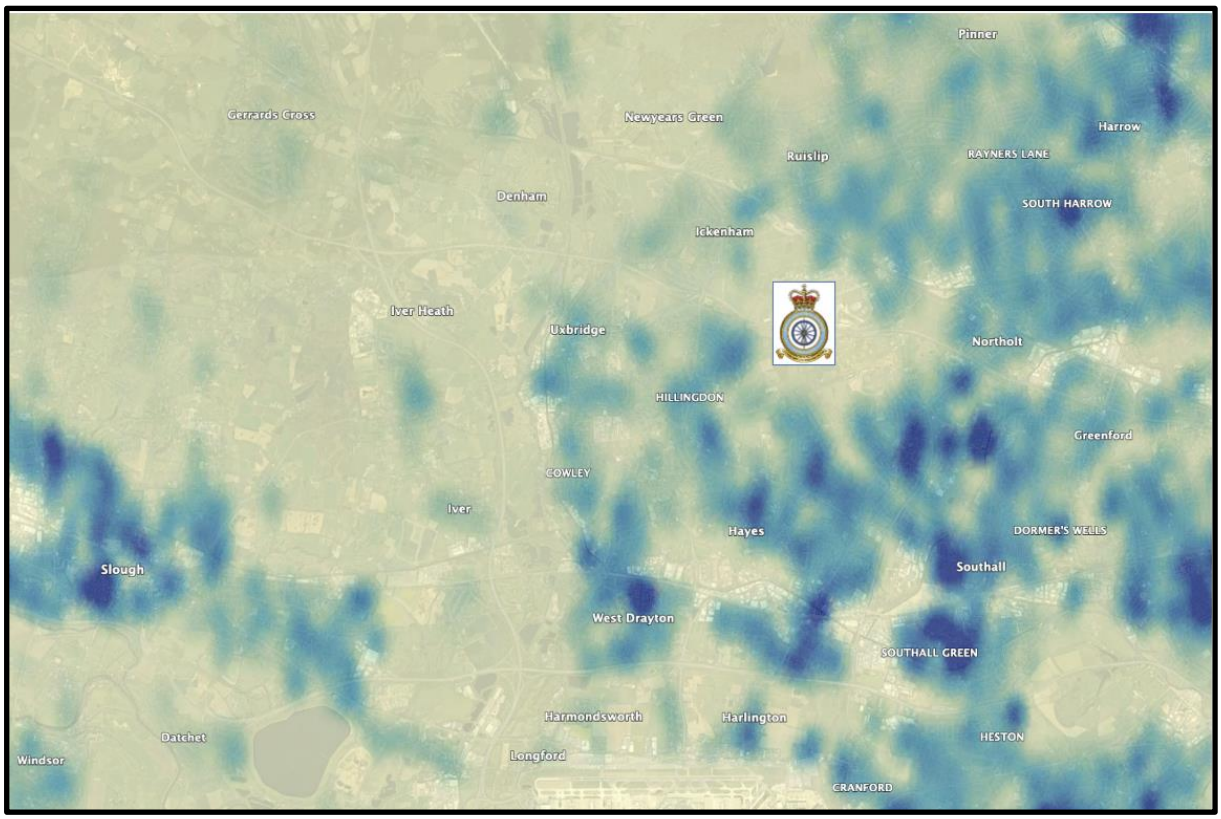

Figure 2: Local areas of population density

Figure 3: Chilterns AONB (white) & Colne Valley Regional Park (yellow)

Runway & Airfield Information

The airfield has one runway (07/25). With prevailing winds in the UK from the southwest, over the last 6 years, RWY25 was in operation approximately 75% of the time (westerly operations) and RWY07 was in operation approximately 25% of the time (easterly operations).

Runway selection at RAF Northolt is directly linked to the in-use runway at London Heathrow with Heathrow dictating the runway direction, which may then require aircraft at RAF Northolt to operate with a tailwind component.

Operating hours are different for military and civil aviation. Military operating hours are Mon-Sun 0800-2200. Business operating hours are Mon-Fri 0800-2000, Sat 0800-1500, Sun 1200-1900, Public Holidays Fri 0800-1500, Public Holidays Mon 1200-1900.

RAF Northolt ATC functions are split between an in-situ RAF Northolt Tower and RAF Northolt Radar, based at 78 Sqn, Swanwick. RAF Northolt Tower delivers a visual control function and a Precision Approach Radar (PAR) service for both runways. Surveillance Radar Approaches (SRA) can be provided by either RAF Northolt Tower using the PAR in azimuth only, or by RAF Northolt Radar.

Airspace Information

RAF Northolt has an Aerodrome Traffic Zone (ATZ), with a radius of 2nm centred on N513309.77 W0002510.55 from SFC-2000ft AAL. It is Class D airspace, within the London Control Zone (CTR). No routine fixed wing flying is to take place within the ATZ south of the

extended runway centrelines, due to the proximity of London Heathrow[2]. The RAF Northolt and London QNH are deemed the same for the purposes of co-ordination and separation. The direction of operation (i.e., westerly, or easterly) between Heathrow and RAF Northolt are also always aligned, based on Heathrow's runway selection.

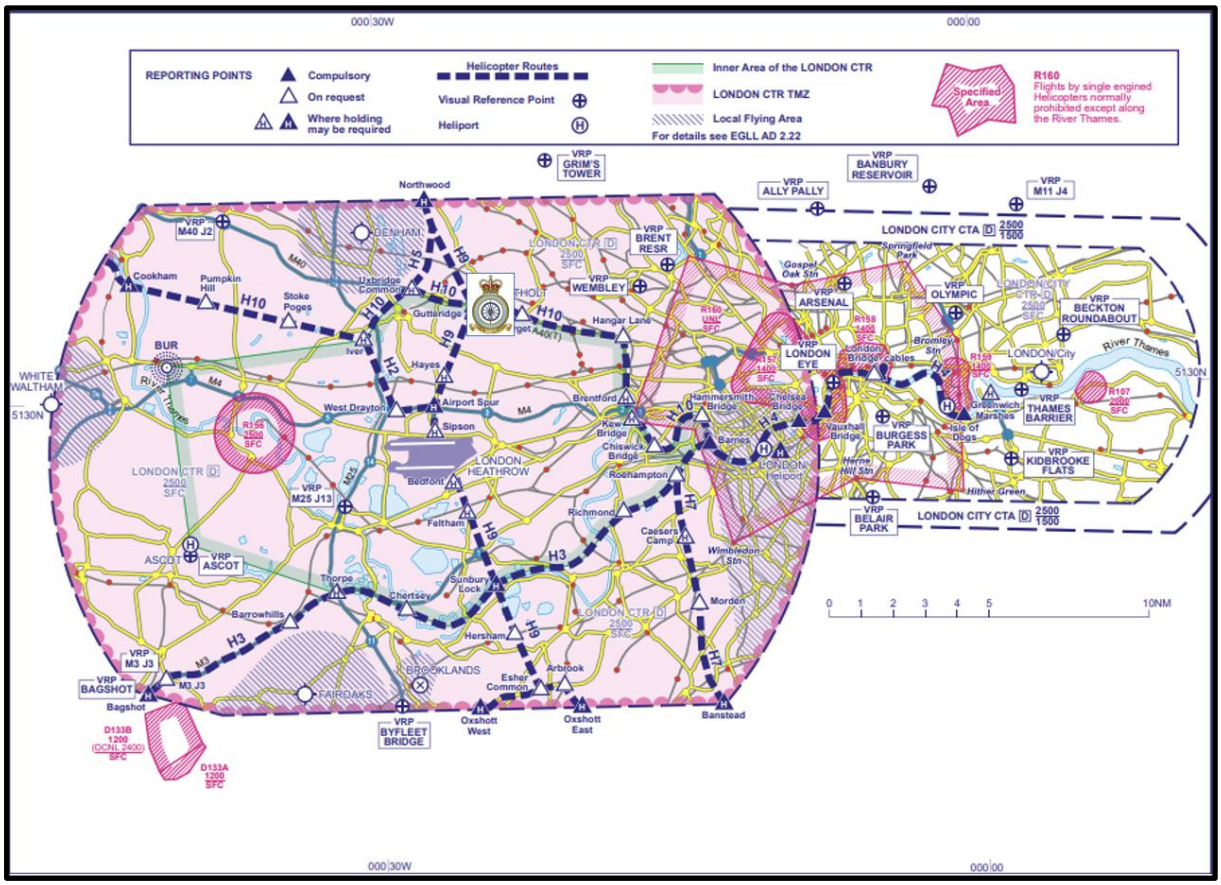

Figure 4: Heathrow (& London City) CTR & Helicopter Routes

RAF Northolt ATZ is embedded in the London CTR which extends from ground level to 2500ft AMSL. A defined wedge of the London CTR is delegated to RAF Northolt and is known as the Northolt Radar Manoeuvring Area (NRMA) which extends from ground level to 2000ft AMSL. When RAF Northolt is closed or is not controlling aircraft, the NRMA is handed back to Heathrow and the Heli routes/ATZ transits are controlled by either Thames or Heathrow Radar.

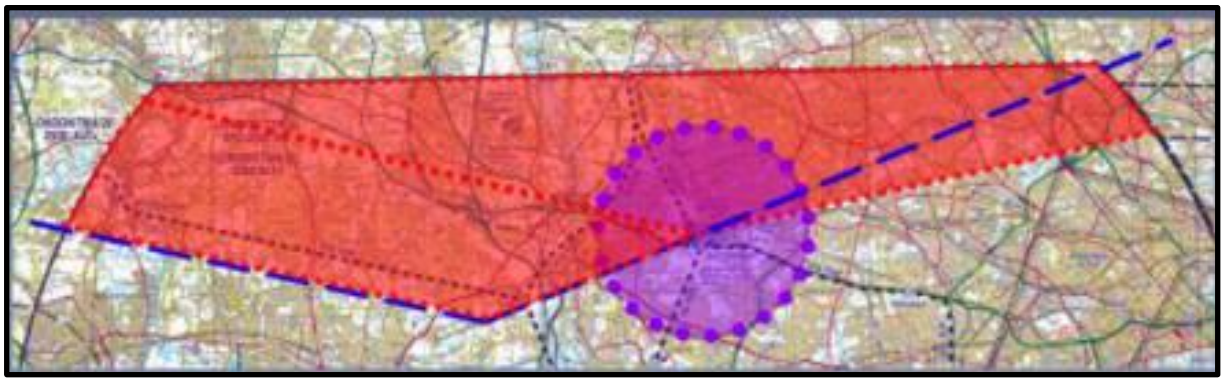

Figure 5: RAF Northolt RMA (NRMA)

[2] There are exceptional occasions such as flypasts that are planned/coordinated with Heathrow in advance.

Figure 6 is a heatmap showing the main flows (swathes) of IFR traffic arriving and departing RAF Northolt.

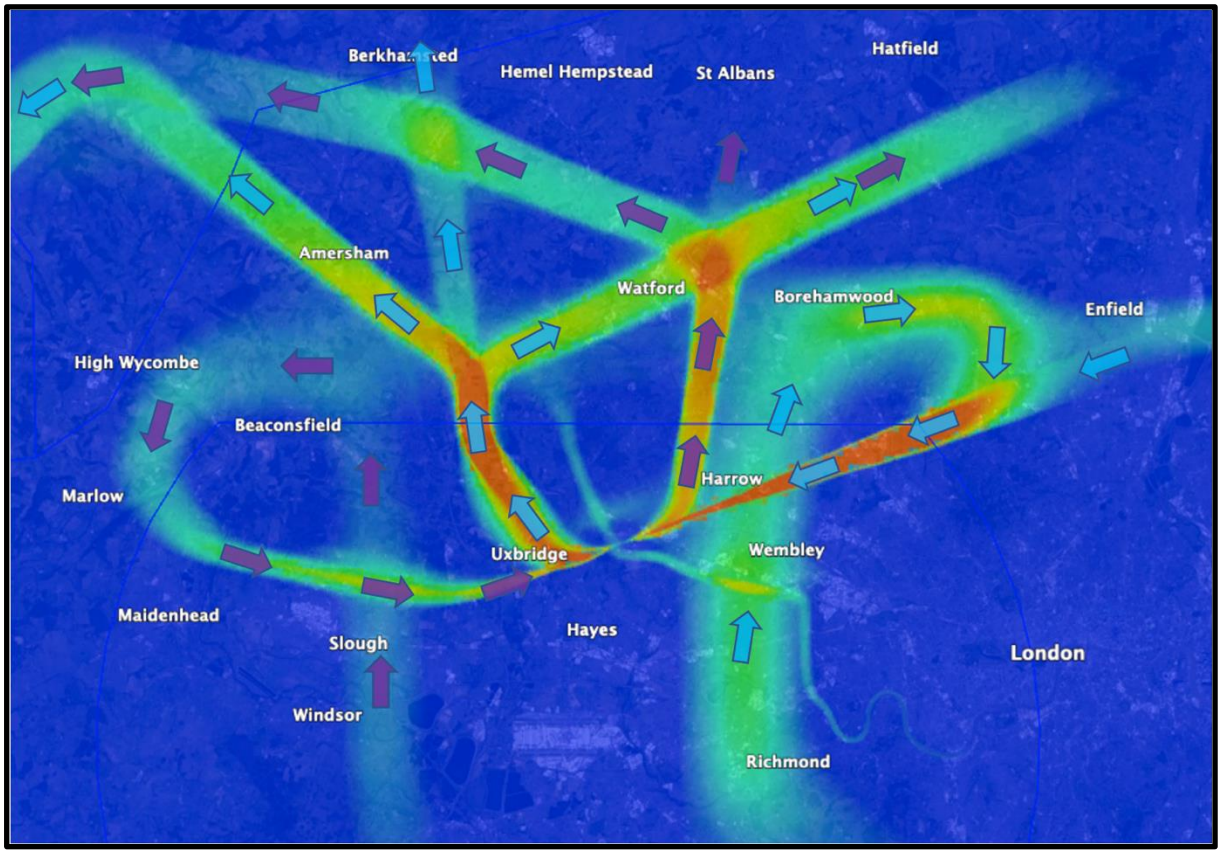

Figure 6: RAF Northolt arrival & departure swathes (2016)

Arrivals into RAF Northolt

Airways Arrivals

The standard airways routes for inbound aircraft to RAF Northolt are the same as those for London Heathrow and will route via the Heathrow stacks (LAM/BNN/OCK/BIG) controlled by Heathrow Director. Once the inbound aircraft is descending to 4000ft, Heathrow Director will release the aircraft to RAF Northolt, usually on passing 6000ft once clear of any unknown conflicting traffic. Once control has been transferred, RAF Northolt Director descends the aircraft to 3000ft as soon as is practicable. The aircraft should remain within the RMA and the delegated fillet (1nm north of the Heathrow RMA).

Swanwick Terminal Control (TC) who provide en-route services for RAF Northolt and adjacent airports will often descend RAF Northolt arrivals early to get them 'under the stacks' to avoid them being held up in Heathrow delay. The arrivals are often descended below an ideal Continuous Descent Approach (CDA) profile, owing to the airspace constraints. The result can be periods of level flight below 7000ft on a regular basis.

RAF Northolt will then position arrivals, usually for an ILS approach to RWY25 or a Precision Approach Radar (PAR)/Surveillance Approach Radar (SRA) to RWY07. Aircraft are also frequently provided with vectors to a visual approach when weather conditions allow.

RAF Northolt's precision approach aid for RWY07 is a Precision Approach Radar (PAR) which is due to go out of service by 2030. As a result of this RAF Northolt is investigating the procurement and technical feasibility for a RWY07 ILS and will evaluate options for ILS and/or PBN arrivals during this ACP. Whilst the anticipated end of life date for the PAR and implementation date of this ACP are currently broadly aligned, the operational requirement for an alternative precision approach to RWY07 would be accelerated should the risk of PAR end of life become more immediate.

Proximity to Heathrow

The proximity of RAF Northolt to Heathrow generates some physical constraints on the RAF Northolt Radar operation to ensure Heathrow and RAF Northolt aircraft can always maintain at least 3nm laterally and/or 1000ft vertically from each other.

Arrivals to RWY07 currently intercept the final approach course at approximately 4nm from touchdown whereas the typical final approach joining point for most airports would be more in the region of 8-10nm from touchdown. The short final approach for RAF Northolt is to ensure separation from Heathrow traffic established on final approach to RWY09L as illustrated in Figure 7.

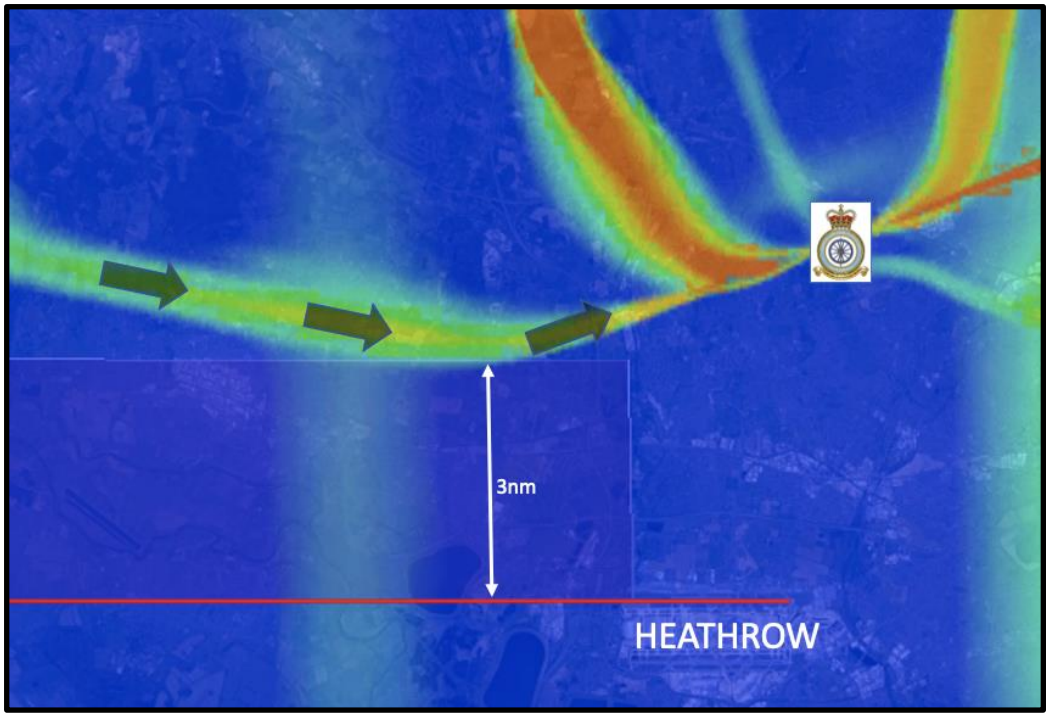

Figure 7: RAF Northolt RWY 07 arrivals vs Heathrow RWY 09L arrivals

Departures from RAF Northolt RWY25 and 07 turn to the north very shortly after departure. This is to maintain sufficient separation from Heathrow's existing Standard Instrument Departures (SIDs) and their Missed Approaches. This interaction is more prominent on RWY25 operations owing to the convergence of the runways and flight paths as illustrated in Figure 8.

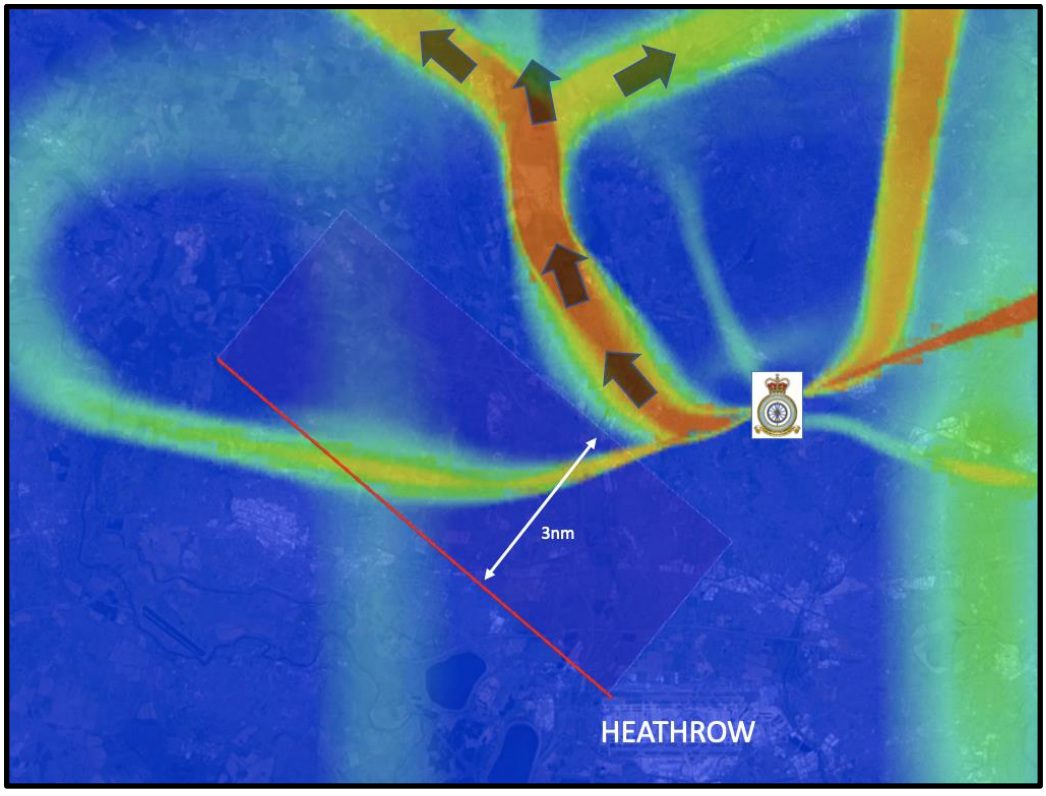

Figure 8: RAF Northolt RWY25 departures vs Heathrow RWY27R Missed Approach

Non-Airways Arrivals

Aircraft arriving at RAF Northolt are usually routed along the reverse of the Charlie and Romeo profiles (described below in Non-Airways Departures), either via BPK or BNN although they can arrive from any direction subject to co-ordination. Aircraft will remain outside of controlled airspace until they have received a positive clearance to enter. These are predominantly military use only.

Departures from RAF Northolt

Airways Departures

Aircraft departing RAF Northolt into the airways system can depart on a BUZAD (northbound), COMPTON (CPT) (westbound and southbound) or MATCH (eastbound and south eastbound) SID. There is also a DETLING (DET) SID, though that is used very infrequently and will shortly be withdrawn from the Military AIP. Table 2 shows the typical departure loading on each of the routes.

BUZAD	24%
COMPTON	44%
MATCH	32%
DET	<1%

Table 2: Approximate usage breakdown of RAF Northolt's SIDs

Aircraft departing on dissimilar SID profiles should be separated by a minimum of two minutes. Aircraft on similar profiles should be separated by a minimum of three minutes. CPT and BUZAD SIDs are considered similar, as both initially head northwest.

RAF Northolt's SIDs turn north immediately after departure. This is to keep away from Heathrow northbound departures and enable RAF Northolt's departures to climb straight to at least 3000ft to climb above the Minimum Sector Altitude, as well as remaining inside Controlled Airspace (CAS).

There are various minimum climb gradients depicted on RAF Northolt's SID charts. Some are for obstacle protection and some for CAS containment. Climb gradients of up to 13% are currently required to stay within CAS and these sorts of gradients are expected to be required going forwards to try to reduce the need for more CAS. RAF Northolt has advised that a minimum obstacle protection climb gradient of 5.5% will need to be accommodated to cater for the A400M aircraft. This requirement could have an impact on the lateral profile of the final SID designs and low altitude however this will not be finalised until later in the ACP process. Note it is not currently expected that CAS protection would also need to be provided for the 5.5% climb gradients.

Non-Airways Departures

RAF Northolt has two non-airways departures: the Romeo and Charlie departures. The Romeo departure is flown from RWY25. Aircraft fly on runway track to 2000ft, when passing 700ft,

turn right to intercept the LON 338R to ROMEO. This profile terminates at the London CTR boundary.

The Charlie MID is from RWY07. Aircraft fly on runway track to 2000ft. At LON 8.9d turn left on BPK 214R to CHARLIE. The profile terminates at the London CTR boundary.

For both these departures, on leaving the CTR boundary, aircraft would be required to remain in Class G airspace and be tactically handed over to adjacent units as required.

NERL's DVOR Withdrawal Strategy

NATS En-Route Limited (NERL) are currently undertaking a rationalisation programme for ground-based DVOR infrastructure. As part of this, the DVORs that RAF Northolt's SIDs rely on will be withdrawn. The current timeline anticipates these all to be withdrawn sometime after 31st December 2022. RAF Northolt publishes its IFPs within the UK Military AIP and, as such, the regulatory assurance of those IFPs falls within the jurisdiction of DAATM and the MAA. Since there is no military process equivalent to CAP1781, RNAV1 SIDs to replace the legacy conventional SIDs have been designed to replicate those IFPs as closely as technically possible; this is an interim measure until the implementation of this FASI ACP, enacted solely because of the DVOR rationalisation programme. It is possible that this may result in small changes[3] to departure tracks when compared to the 2016 swathes shown in Figures 6, 7 and 8 above, but at the time of writing the RNAV1 SIDs have not been implemented and therefore the swathes are not available as a baseline comparison.

Existing Noise Contours

RAF Northolt do not have any planning conditions which require 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 have generated noise contours for RAF Northolt using the Federal Aviation Administration's Aviation Environmental Design Tool (AEDT). These contours consist of the combined effect of all military and civilian aircraft at RAF Northolt in 2016 for different time domains and noise indices. The baseline year of 2016 was chosen as it is considered a representative year of busy operations.

The primary legislation regarding environmental noise control is set out in the Environmental Protection Act 1990. The MOD has exemption from clause 79(1)(g) of this Act. MOD policy regarding environmental noise is outlined in JSP 418 Leaflet 04-1: Environmental Noise, which states that the MOD must mitigate, as far as reasonably practicable, the effects of the environmental noise which its activities produce.

[3] The interim RNAV1 SIDs are not PANS OPS compliant in all circumstances. This will be permitted on an interim basis to replicate existing tracks as closely as possible.

These contours were created in accordance with the Environmental Noise Regulations 2006, No. 2238, Statutory Instruments. They do not include Engine Ground Run (EGR) operations or circuits.

In accordance with JSP 418, the data used to inform the noise contours must cover a period of at least 12 months. The RAF Northolt data used to produce the ANC was taken from 1 January 2016 – 31 December 2016. The baseline year of 2016 was chosen as it is considered a representative year of normal operations. The total number of aircraft flight movements over this period was obtained from ATC logs and broken down into Average Daily Movement (ADM) figures, based on a standardised flying year of 220 operational days[4] for each time domain (day, evening, and night). This was then used in conjunction with Radar Data.

The size of these contours is determined largely by four main factors:

- The type of aircraft using the aerodrome
- The number of aircraft using the aerodrome
- The frequency of use of each flight path
- The height of aircraft on those flight paths

The shape of the contours is directly influenced by the position of the flight paths, especially at c.3000-4000ft and below.

Figures 9 and 10 show RAF Northolt's noise contours as they were in 2016 for the following indices:

- L_{DEN} – 24 hour averaged noise metric with evening penalty of 5dB and night penalty of 10dB incorporated.
- $L_{Aeq,16\,h}$ Day – 16 hour averaged noise metric[5].

These 2016 contours are considered a suitable benchmark against which to describe the baseline in Stage 2 (see next section) however they will be updated to inform the assessment of the shortlisted options against an updated baseline in Stage 3[6].

[4] Where possible, flights and training are not conducted during public holidays and weekends (JSP 418). This is reflected in the policy guidance describing 220 flying days as the average flying year.

[5] RAF Northolt do not usually have night movements

[6] Noise modelling will be performed to CAP2091 Category C in Stage 3 onwards

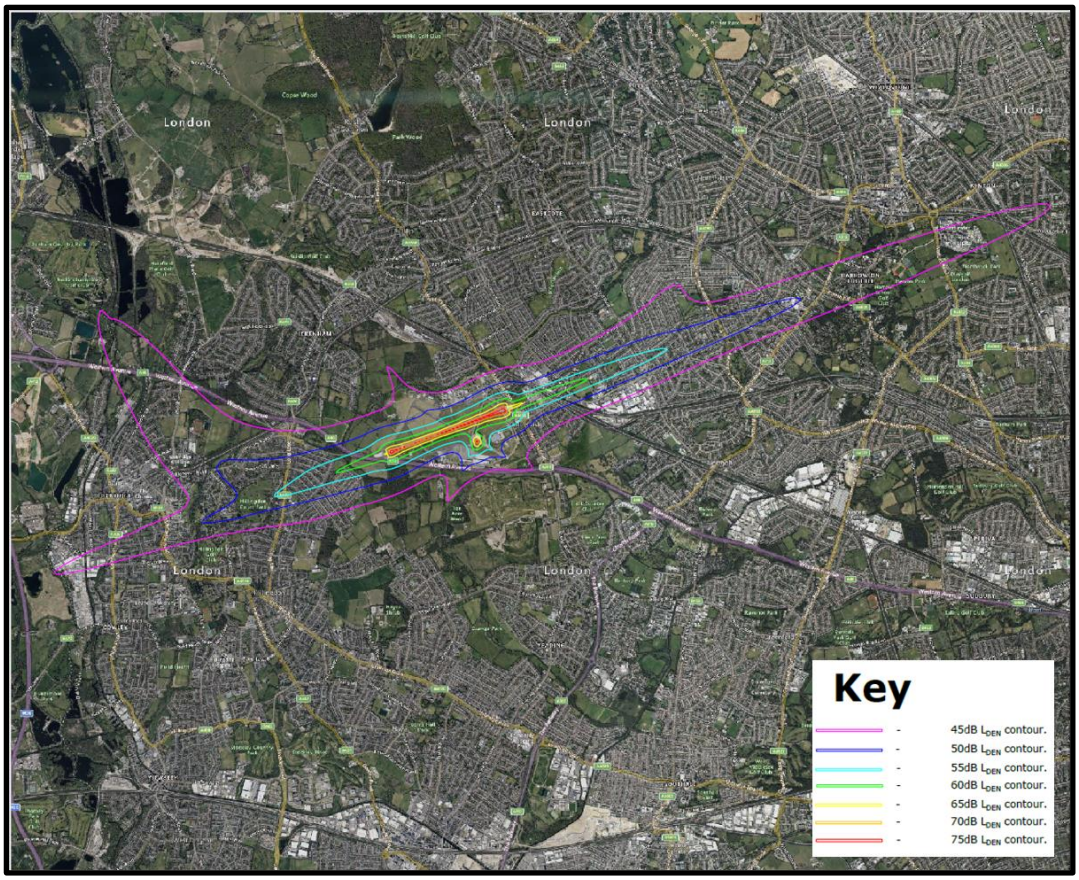

Figure 9: RAF Northolt L_{DEN} Contours 2016

Figure 10: RAF Northolt $L_{AEQ,16h}$ Day Contours 2016

Movement Numbers

Table 3 below provides a breakdown of civil and military fixed wing and rotary movements at RAF Northolt from 2016-2021.

Movements dropped sharply in 2018 due to Air Traffic Controller capacity, and then in 2019 due to runway resurfacing works which meant only rotary movements could be accommodated. The low movements in 2020 and 2021 were due to COVID-19. 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. This is the rationale for using that year for as a representative year for typical RAF Northolt movements.

Year	RWY25	RWY07	Total
2016	11,373	5089	16,462
2017	11,776	2986	14,762
2018	6007	2867	8874
2019	3390	914	4304
2020	3413	967	4380
2021	4895	1670	6565
2022 (01 Jan – Sep 22)	4597	1688	6285

Table 3: RAF Northolt Civilian & Military Movements 2016-2022 to date

Constraints from other LTMA Traffic Flows

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. These dependencies are likely to exist with any future RAF Northolt airspace design option which requires continuous climb operations/continuous descent operations (CCO/CDO) to/from higher levels than today or moves routes closer to those airports.

The leading constraints to all these airports is the Heathrow arrival operation including its holding stacks and the Heathrow departures, which are limited to 6000ft underneath their own arrivals. Many years ago, when the LTMA airspace was designed, this was not a constraint, as

the aircraft climbed so slowly that levelling off below arrivals was not a factor. Aircraft now climb much more quickly and so reach 6000ft well before they cross underneath the 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.

It is important to note that this is the baseline published airspace design which is restricted in this way. An airspace design assumes there is always conflicting traffic on an adjacent route, except where adjacent routes are not separated from each other, in which case, the arrival or departure is delayed until the conflicted traffic has passed.

However, Air Traffic Control (ATC) do not rely just on the route structure, otherwise every single departure from RAF Northolt would always level at 3000-6000ft and not climb higher until joining the network airspace many miles from RAF Northolt and delays would be intolerable. There is not always conflicting traffic and ATC can tactically climb aircraft above their published flight path altitudes earlier and they also vector aircraft to laterally deconflict from each other to enable more direct routings, continuous climb, and continuous descent.

All RAF Northolt aircraft departures joining the en-route system are subject to release approval from London Terminal Control (TC), Swanwick, who provide en-route services for RAF Northolt and adjacent airports. This is because some of the current RAF Northolt departure routes conflict with the Luton departure routes. Luton airport has 'freeflow' which permits aircraft to depart without release authority from London TC. Therefore, before an aircraft is permitted to depart RAF Northolt, dependent on both aerodromes' runway configuration, an agreement may be required that suspends Luton's freeflow allowing the airspace to become available for the RAF Northolt departure. This currently results in delays to RAF Northolt departures whilst they wait for the airspace to become available. Likewise, this also generates delay for Luton's departures. The release authority is time-limited to 6 minutes, therefore if an aircraft is unexpectedly delayed on the ground, the departure approval is cancelled and must be reapplied for. Although the main confliction is between RAF Northolt and Luton, some London City routes present conflictions that need resolving before RAF Northolt departures are permitted e.g., between RAF Northolt MATCH departures and London City BPK departures.

In 2016, there was a total of 15,277 minutes delay to Luton departures caused by the dependency with RAF Northolt and London City SID interactions. The average departure delay was 5 mins 29 seconds for any flight with a delay on obtaining a release.

RAF Northolt only have delay statistics from 2020 onwards. In 2020 and 2021, RAF Northolt recorded total delays of 1673 and 2470 minutes respectively in obtaining departures release from London Terminal Control for their own traffic. In the year to date[7], this figure is already 4907 minutes with an average departure delay of 1 min 48 seconds for any flight with a delay on obtaining a release. The longest delay for an individual flight was 30 minutes.

The RAF Northolt FASI ACP Statement of Need (SoN) states RAF Northolt's ambition to remove these conflictions to reduce or remove the delays that are currently experienced. This will help

[7] Jan-Sep 2022

RAF Northolt to meet its Design Principles (DP) by reducing air traffic controller workload, permitting military and governmental activity (DP2), minimising impact on other airspace users (DP3), facilitating operational efficiencies to maximise benefits to as many stakeholders as possible (DP5), and minimising fuel and greenhouse gases (DP6).

Transition Altitude

Even with a redesign and modernisation of the airspace there is another significant and fixed constraint to consider, the Transition Altitude (TA). In the LTMA this is 6000ft.

This section will not explain what the TA is in detail, other than to say the way aircraft reference their height above ground changes above 6000ft compared to at or below 6000ft. At or below 6000ft, aircraft fly at an altitude. Above 6000ft they fly at a Flight Level (FL).

Whenever aircraft are not laterally separated, they are kept at least 1000ft apart vertically. 5000ft is 1000ft below 6000ft. Similarly, FL70 is 1000ft below FL80.

However, 6000ft and FL70 are not always at least 1000ft apart. In fact, sometimes 6000ft and FL80 are not always at least 1000ft apart.

Therefore, for RAF Northolt departures to be guaranteed continuous climb in the future to 6000ft, Heathrow, Luton and London City traffic either need to be laterally deconflicted or climb gradients need to be significant. To put this into context, this would mean all aircraft from Heathrow on the current BPK SID from RWY27L would be required to climb at a gradient of at least c.16.6% to enable RAF Northolt's existing RWY25 CPT departure to be guaranteed climb to 6000ft.

Any SIDs that climb above 6000ft need to climb continuously from the runway, to at least FL90.

The ability to enable continuous climb for all departures within the LTMA to at least 7000ft (as explained above they would need to climb to at least FL90) is an immense challenge. Therefore, enabling as much track distance between Heathrow, RAF Northolt and London City and Luton departures is essential in generating the best possible chance of improved vertical performance.

Helicopter Routes

RAF Northolt is situated along multiple helicopter routes, H10, H9, H5 and H2 and is responsible for controlling helicopters on sections of these routes within RAF Northolt airspace when the airfield is open, and RAF Northolt Radar has control of the NRMA.

When RAF Northolt is closed, the Heli routes/ATZ transits are controlled by Heathrow or Thames Radar.

Controlled Airspace Arrangements and General Aviation

RAF Northolt is located within the London Control Zone (LCTR) which is Class D Controlled Airspace (CAS). Class D airspace is a known traffic environment and permission is required to

enter the airspace. This provides aircraft operating to and from RAF Northolt with protection against other air traffic, in that all air traffic is known and can therefore be separated.

The LCTR northern boundary is 3nm north of RAF Northolt and the airspace immediately outside of these boundaries is classified as Class G airspace from Above Ground Level (AGL) to 2500ft. Class G airspace is not controlled, and aircraft can operate in the airspace without any air traffic permissions, which results in an unknown traffic environment. Above 2500ft the airspace is CAS LTMA Class A. This results in RAF Northolt aircraft having an extremely limited amount of time/space to climb/descend aircraft to ensure that they are contained within CAS and afforded the protection CAS provides.

Aircraft departing RAF Northolt into the airways system are to achieve an altitude of 3000ft London QNH before crossing the London CTR boundary, requiring climb gradients up to 13.2%. Aircraft unable to meet this requirement are to inform RAF Northolt Air Traffic Control before requesting taxi.

Denham Aerodrome

Denham Aerodrome is situated 4.5nm northwest of RAF Northolt and has an ATZ with a radius of 2nm centred on N513518 W0003047 from SFC-2000ft Above Aerodrome Level (AAL). Denham's ATZ straddles Class G and the Class D airspace of the LCTR. The portion of Denham's ATZ that lies in the LCTR is known as the Denham Low Flying Area (LFA). Denham's LFA has a ceiling of 1200ft, within which there is a flight restriction of 1000ft Above Mean Sea Level (AMSL). This is to provide a buffer to help prevent Controlled Airspace Infringement Tool (CAIT) activation, by deconflicting with current RAF Northolt RWY25 (westerly) departures that route above the ATZ 'not below 1500 ft AMSL'. Additional local agreements between Denham and RAF Northolt mean that Denham will not utilise the portion of their ATZ south of the A40 without prior notification to RAF Northolt ATC. Denham has advised that they would value an LFA with an upper limit of 1500ft, allowing them to raise their circuit height from 750ft to 850ft. They also desire the restriction to 'not go south of the A40' to be moved to 'not south of the M40'.

Figure 11 shows illustrates the interaction between RWY25 departures from RAF Northolt and the Denham ATZ/LFA. Avoiding/limiting this interaction is a feature in some of the illustrative flight paths that appear in the Comprehensive List of Options which rely on a later turn on RWY25 departures to avoid the Denham ATZ.

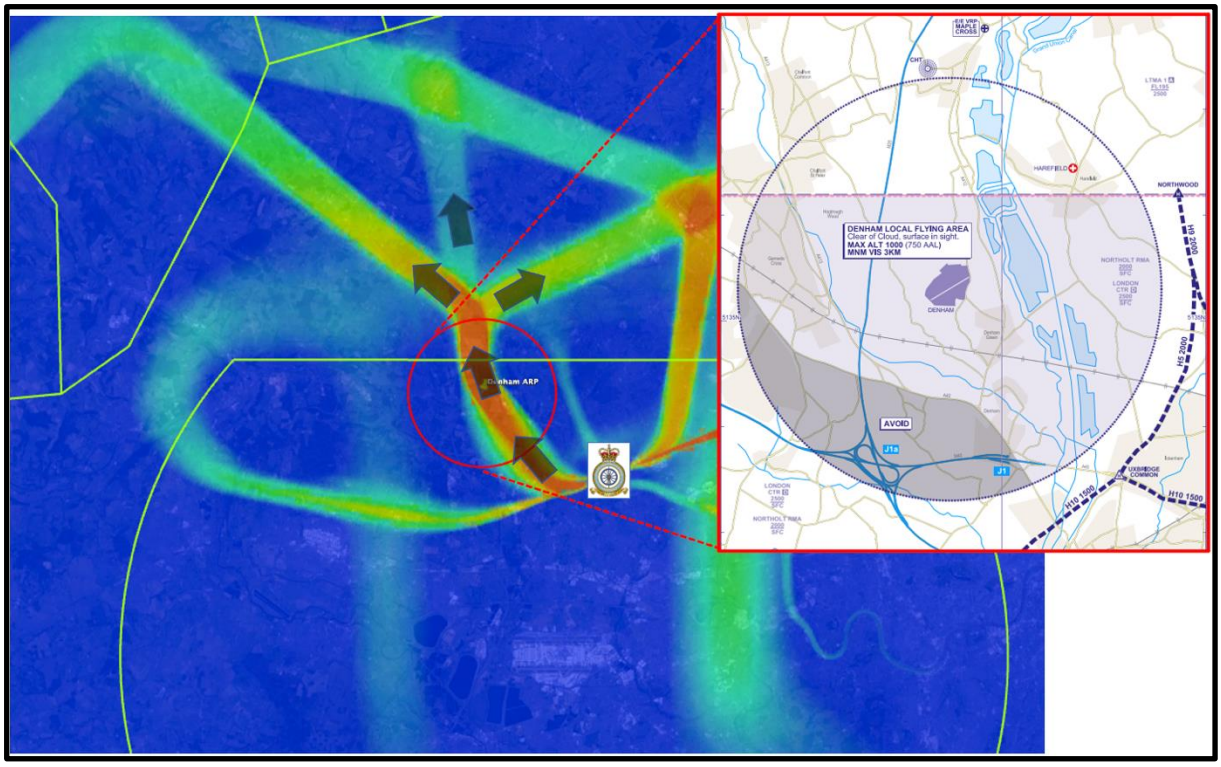

Figure 11: RAF Northolt RWY25 departures & the Denham ATZ/LFA

The airspace surrounding the LCTR, especially to the west, north and east of RAF Northolt is extremely congested with General Aviation (GA) aircraft. In 2017, Airspace4All published a piece of work on VFR Significant Areas (VSA). The term VFR Significant Area denotes a volume of airspace which has been identified as being particularly important to VFR operations i.e., General Aviation (GA). A VSA might take the form of a route, a zone or an area chosen for its particular importance to its GA users. These areas do not have any official status but are intended to highlight the importance of a particular area so that any future airspace development plans can take due account of the GA activity.

Of relevance to RAF Northolt is the 'Heathrow/Luton gap' and the 'Brize Norton-Heathrow-Luton Gap' which are illustrated in Figures 12 and 13.

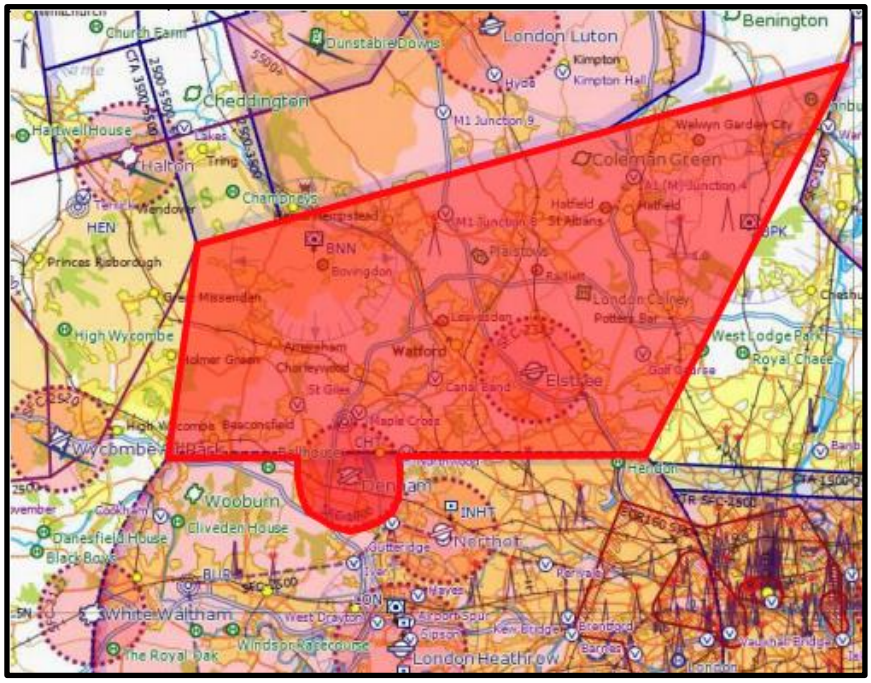

Figure 12: The Heathrow-Luton Gap, identified by Airspace4All

The 'Heathrow/Luton gap' is 8nm wide by 25nm long. It contains two major GA airfields (Elstree and Denham), two microlight sites (Plaistows and London Colney) and at least one airstrip and several helipads, all of which require access to this area for inbound, outbound, and local flights. The top of the Elstree Aerodrome Traffic Zone (ATZ) is 168ft below the base of the 2500ft LTMA, making overflight of the ATZ difficult. The gap between it and Luton CTR is 6nm with two microlight sites therein, while the gap between it and Heathrow CTR is 1.1nm. It is a major east-west transit traffic route between the Midlands and the Continent.

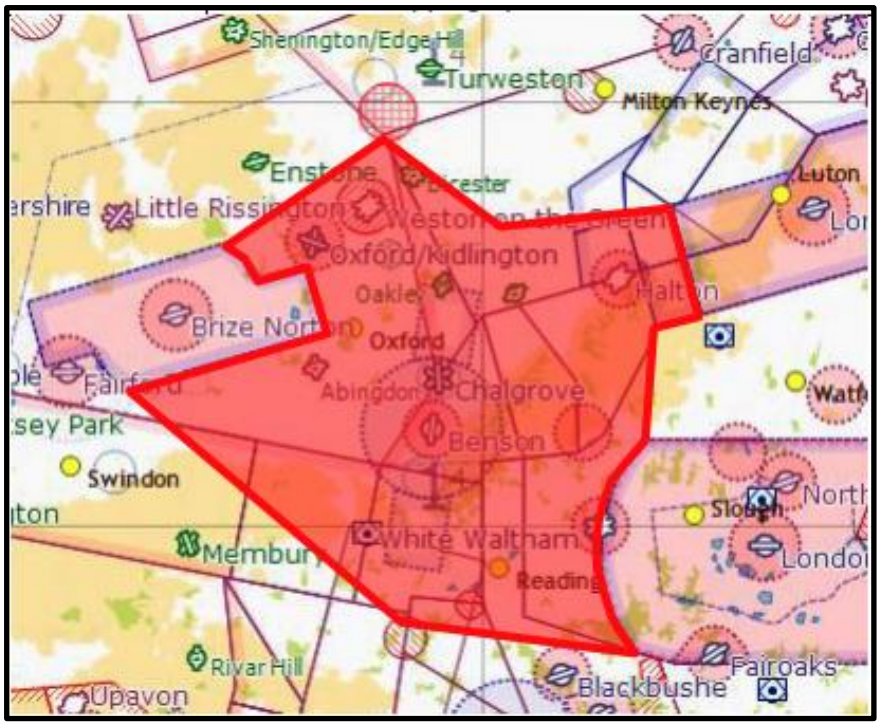

Figure 13: The RAF Brize Norton-Heathrow-Luton Gap, identified by Airspace4All

The ‘Brize Norton/Heathrow/Luton gap’ is irregularly shaped, maximum 36nm deep by 41nm wide, though narrower to the east of the Brize CTR. Most of it is within the Oxford Area of Intense Aerial Activity (AIAA). It contains major civil airfields at Oxford, White Waltham and Wycombe Air Park, and a major military helicopter airfield with associated Military Air Traffic Zone (MATZ) at RAF Benson.

Restricted Areas EG R101 and EG R104 to 2400ft and Danger Area EG D129 up to FL120 are within the area. The RAF Benson MATZ runs north/south through the middle of the area and less confident/non radio traffic tend to fly to the west of RAF Benson; the eastern side of RAF Benson having a complex base and traffic associated with Wycombe and White Waltham.

On days with a cloud base of less than 3000ft the transit around RAF Benson becomes a challenge both for pilots and the Lower Area Radar Service (LARS) providers, when available. This airspace is essential for access to many airfields and airstrips in and around the local area and for north-south and east-west transit traffic and other traffic avoiding the adjacent CAS.

Initial Options Development (unconstrained)

An initial design workshop was held at RAF Northolt in September 2019. The workshop was comprised of subject matter experts (SME) who, using the CAA approved Design Principles and their own expertise, drew an initial list of illustrative route options.

This activity was unconstrained with regards to potential dependences on adjacent airport operations.

To assist in meeting RAF Northolt's Design Principles, various data inputs were used to help inform the SMEs as to how to best meet the Design Principles. Examples of these were:

- Heat Maps generated from radar tracks of existing RAF Northolt Operations (DP7a)
- Heat Maps generated from radar tracks of existing Heathrow Operations (DP3)
- Airspace maps showing adjacent operations such as Denham Aerodrome (DP3)
- Population Density Maps (DP7b)

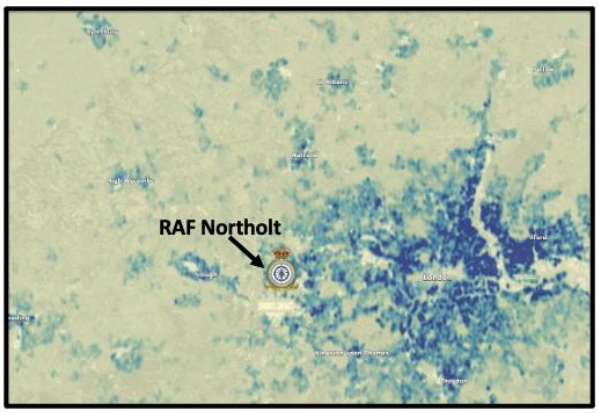

Figure 14: Population Density

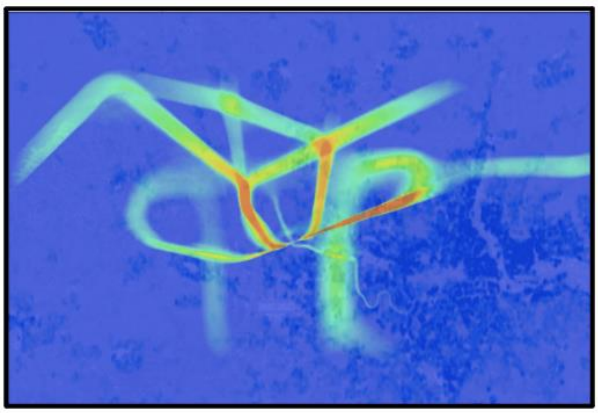

Figure 15: RAF Northolt Radar Track Heat Map

The SMEs took each data layer in-turn and sketched flight paths that aimed to optimise for each Design Principle. This generated a wide variety of potential flight paths. For example, flight paths that avoided population densities (DP7b) were often different to flight paths that aim to minimise numbers of people newly overflown (DP7a) and flight paths that were more direct to reduce CO_2 (DP6) were often different to those which aimed to minimise impact on other airspace users. This is illustrated below:

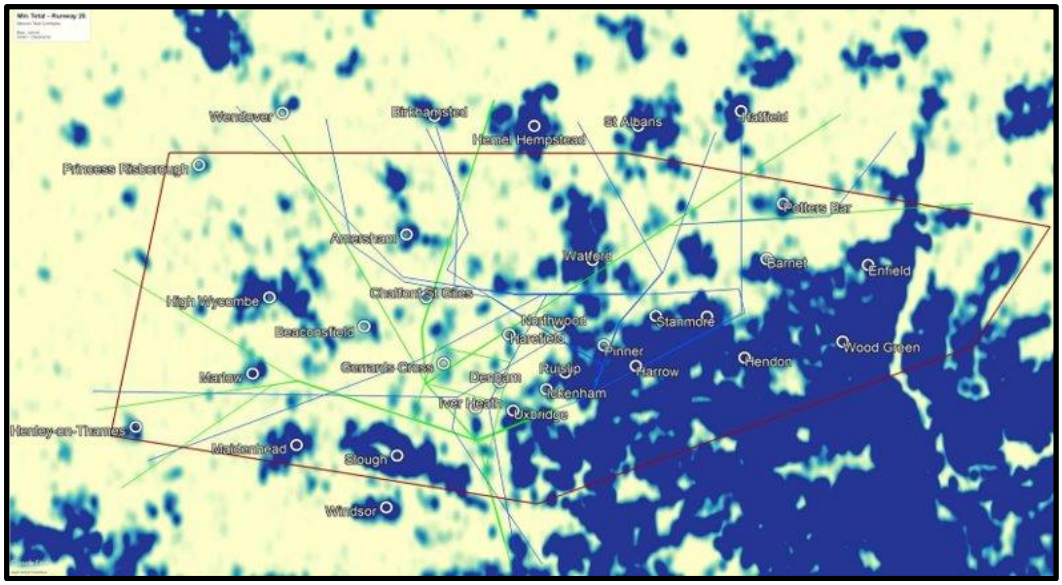

Figure 16: Illustration of sketched flight paths in green avoiding areas of population density

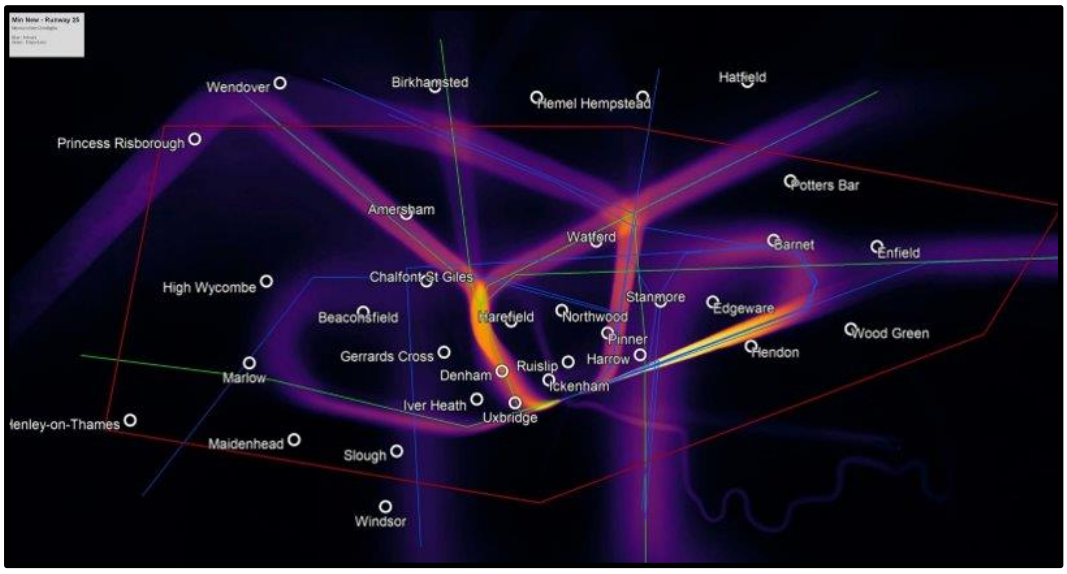

Figure 17: Illustration of sketched flight paths in green remaining within areas currently overflown

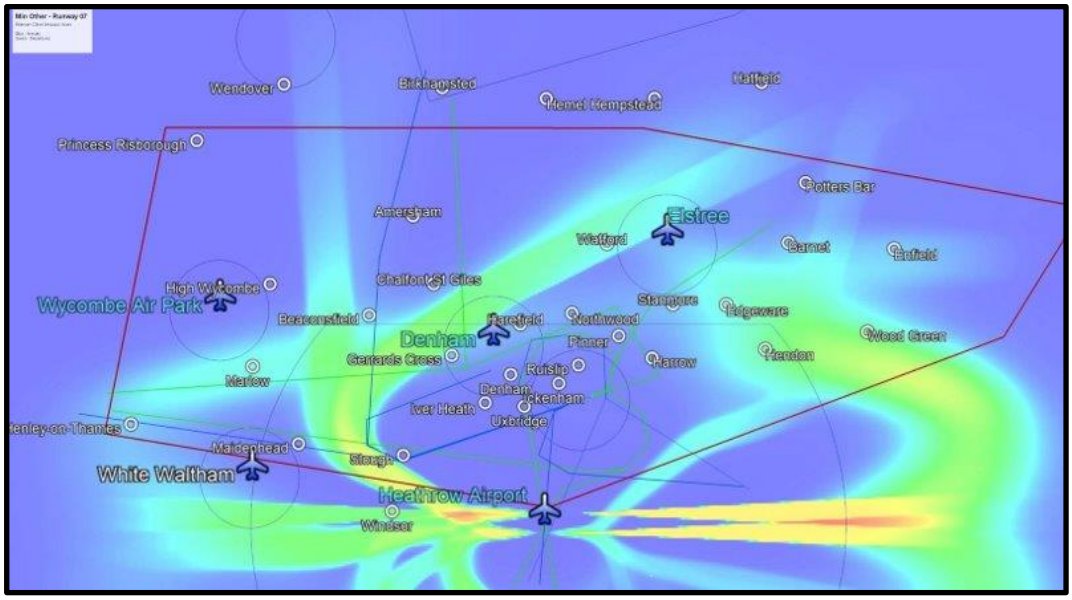

Figure 18: Illustration of sketched flight paths in green avoiding adjacent Aerodrome Traffic Zones

This was done for both arrivals and departures, as well as each runway (07/25). At this stage, the flight paths that were sketched did not consider international Instrument Flight Procedure (IFP) design criteria, or technical viability based on all considerations but were simply trying to position flight paths according to the Design Principles. Figure 19 represents all the sketched flight paths before IFP design criteria were applied. It is this image that was shared with stakeholders in the initial engagement in 2019/20.

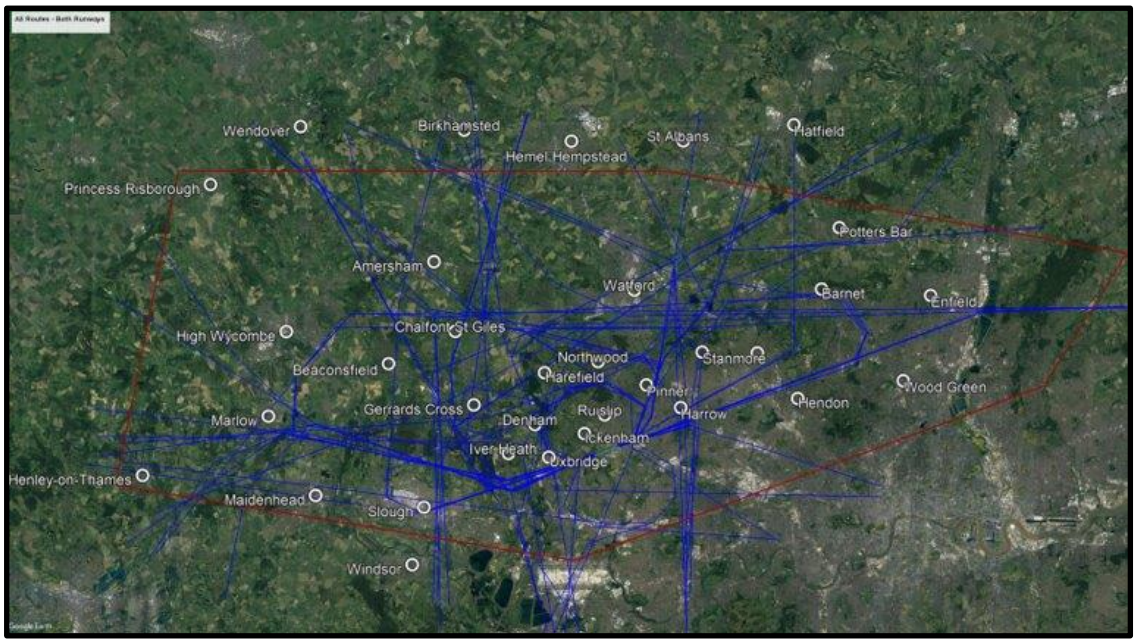

Figure 19: All sketched flight paths

Upon completion of the workshop, the sketched flight paths were passed to an IFP Designer to generate IFP tracks that were as close to the hand-sketches as possible. This ensured they were physically flyable and designed to a PBN specification. This process would introduce Design Principles 1 and 4 to the options development.

The IFP Design process is extremely time consuming, and it was not proportionate to apply the full rigour of IFP design to every option at this stage. A series of assumptions were made.

- The designs were completed using the PBN specification Required Navigation Standard 1 (RNP1) with Radius to Fix (RF) turns as this enables IFP designers to generate routes most efficiently. It is accepted that the future design work may have to cater for the absence of RF functionality.

- For departures, climb gradients of both 7% and 10% were initially explored at this stage to understand where differing 7000ft points might be based on a continuous climb. The result of this is that twice the number of illustrative departure tracks were generated with the only difference being the 10% departure tracks were shorter than the 7% tracks. Many can climb much more steeply however 7% was chosen as a suitable, illustrative gradient for this stage of the project which could help explore issues going forwards. Note that gradients of up to 13% are expected to be required for the initial climb out of SIDs to reduce the need for more CAS but a 7% gradient as used in the illustrations is useful to help understand impacts further from the airport, especially in the event CCO to 7000ft is not available.

- For arrivals a 3˚ decent profile was assumed.
- An unrestricted speed climb was catered for, which resulted in a large radius of turns.

Figure 20 shows the illustrative flight paths generated, with departure track lengths based on a 7% gradient.

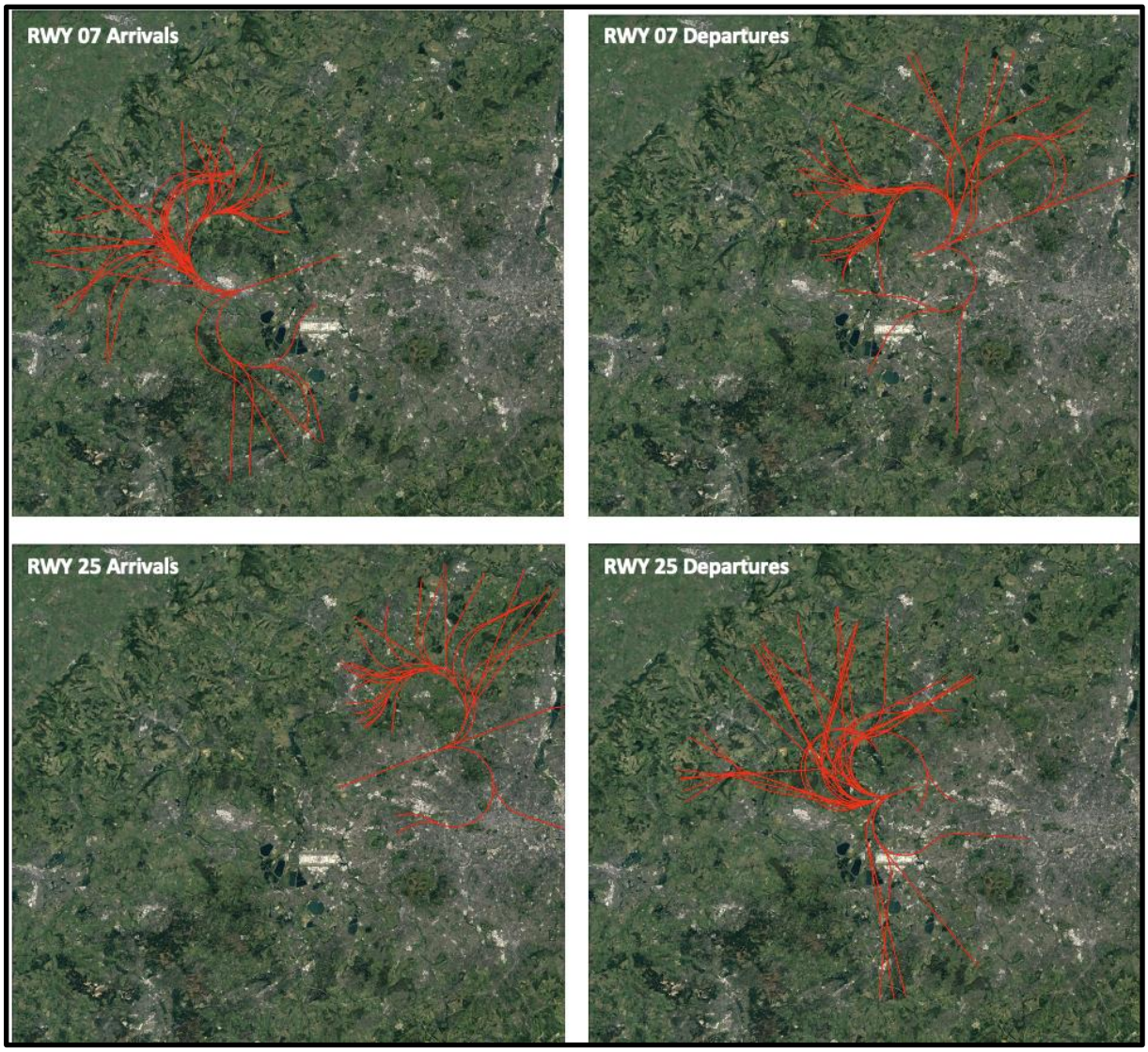

Figure 20: Initial illustrative flight paths following IFP design

Stakeholder Engagement (2019 and 2020)

In accordance with CAP1616, option development should include stakeholder engagement to test that the options have been designed with regard to the approved Design Principles. To meet this requirement, RAF Northolt conducted the following activity. A log of all the engagement activity is available at Appendix C.

Identification of stakeholders

RAF Northolt reviewed the list of stakeholders it had engaged with as part of Stage 1, Step 1B Design Principles. As the geographical area that could potentially be affected by RAF Northolt's ACP (see CAA Airspace Change Proposal (ACP) Portal) remained unchanged at this point, it was decided that all stakeholders previously engaged in Step 1B should be included in Step 2A's engagement activity. In its response to RAF Northolt's Step 1B submission, the CAA had identified the Chiltern Conservation Board as an additional stakeholder that RAF Northolt should engage with from Stage 2 onwards. During Stage 2, the Colne Valley Regional Park were also identified as stakeholders and added to the distribution list. Letters were sent to Stakeholders inviting them to attend engagement as detailed below. The list of RAF Northolt stakeholders is at Appendix B.

Engagement activity

RAF Northolt developed two different engagement activities, based on the identified stakeholders. Stakeholders were sent a letter and email of invitation for the engagement sessions. Both types of engagement activity used the same material to explain the methodology used to create the options and all presentations were conducted by Senior Air Traffic Control Officer (SATCO) RAF Northolt to ensure continuity of the information provided. At the end of each activity, all participants were requested to complete a Feedback Form about the information they had received, copies of which can be found at Appendix F. The following engagement activities took place:

Drop-in sessions: For communities and councils, RAF Northolt held two drop-in sessions at The Link, Portal Close, Ruislip, HA4 6NN. The location outside of the Station allowed interested parties to walk-in and were timed to cover the working day and early evening to enable people with differing work or family commitments to attend on an ad-hoc basis. This activity took the form of presentation boards and a verbal presentation to groups. As stakeholders arrived ad-hoc, groups were formed and given the presentation, with all questions being recorded. These drop-in sessions were held on 19th and 25th November 2019.

Information presentations: For airports, aircraft operators and all remaining stakeholders, RAF Northolt held two information briefs on successive weeks. The information briefs were conducted at set times during the working day to enable those attending to fit them into their work schedule. This activity took the form of a presentation to attendees, with the ability to ask questions during the presentation. A copy of the presentation given to stakeholders is at Appendix E. These presentations were held on 20th and 28th November 2019.

Additional catch-up brief: After the initial engagement events, it was decided by RAF Northolt that another opportunity should be arranged to provide a further opportunity to stakeholders who were unable to attend the previous engagement events in November 2019, so a 'catch-up' drop-in session was held at The Link. This took place on 23rd January 2020.

Feedback received

In total, 37 people attended an engagement event, with 25 attending a drop-in session and 12 attending an information presentation. Copies of all completed Feedback Forms are within Appendix F. Overall; the feedback suggests that stakeholders agreed they were informed as to where RAF Northolt is in the airspace change process. In addition, they agreed with how RAF Northolt's Design Principles are being applied to the airspace design process during Step 2A. The following key points have been extracted from the raw data collected at each engagement event:

Quantitative feedback. From the 37 attendees, 34 feedback forms were completed (23 from drop-in sessions and 11 from the information briefs). Of the feedback received, there was 100% positive feedback from the stakeholder information briefs. After the drop-in sessions, there was 94% positive feedback, 3% unanswered and 3% negative feedback. The 3% negative feedback relates to a "no" answer to Questions 1 (1 person) and 5 (2 people) respectively.

Qualitative feedback. From the 34 feedback forms, 13 comments were provided. The positive comments focussed on the fact that the methodology being used was sensible and that the engagement was thorough, open, and well directed with questions answered comprehensively. The comments of concern focussed on the clarity of flight routes, environmental impacts, and effective use of navigational systems (see Appendix F). The Chiltern Conservation Board's attendance was followed up with a letter to RAF Northolt expressing their considerations (See Appendix F, pages 42-46); RAF Northolt's response can be found at Appendix F, page 47.

How the 2019/2020 feedback influenced the process

Table 4 below summarises the main feedback received, together with RAF Northolt's response.

Stakeholder	Feedback	RAF Northolt Response
Anonymous	Ensure the most modern navigational equipment is used, which enables surrounding area not to be 'as impacted'.	RAF Northolt are looking at what is possible with all PBN specifications although RAF Northolt does need to ensure that all their operators will be able to utilise the new route structure.
Crane Valley Partnership	Needs to be consideration of the impact on tranquillity in relation to green spaces e.g., Colne Valley Regional Park and Chilterns AONB.	Tranquillity will be explored in the Initial and Full Options Appraisals (IOA/FOA).
Crane Valley Partnership	Consider cumulative disturbances and impacts.	Yes, cumulative noise, overflight and CO_2 impacts from adjacent airports are considered in Stage 3 of the ACP.

Friends of River Crane Environment	Would like to know how many flights will use each route.	RAF Northolt added details of movement numbers throughout their CLOO engagement slides based on 2016 movements.
Friends of River Crane Environment	Minimisation of impacts on airfield site drainage.	The airspace design will not affect site drainage.
Anonymous	Raise Denham LFA to 1200ft and create a fillet to the NW of Denham to improve safety and reduce infringements.	RAF Northolt have illustrative flight path options which still route through the Denham ATZ as well as options that avoid Denham ATZ, and this request will be taken into consideration in the appraisals of those options.
Chilterns Conservation Board	Should include potential sharing of routes with Luton and Heathrow.	RAF Northolt do have options which, as today, would be likely to share the same lateral volume of airspace as Heathrow flight paths however this would mean that RAF Northolt traffic may receive less optimal vertical profiles than if they are laterally separated. This in turn could leave to greater cumulative impacts for some communities.
Chilterns Conservation Board	Minimise overflight of the Chilterns AONB.	The Chilterns AONB boundary has been added to each of the options in the CLOO and an assessment of overflight will be part of the IOA.

Table 4: Summary of 2019 Stakeholder Feedback & RAF Northolt's response

COVID-19

The COVID-19 pandemic had an extraordinary effect on civil aviation and resulted in the majority of the FASI(S) Airports pausing their respective ACPs in early 2020. RAF Northolt was initially able to continue the work it had started on Step 2A however, in November 2020 RAF Northolt formally paused its ACP and updated the CAA ACP Portal to state:

> *"RAF Northolt remains committed to the Govt's Airspace Modernisation Strategy however, it has paused its ACP to ensure it maintains a coherent approach with neighbouring Airports. RAF Northolt will resume ACP activity and agree new timelines with the CAA to remain aligned with other FASI(S) Airports."*

FASI ACP Re-mobilisation

The FASI Airspace Change Programme is being conducted to meet the Government's Airspace Modernisation Strategy (CAP 1711). During the period that most airports had paused their respective ACPs, the Airspace Change Organising Group (ACOG) worked to secure Government funding to enable airports to restart their ACP activities.

In March 2021 the Department for Transport (DfT) announced a £5.5M AMS Support Fund to assist ACP Sponsors to resume ACP activity. This has resulted in most ACP Sponsors being able to restart their ACP. RAF Northolt, as a 'state-owned asset', is currently not eligible to draw from the AMS Support Fund. Despite this, it was decided that it would restart its ACP in 2021.

CAA Restart Guidance

To assist ACP Sponsors to restart their respective ACPs the CAA issued a Policy Statement: *Guidance for Sponsors currently progressing through the CAP 1616 process: Restarting a 'paused' Airspace Change Proposal (ACP)*[8]. The guidance required ACP Sponsors to provide contextual information to evidence that it met the CAA's requirements to restart a paused ACP.

RAF Northolt considered the guidance provided by the CAA and concluded that it met the requirements of the CAA Policy Statement and that the RAF Northolt FASI ACP could restart from its pre-pause position.

RAF Northolt wrote to the CAA on 20th May 2021 to request that it restart its paused ACP and continue its activity from Step 2A. The letter can be found at the CAA ACP Portal.

The CAA responded to RAF Northolt on 9 June 21 stating that it was *"satisfied with the assessment and agrees the proposal can resume".* The CAA ACP Portal was updated to reflect that the RAF Northolt FASI ACP is 'in progress' and the letter from RAF Northolt to the CAA was uploaded onto the CAA ACP Portal. The CAA informed RAF Northolt that it would not review the ACP Timeline until the ACOG produce iteration two of its Masterplan. An indicative timeline for RAF Northolt to submit Stage 2 documentation was agreed on 27 May 22 for a proposed Gateway date of 24 June 22 and can be found on the CAA ACP Portal.

[8] 20201028 ACP restart guidance Final for publication.pdf (caa.co.uk)

As part of its restart activity RAF Northolt committed to updating its Stakeholder Community. This feedback was in the form of a letter sent to all identified stakeholders that can be found on the CAA ACP Portal.

Consideration of the time required to work with neighbouring FASI sponsors, and the potential additional work that could take longer than anticipated, RAF Northolt applied to delay its Stage 2 Gateway Submission to 28th October 2022. This was approved by the CAA on 25th January 2022.

Further Options Development (2022)

RAF Northolt acknowledges that the Airports National Policy Statement (ANPS)[9] supporting a new northwest runway at Heathrow Airport remains part of the up-to-date planning policy on airport expansion in the southeast. At the time of restarting this ACP and at the time of writing, Heathrow has paused work on their application for planning consent for expansion and has embarked on a 2-runway ACP. However, RAF Northolt's Statement of Need clearly articulates that a potential third runway is just one of several scenarios that must be considered.

Once RAF Northolt's ACP project was re-commenced, additional illustrative flight paths were generated to take account of some constraints from Heathrow's operations which are likely to be prevalent in any future design (DP1 and DP3), in either a 2 or 3-runway Heathrow scenario, and also to have some options which are more closely aligned to today's operation to reduce the numbers of people newly overflown (DP7a).

Figure 21 shows the additional illustrative flight paths that were developed in yellow against the original tracks in red which had been generated before the pause due to COVID-19.

Figure 21: All initial illustrative flight paths following IFP design with additional ones generated following restart in yellow

Next, the significant number of illustrative flight paths generated at this point were grouped into routes based on their broad geographical direction. A swathe or 'design envelope' was then generated around each group and then each design envelope in turn became the Comprehensive List of Options for a second round of Step 2A engagement to build on the engagement carried out in 2019.

Generating design envelopes that are based on multiple illustrative flight paths that had been specifically designed in accordance with specific Design Principles had the following advantages:

- It made a significant number of illustrative flight paths into a manageable number of options that can be evaluated and appraised.
- There were clear similarities in route positioning that enabled RAF Northolt to group the illustrative flight paths into a concise set of envelopes/options.
- It provides some early certainty to all stakeholders (both community and industry) in the likely areas of route positioning to/from RAF Northolt enabling them to feedback on the pros and cons of each option relevant to their location or interest.
- It aided stakeholder engagement by enabling feedback on geographical regions rather than a high number of individual route options that could be difficult to distinguish between.
- It retained flexibility in the design process going forwards. Whilst route positioning closer to RAF Northolt is more certain and less dependent on adjacent airports (apart from

[9] ANPS

Heathrow), the further from RAF Northolt, the more variables come into play from Heathrow, Luton, London City and NERL's network joining points and interactions.

- The exact positioning of route centrelines in the immediate vicinity of RAF Northolt is highly dependent on Heathrow's operation and IFP design criteria, some of which could need to be outside of standard rulesets and require bespoke safety case assurances. In this scenario, ruling individual route centrelines in/out without significant Safety Assurance work would be premature.

- The illustrative route centrelines within each Option could still be used to inform the DPE and then to analyse and generate a range of potential metrics to help inform the partly quantitative Initial Options Appraisal (IOA).

Stakeholder Engagement (June 2022)

Identification of stakeholders

RAF Northolt reviewed the list of stakeholders engaged with as part of Stage 2, Step 2A in 2019. As the geographical area that could potentially be affected by RAF Northolt's ACP (see CAA ACP Portal) remained unchanged at this point, it was decided that all stakeholders including those who were engaged in the previous Step 2A engagement held in 2019 should be included in the second round of engagement. The list of RAF Northolt stakeholders is at Appendix B. Open invitations to the engagement activities were sent to 300 stakeholders, via letter and email. A copy of the scanned invitation letter can be found at Appendix D, pages 27-28. Follow up invitation emails were sent throughout May and June 2022.

A log of all the engagement activity is available at Appendix C and all the engagement correspondence is at Appendix D.

Engagement activity

RAF Northolt used two different engagement activities, based on the identified stakeholders. An information presentation was developed and used in all sessions, and can be found at Appendix E. There were five sessions in total, two online, two in-person and one bespoke online session for London City Airport, who were unable to attend the other sessions. One session was arranged for the evening, to maximise attendance for those unavailable during the standard working day.

Both types of engagement activity used the same information brief to explain the methodology used to create the options and all presentations were conducted by Trax International and RAF Northolt ACP Team to ensure continuity of the information provided. At the end of each activity, all participants were requested to complete a Feedback Form, either online or via a paper form, about the information they had received; a copy of which can be found at Appendix F, pages 50-52. At the in-person sessions, attendees were offered an information leaflet capturing the key points of the brief, to take away. A copy of this leaflet can be found at Appendix D, pages 67-68. Additionally, the information presentation slide pack was emailed to stakeholders at their request. Further slide packs were emailed to NATMAC members, to ensure those who were unable to attend had a copy of the brief. The following engagement activities took place:

Online Information Briefs. For airports/airspace users and communities and councils, RAF Northolt held two online information briefs. Stakeholders were invited by email and letter, and an attendance log was created for each session. The airport/airspace user's information presentation was held at 0930 on Wednesday 8th June 2022 and the communities and councils' presentation at 1700 on Thursday 9th June 2022.

In-Person Information Drop-In Sessions. For communities and councils, RAF Northolt held two drop-in sessions at The Link, Portal Close, Ruislip, HA4 6NN. The location outside of the Station allowed interested parties to walk-in and were timed to cover the working day and early evening to enable people with differing work or family commitments to attend on an ad-hoc

basis. This drop-in session took the form of presentation boards, leaflets, and a verbal presentation to groups. A copy of the leaflet can be found at Appendix D, pages 62-63. Within the drop-in session, the information presentation was delivered, with the timing of this brief conveyed in the invitation letter. These drop-in sessions were held on the morning and afternoon of Wednesday 15th and 22nd June 2022 respectively.

Additional briefs. After the initial engagement events, RAF Northolt provided a further opportunity to London City Airport who were unable to attend the previous engagement event on Wednesday 8th June 2022, so an online information brief was delivered on Tuesday 19th July 2022.

Question Log:

Attendees were offered the opportunity to ask questions throughout the brief. Questions that were not answered at the time, but answered later, can be found in Table 5 below.

Stakeholder	Question	RAF Northolt Response
Ruislip Residents Association Oxford Aviation Services Ltd. and Heliport Biggin Hill Airport Ltd.	Do RAF Northolt know how many of the aircraft movements are military?	RAF Northolt can and has provided details on the number of civil and military movements in response to Requests for Information, under the Freedom of Information Act. At this stage of the ACP, RAF Northolt has not broken down their movement statistics beyond number of movements from each runway. 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.
South Ruislip Residents Association	When is the CAP of 12,000 [civil movements at RAF Northolt per year] being reviewed?	There is no planned review of the CAP of 12,000 civil movements for the duration of the RAF Northolt ACP.
Biggin Hill Airport Ltd.	Would RAF Northolt look at making all the routes ICAO complaint?	RAF Northolt will aim to design the procedures in accordance with PANS OPS.

Table 5: Stakeholder Questions & RAF Northolt's response from the 2022 engagement sessions

Feedback received

In total, 40 people attended an engagement event, with 33 attending an online brief and 7 attending the in-person drop-in sessions. Attendees were encouraged to use the online Feedback Form, which could be accessed by a QR code, or a link sent with the slide deck via email. Hard copies of the Feedback Form were provided at all in-person sessions, with details on how to respond provided on the take-away leaflet. Copies of all completed Feedback Forms are within Appendix F.

One feedback letter was received by London Borough of Harrow Planning Policy Team, who did not attend the brief, but received a copy of the slide deck. This letter, along with RAF

Northolt's response, can be found at Appendix F, pages 95-98. Another email was received by Aircraft Owners and Pilots Association (AOPA), who also did not attend the brief but received a copy of the slide deck. This email and the response can be found at Appendix F, page 102. Additionally, following their provision of feedback via the feedback form, Denham Aerodrome requested a Bi-Lat to further discuss RAF Northolt's Design Options. The meeting was held on 28th June 2022 and the email correspondence and minutes from the meeting can be found at Appendix D, pages 61-66. Denham also submitted a second Feedback Form following the Bi-Lat, which was received on 18th August 2022. One question was answered in the Feedback Form (Q5), which has been detailed in the qualitative analysis below.

Overall, the feedback suggests that stakeholders agreed they were informed as to where RAF Northolt is in the airspace change process. In addition, they agreed with how RAF Northolt's Design Principles are being applied to the airspace design process during Step 2A. The following key points have been extracted from the raw data collected at each engagement event:

Quantitative feedback. From the 40 attendees, 20 Feedback Forms were completed (100% of forms completed were online). One feedback form was completed by a person who did not attend the brief (see above) and one stakeholder provided two feedback forms. Eleven of the feedback forms were from attendees at the Online Airport/Airspace Users brief, four were from attendees at the Online Community brief, and three from the in-person Community briefs held at the Link Centre. Based on the Yes/No questions in the feedback form (Q4-9), 97.1% of feedback was positive, 2.9% was negative (measured as a "No" response to Question 5- '*Do you agree that RAF Northolt Design Principles are being applied to the airspace design process during Stage 2A?'* (1 response) *and* Question 7 – *'Were you satisfied with the layout of the information provided?*' (three responses). A list of the feedback received can be found at Appendix F.

Qualitative feedback. From the 19 feedback forms, 25 comments were made across six questions (Q4-7 and Q8-10). The positive comments largely focused on the approach RAF Northolt has taken being "*methodical and comprehensive*", and "*logical, with a large number of options considered*". There was mixed feedback on Question 7 – '*Were you satisfied with the layout of the information provided?*', with some comments on the presentation pack being "*informative*" and "*clear, with questions answered clearly*", but two comments stating it would have been beneficial for the movement statistics to have been broken down into military and civilian, as well as rotary and fixed wing movements. Additionally, one feedback form reported a formatting error, which was resolved, and the corrected presentation emailed to all attendees. The comments of concern focussed on the clarification of RAF Northolt's IFPs being designed to an ICAO standard and PANS Ops compliancy, as well as requests to avoid interaction with various other airport flight paths, including Denham. Additionally, one feedback form reported that RAF Northolt Design Options had not taken into consideration the safe flying over Denham ATZ (see Appendix F, pages 93-94). This form was received after the bilateral meeting with Denham held on 28th June 2022.

How the 2022 feedback influenced the process

Table 6 below summarises the main feedback received together with RAF Northolt's response.

Stakeholder	Feedback	RAF Northolt Response
Anonymous	It would have been useful to have the movement statistics broken down by military / civilian and then rotary / fixed wing / turboprop/jet, etc. it would also be useful to confirm that the designs of approaches and departures will be also designed to an ICAO standard for the civilian operators (Q7).	This level of detail will be confirmed during Stage 3. See also response to London Biggin Hill Airport.
London Borough of Ealing	I'd reserve position until further information on cumulative impacts is available (Q4).	No response required.
London Biggin Hill Airport	One question which has not yet been answered is whether the Instrument Procedures for arrivals and departures, which will determine the airspace design requirements, have been designed to PANS Ops requirements, considering Obstacle Clearance, for example.	RAF Northolt stated that it aims to design all procedures in accordance with PANS Ops during the online meeting. The formative IFP work has included some Obstacle Clearance considerations.
NERL	We have observed possible missing elements in the swathes. We would like to suggest either a widening of the swathe depicted on page 34 or additional swathes north and south of that option to ensure that maximum flexibility for design development and the deconfliction of routes between different sponsor ACPs is taken forward into Stage 3.	RWY25 Option 4 was designed to minimise newly overflown populations and minimise fuel/Greenhouse gases (straight in from LAM). The population is very high either side of the Option 1 and 4 swathes and it's not routinely overflown so any routes in there would not meet any of the DPs without knowing the direction of flight from the stack. RAF Northolt are not excluding any movement outside of the swathes in Stage 3 if necessary (for example to be operationally viable or reduce CO_2). At this stage, it would not be in accordance with RAF Northolt's DPs and process if the swathes were widened based on retaining flexibility for Stage 3 alone as it is unknown where the new easterly Heathrow stack would be. The swathes are not a constraint but are based on where RAF Northolt routes would be preferable, based on the DPs and current knowledge.
Biggin Hill Airport Ltd.	You have used taxpayers' money to undertake and ACP that is not required for military aircraft operations. This is a gross waste of taxpayer's money. You should not be undertaking an ACP at all because military aerodromes are not required to do so.	With the anticipated change to the surrounding airspace, RAF Northolt must change its airspace design accordingly. RAF Northolt were included in the minimum group of airports that CAA and NATS advised must take forward an airspace change to deliver on the AMS (see NATS

		Feasibility Report into Airspace Modernisation in the south of the UK and the CAA Assurance into the NATS Feasibility Report).
British Helicopter Association	Just do not impact the Heli-lanes.	In line with DP3 RAF Northolt will consider all other airspace users.
Heathrow Airport Ltd.	Due to the impacts of COVID, Heathrow has temporarily paused work on the application for planning consent for Heathrow expansion. The ANPS supporting a third runway at Heathrow remains up to date planning policy on airport expansion in the southeast and continues to have full effect.	Noted.
Denham Aerodrome (Bickerton's Aerodromes Ltd)	During engagement with RAF Northolt in 2019 Denham raised concerns about safety of Denham traffic due to restrictions in Denham's ATZ as a result of RAF Northolt traffic flying through Denham's ATZ. The RAF Northolt Design Options have not clearly addressed these safety concerns and the measures proposed to enhance safety in the Denham ATZ. Further discussion took place at a meeting 28 June 2022. Denham has noted that the Letter of Agreement dating back many years was created when there was less traffic at RAF Northolt and it was military, and the change of circumstances to more traffic which are now predominantly civil is a change in circumstances that should be transparently addressed.	For a detailed response please see meeting notes in Appendix D. In summary, RAF Northolt has designed RWY25 departure options which aim to avoid the Denham ATZ. These will rely on changes to the Heathrow operation to be safely accommodated. Currently RAF Northolt do not know if those changes at Heathrow are feasible and/or acceptable to Heathrow.

Table 6: Summary of 2022 Stakeholder Feedback & RAF Northolt's responses

The next section sets out RAF Northolt's Comprehensive List of Options at Step 2A, as a result of the design and engagement work so far.

RAF Northolt's Airspace Design Options at Step 2A

This section sets out RAF Northolt's Comprehensive List of Options at Step 2A of the Airspace Change Proposal. Each option has a description of what it is trying to achieve and, for the purposes of enabling stakeholder engagement and enabling the DPE and analysis in the Initial Options Appraisal (IOA), a range of illustrative route centrelines each aiming to achieve various Design Principles. 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 Comprehensive List of Options:

- 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 us 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.

- All the illustrative track lengths are based on an assumption of 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, 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.

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 in order 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.

As described in the Stakeholder engagement section, RAF Northolt has a series of different options broken down into the following categories:

- Easterly Arrival Options

- Westerly Arrival Options

- Easterly Departure Options
- Westerly Departure Options

Do Nothing

This option would see RAF Northolt maintaining the Status Quo with its airspace design (the London CTR as per the Civil AIP) and its IFPs (as per the Military AIP).

Figure 22 below illustrates the overflight swathes experienced in 2016 with nominal centrelines of those swathes which could be IFPs or vectored traffic patterns. The nominal centrelines shown below will be used for baseline comparisons in the Design Principle Evaluation and Initial Options Appraisal.

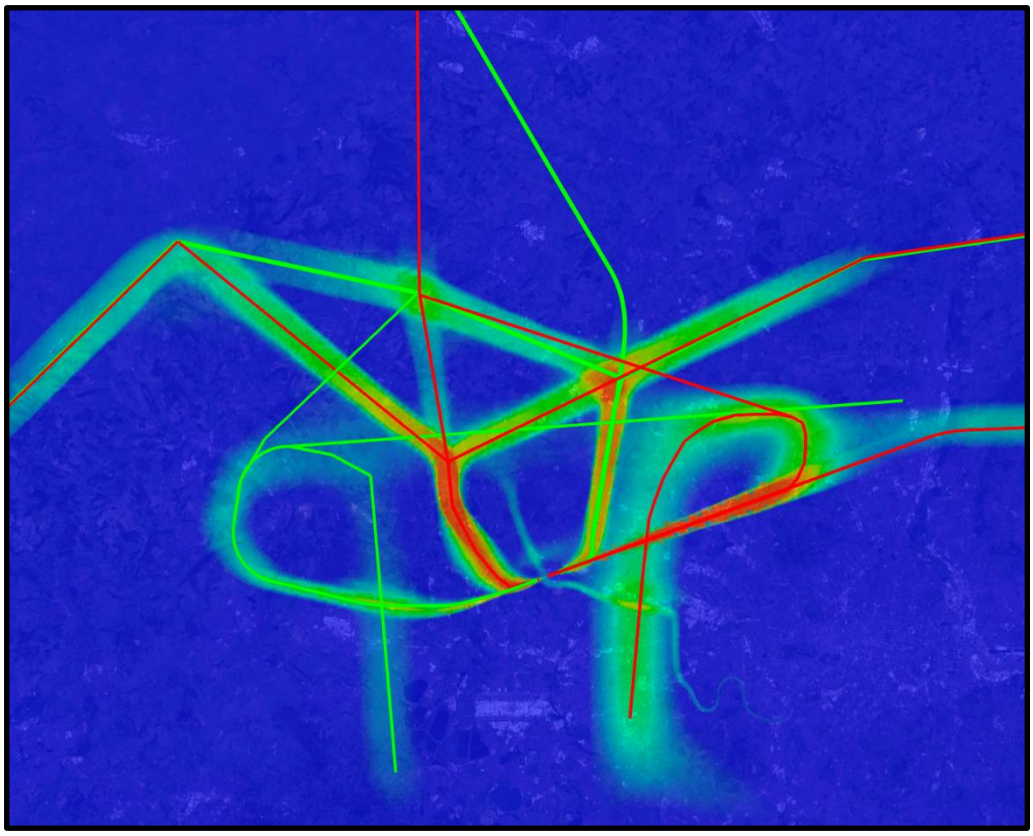

Figure 22: RAF Northolt's existing traffic patterns

The high number of similar, illustrative tracks represent the many different types of types of approach that are being investigated including PBN to ILS, RNP APCH, offset approaches, straight in approaches and different final approach joining point locations.

Easterly Arrivals Option 1: Approach from the north/northeast

This option would see arrivals approach RAF Northolt from the north and/or northeast of the aerodrome. 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.

Figure 23: Option 1, with arrows showing direction of traffic flows

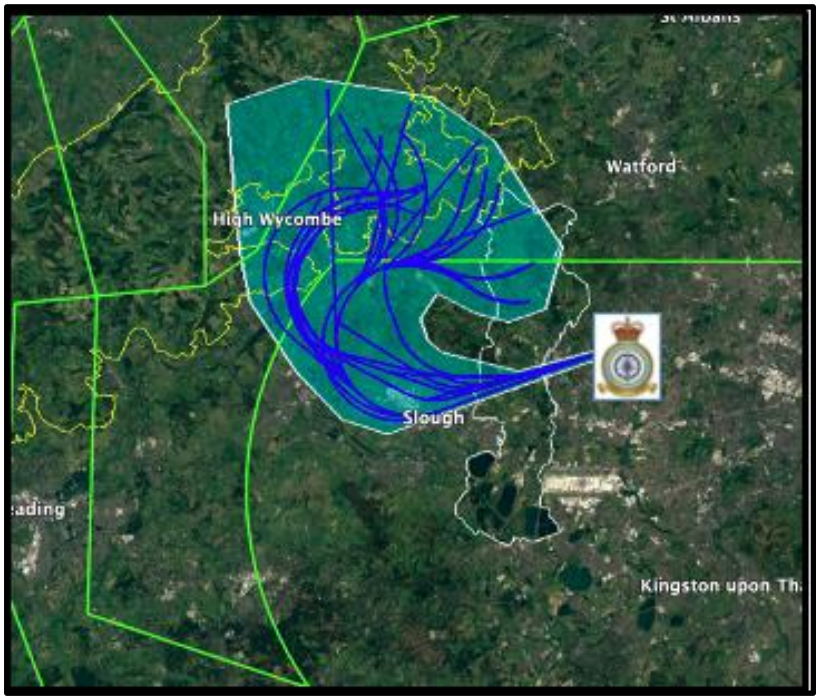

Figure 24: Option 1, illustrative flight paths

Easterly Arrivals Option 2: Approach from west/northwest

This option would see arrivals approaching RAF Northolt from the west/northwest of the aerodrome to join final approach at c.7/8nm final. This would be a significantly different direction of arrival compared to today.

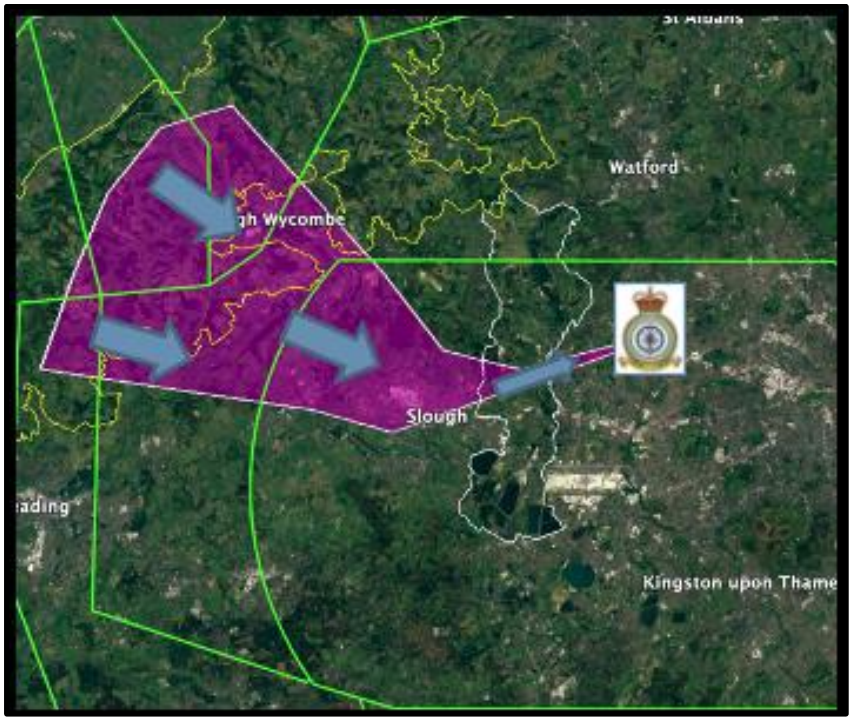

Figure 25: Option 2, with arrows showing direction of traffic flows

Figure 26: Option 2, illustrative flight paths

Easterly Arrivals Option 3: Approach from south

This option would see arrivals making an approach from the west and/or south of RWY07 extended centreline. This would generate a much more direct arrival from the OCK/BIG directions.

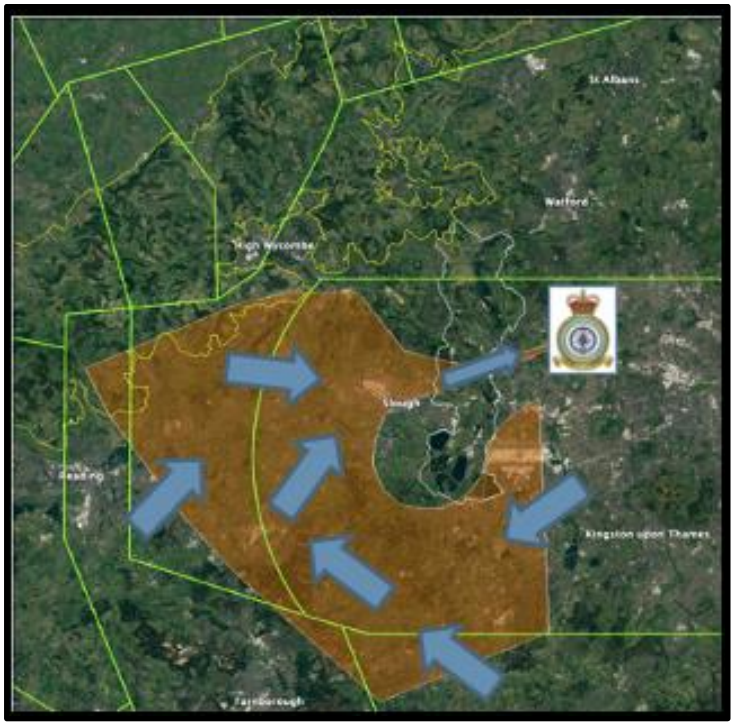

Figure 27: Option 3, with arrows showing direction of traffic flows

Figure 28: Option 3, illustrative flight paths

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.

Figure 29: Option 1, with arrows showing direction of traffic flows

Figure 30: Option 1, illustrative fight paths

Westerly Arrivals Option 2: Approach from 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.

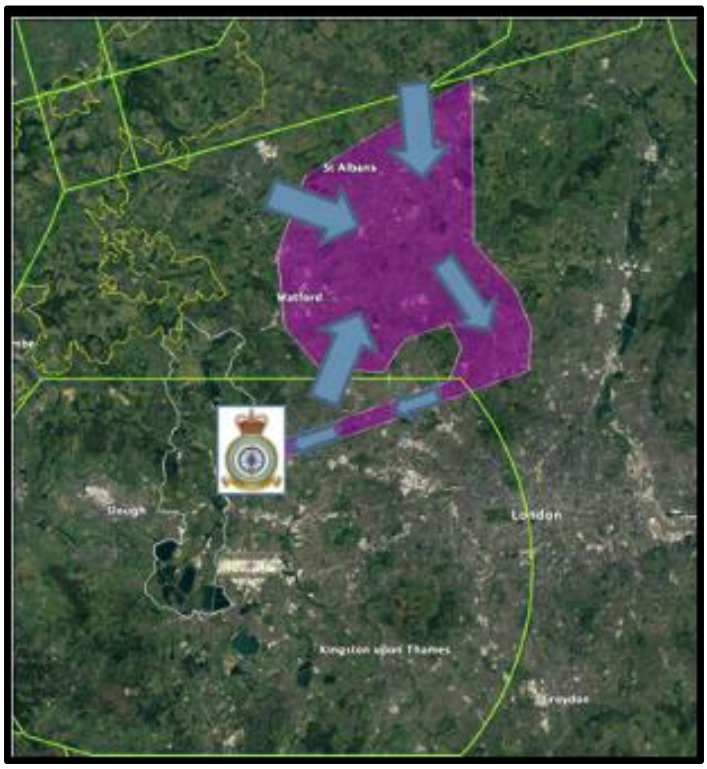

Figure 31: Option 2, with arrows showing direction of traffic flows

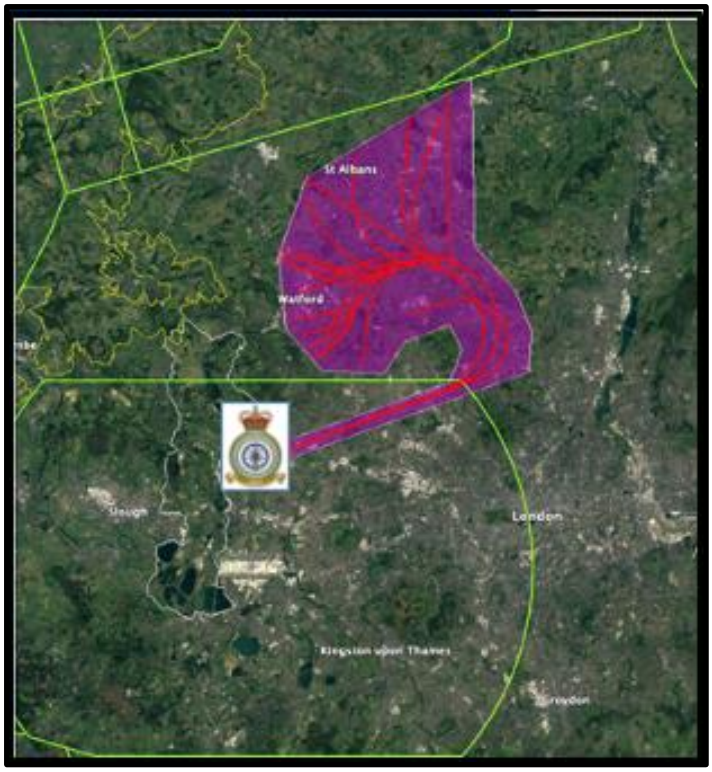

Figure 32: Option 2, illustrative flight paths

Westerly Arrivals Option 3: Approach from the south

This option would see arrivals making an approach from the south of the RWY25 extended centreline, rather than from the north. This would generate a much more direct arrival for traffic from the south (OCK/BIG)

Figure 33: Option 3, with arrows showing direction of traffic flows

Figure 34: Option 3, illustrative flight paths

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.

Figure 35: Option 4, with arrows showing direction of traffic flows

Figure 36: Option 4, illustrative flight paths

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 vicinity of BPK.

Figure 37: Option 1, with arrows showing direction of traffic flows

Figure 38: Option 1, illustrative flight paths

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.

Figure 39: Option 2, with arrows showing direction of traffic flows

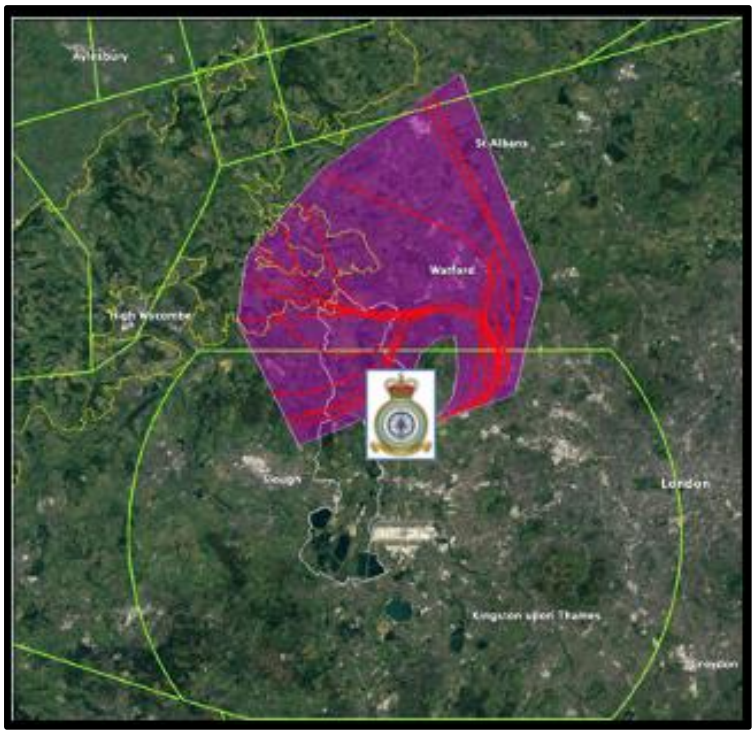

Figure 40: Option 2, illustrative flight paths

Easterly Departures Option 3: Depart to the south

This option would see departures from RWY07 turning much more direct to the south to avoid flying all the way around Heathrow.

Figure 41: Option 3, with arrows showing direction of traffic flows

Figure 42: Option 3, illustrative flight paths

Easterly Departures Option 4: Depart to the east

This option would see RWY07 departures climbing straight ahead for much longer than today to minimise numbers of people newly overflown and total population overflown.

Figure 43: Option 4, with arrows showing direction of traffic flows

Figure 44: Option 4, illustrative flight paths

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 of 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.

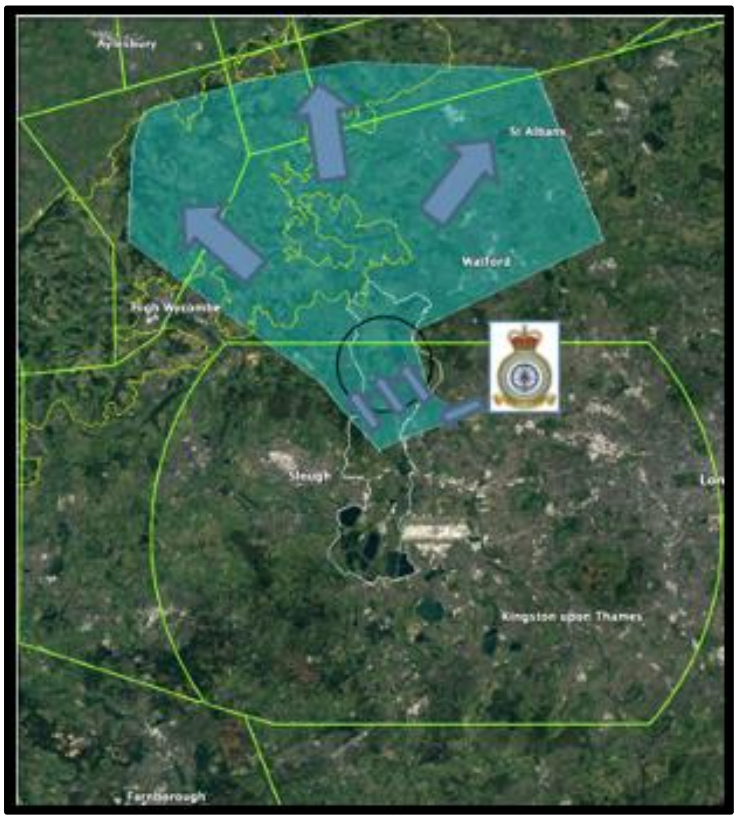

Figure 45: Option 1, with arrows showing direction of traffic flows. Denham ATZ in black.

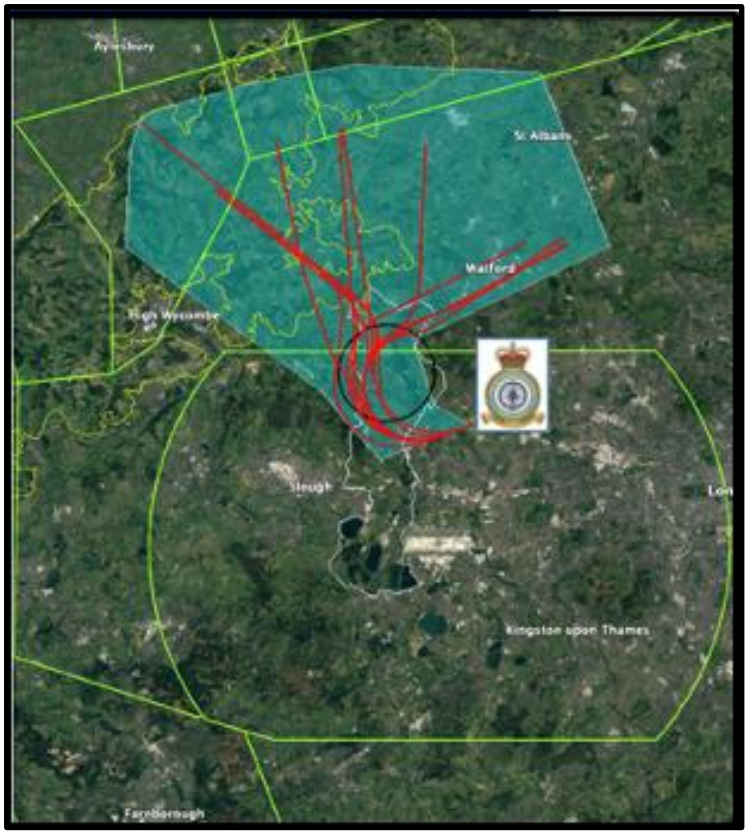

Figure 46: Option 1, illustrative flight paths. Denham ATZ in black.

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.

Figure 47: Option 2, with arrows showing direction of traffic flows. Denham ATZ in black

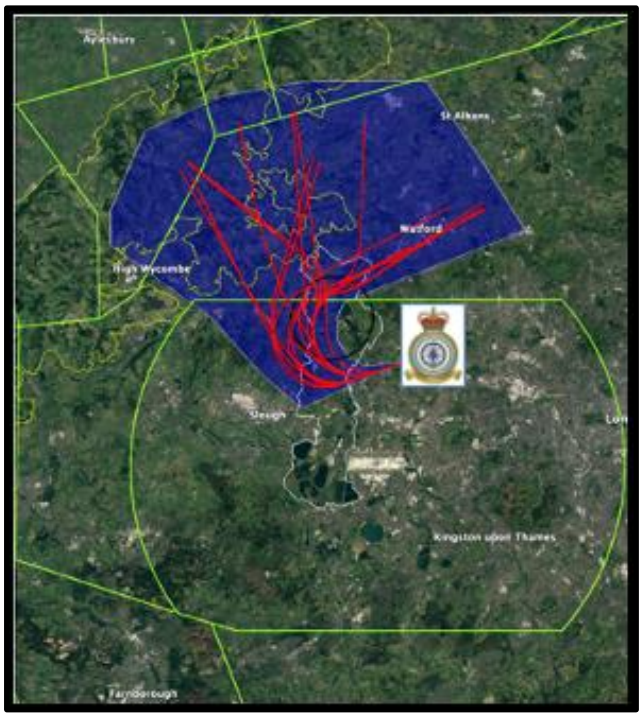

Figure 48: Option 2, illustrative flight paths. Denham ATZ in black.

Westerly Departures Option 3: Depart to the west

This option would see RWY25 departures following the existing RWY07 arrival swathe, north of Slough towards Marlow before continuing west or turning north. RAF Northolt would expect these tracks to service west/southwest (CPT) departures.

Figure 49: Option 3, with arrows showing direction of traffic flows. Denham ATZ in black.

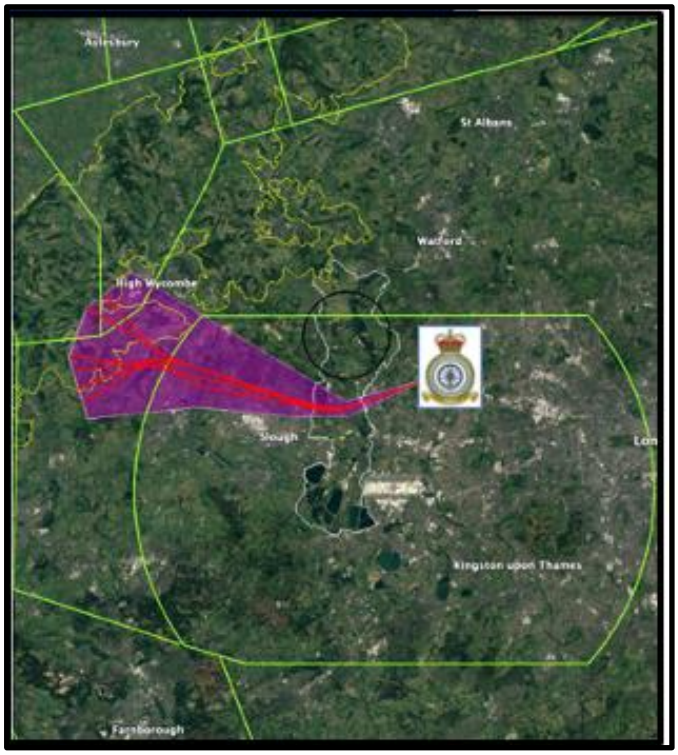

Figure 50: Option 3, illustrative flight paths. Denham ATZ in black.

Westerly Departures Option 4: Depart to the south

This option would see departures from RWY25 turning much more direct to the south to avoid flying all the way around Heathrow.

Figure 51: Option 4, with arrows showing direction of traffic flows. Denham ATZ in black.

Figure 52: Option 4, illustrative flight paths. Denham ATZ in black.

Options for Controlled Airspace and other Procedures

Non-airways Departures (CHARLIE/ ROMEO)

RAF Northolt has published departures for aircraft not joining the ATS network. They ensure obstacle protection before directing aircraft to leave CAS at the edge of the London CTR, without climbing into the TMA. They are usually only used by Military aircraft and infrequently (on average less than once per day), but when they are used, it is often helicopters departing IFR. They are based on conventional navigation aids that are due to be decommissioned and therefore will also need to be upgraded to PBN. Their design is not integral to the wider LTMA design and will be closely linked to the wider final RAF Northolt solution. However, until the final CAS construct is known, and RAF Northolt's core airways arrival and departure designs and Heathrow interactions are determined, it is not possible to generate solutions.

Radar Training Circuit

RAF Northolt has Radar Training Circuits published in the Military AIP, for use by RAF Northolt-based aircraft, used for crew training. They are designed to provide obstacle protection and ensure the aircraft can be contained within the Radar Manoeuvring Area (RMA). The RMA is based on the overall LTMA design, including separation from Heathrow and Luton. There is potential that they would need to be redesigned to compliment the wider airspace design. However, until the final CAS construct is known, RAF Northolt's core arrival and departure designs, and Heathrow interactions are determined, it is not possible to generate solutions.

Missed Approaches

These procedures are part of an Instrument Approach Procedure and enable aircraft to safely reposition for another approach under certain circumstances if they are unable to land from their first approach. This is a safe and routine part of operations for all pilots and air traffic controllers. There are many reasons for a pilot, or an air traffic controller, to initiate a missed approach. RAF Northolt do not keep records of Missed Approaches but anecdotally, they are very uncommon, occurring on average once every 2-3 months.

The design of the Missed Approach Procedure is very specific to the type of approach and the airspace construct and sometimes, the initial departure tracks. It is unknown if there will be a requirement to change the Missed Approach procedures at this stage, nor the ability to guess what they will look like due to all the variables and it would not be proportional to attempt to do so.

After the Full Options Appraisal (FOA) concludes and RAF Northolt's preferred options are chosen, the Missed Approaches will then be considered to support the safe operation of the design and include the considerations in the consultation material in Stage 3.

Controlled Airspace

RAF Northolt doesn't have a CAS volume associated with the aerodrome. It is located within the LON CTR and wherever possible IFR arrivals and departures are contained within the London CTR and adjacent LTMA structures.

Airspace containment of IFPs is very closely related to the design characteristics as well as track performance (flyability) along the route centrelines. As described previously, the illustrative flight paths are likely to move as options are refined throughout the project. Refinement will be based on integration with the wider airspace network (especially Heathrow) 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.

In the absence of near-final proposals from RAF Northolt, Heathrow and adjacent LTMA aerodromes, it is not feasible at this stage to design CAS structures. Any changes to CAS dimensions within the LTMA and/or London CTR are dependent on detailed Heathrow, NERL and adjacent route interactions. It is the aspiration of RAF Northolt to contain the airways arrival and departure IFPs within CAS and ideally reduce the extant volume of CAS wherever possible.

Design Principle Evaluation

As part of the Airspace Change Process at Step 1B, RAF Northolt developed a set of Design Principles with identified stakeholders. The aim of the Design Principles is to provide high-level criteria that the proposed airspace design options should meet. They also provide a means of analysing the impact of different design options and a framework for choosing between or prioritising options.

The Design Principle Evaluation (DPE) involves taking all the options developed and qualitatively evaluating them against the Design Principles to understand how well they are aligned. This helps to determine which options best meet the Design Principles and therefore will be taken forward to the next stage of the airspace change proposal, or if any can be discontinued at this stage.

Design Principle Evaluation

At the Design Principle Evaluation (DPE) step, CAP1616 requires airspace change sponsors to qualitatively evaluate options against the Design Principles, and categorises each evaluation as either 'met', 'partially met' or 'not met'.

The CAA has requested evidence that the DPE includes an assessment of how the different Design Options respond to the relevant Airspace Modernisation Strategy (AMS) Design Principle:

"*Subject to the overriding design principle of maintaining a high standard of safety, the highest priority principle of this airspace change that cannot be discounted is that it accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it*."

There are five known outcomes, or ends, that are expected from airspace modernisation as detailed in CAP1711 and RAF Northolt's Design Principles already include these objectives. Table 7 sets out which parts of RAF Northolt's DPE assesses against the five AMS known outcomes.

AMS known outcome	RAF Northolt's Design Principle which assesses this outcome
Maintain and enhance high aviation safety standards	Must be safe
Secure the efficient use of airspace and enable integration	Should minimise impact on other airspace users
Avoid flight delays by better managing the airspace network	Should facilitate operational efficiencies to maximise benefits to as many stakeholders as possible
Improve environmental performance by reducing emissions and by better managing noise	Should minimise fuel and greenhouse gases

	Should minimise the impact of aircraft noise by: a. Minimising the number of people newly overflown b. Minimising the total number of people affected by noise c. Where possible minimise overflight of communities with multiple routes
Facilitate defence and security objectives	Must ensure continuation of military and governmental operational activity.

Table 7: AMS Known Outcomes Mapped Against RAF Northolt's Design Principles

To evaluate each option in a fair and transparent way, the methodologies set out in Table 8 have been followed when evaluating against each Design Principle.

Design Principle Evaluation Methodology

The illustrative tracks within each option have been placed into groups that could be expected to have a similar order of magnitude of impacts and benefits and then used to contribute to the overall evaluation of the Option as a whole.

Where evaluation of all the groups of illustrative tracks within an option have the same result (Met, Partially Met or Not Met), the Option will receive that evaluation outcome for that Principle. Where there are different results depending on the different groups of illustrative tracks, that DP will be marked as Partly Met for the option. An illustrative example is shown in Figure 53.

The exception to this is the baseline assessment of the AMS principle. The CAA has requested evidence that the Design Principle Evaluation includes an assessment of how the different Design Options respond to the relevant AMS Design Principle: "*Subject to the overriding design principle of maintaining a high standard of safety, the highest priority principle of this airspace change that cannot be discounted is that it accords with the CAA's published Airspace Modernisation Strategy (CAP1711) and any current or future plans associated with it.*"

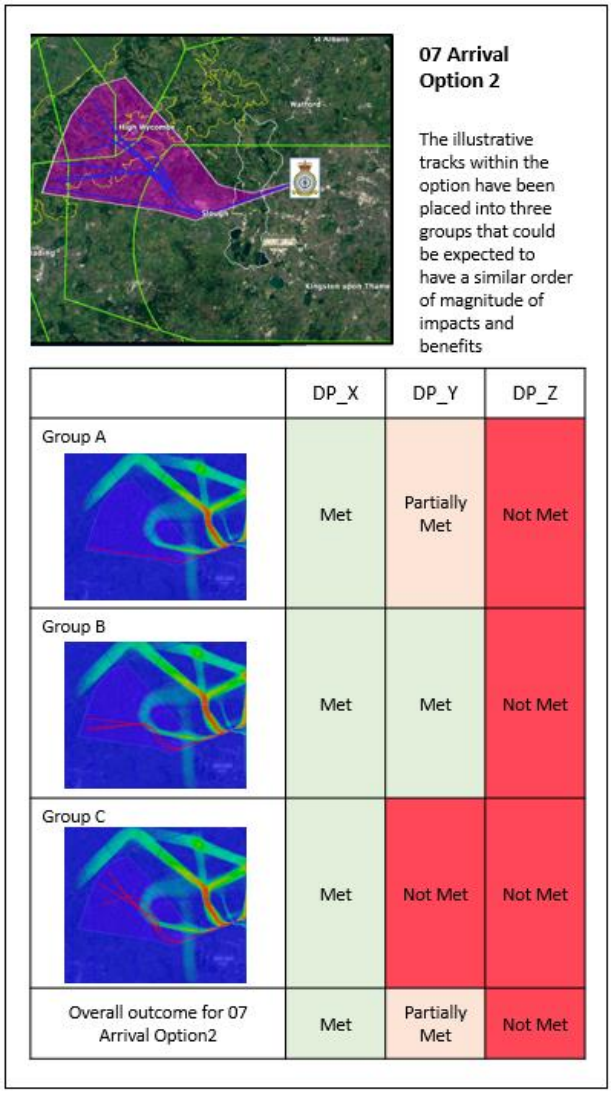

Figure 53 Illustrative Example of DPE

The 'Do Nothing' scenario did not meet the AMS Design Principle, as it would not offer any opportunity for the airspace to be modernised, in accordance with AMS and Masterplan requirements. This 'Do Nothing' scenario has been discontinued; however, the 'Do Nothing' scenario will remain present throughout the ACP for baseline comparative purposes only.

	Design Principle	Approach to Evaluation	Met	Partially Met	Not Met	Criteria for Discontinuing
1	Must be safe	Qualitative assessment will be undertaken by SME. The assessment will state any potential safety concerns and indicate if additional safety case mitigation may be required ahead of ACP submission.	No reason identified as to why the option is less safe than today and cannot be operated within existing rulesets and separation standards	The airspace design is anticipated to be safe, however additional work would be required to generate an acceptable safety case and/or new standards may be required	Acceptable safety assurances are not likely to be met, therefore option discontinued.	Option will be discontinued at this stage if it does not meet this DP as it is a Must DP
2	Must ensure continuation of military and governmental operational activity	A qualitative assessment to determine if any of the options have any characteristics that would inhibit the future military and governmental operational activity to/from RAF Northolt	Nothing identified as to why the option would not ensure the continuation of military and governmental operational activity	N/A – The assessment is whether an option does or doesn't ensure continuation of military and governmental operational activity	Issue(s) identified which may not ensure continuation of military and governmental operational activity	Option will be discontinued at this stage if it does not meet this DP as it is a Must DP
3	Should minimise impact on other airspace users	Qualitative assessment of whether each option could affect one or more of the following: - Require more/less CAS where the assumption is that more CAS is more likely to have a negative impact, - Enable/inhibit CCO/CDO for other airports routes below 7000ft, - Affect existing helicopter routes, - Impact on GA or adjacent airport operations. Whilst design options are not available from Heathrow at the time of this evaluation, due to the proximity to RAF Northolt as well as significant points within NERL's Network, there is confidence that where there would be significant impacts on RAF Northolt/Heathrow based on geography and limited scope to change some of the existing interactions close to the airports.	No issues currently identified that would negatively affect other airspace users	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	Issue(s) identified which would result in a detrimental impact on other airspace users to the point of significantly disrupting their operations.	Option will not be discontinued at this stage if it does not meet this DP alone as it is a Should DP[10]
4	Should facilitate design using modern navigational technology	Qualitative assessment of whether an option is expected to adopt modern navigational technology i.e., Performance Based Navigation (PBN).	The option adopts the PBN.	N/A – the option either requires PBN or doesn't.	The option does not adopt PBN.	Option will not be discontinued at this stage if it does not meet this DP alone as it is a Should DP[11]
5	Should facilitate operational efficiencies to maximise benefits to as many stakeholders as possible	Operational efficiencies cover a wide range of in considerations. For this evaluation there is a focus on delay, as considerations such as CCO/CDO, CO2 and impact on other airspace users are addressed by other Design principles. Note that our SoN states the importance of trying to reduce conflictions and dependencies between RAF Northolt, Luton, Heathrow, and other local airports. A qualitative assessment of whether the option is expected to minimise or increase delay for RAF Northolt or other FASI future airport operations. Whilst design options are not available from Heathrow at the time of this evaluation, due to the proximity to RAF Northolt there is a confidence that where there would be significant impacts on RAF Northolt/Heathrow based on geography and limited scope to change some of the existing interactions close to the airports.	Option has specific characteristics which would minimise delay for RAF Northolt and/or adjacent FASI aerodromes.	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.	Option has characteristics that **could** generate increased delay for RAF Northolt or adjacent FASI aerodromes	Option will not be discontinued at this stage if it does not meet this DP alone as it is a Should DP[8]

[10]Although the options will not be discontinued on the basis of this DP alone, their performance against this DP will be considered as part of their overall performance in the Design Principle Evaluation; please see the 'discontinuing methodology' section below for further details.
[11]Although the options will not be discontinued on the basis of this DP alone, their performance against this DP will be considered as part of their overall performance in the Design Principle Evaluation; please see the 'discontinuing methodology' section below for further details.

	Design Principle		Approach to Evaluation	Met	Partially Met	Not Met	Criteria for Discontinuing
6	Should minimise fuel and greenhouse gases		Assessment based on carbon emissions of each option, using track mileage as an initial surrogate. Following engagement with NERL and Heathrow, there is an anticipation 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 they would route via the Lambourne (LAM)/Bovingdon (BNN)/Ockham (OCK)/Biggin (BIG) directions, noting that the exact locations will be determined in Stage 3. For departures the qualitative estimate is based on the options direction compared to expected Network points such as DAGGA/Compton (CPT) and Trent (TNT).	The option is expected to reduce track mileage compared to the baseline.	The option is not expected to significantly change compared to the baseline.	The option is expected to increase track mileage compared to the baseline.	Option will <u>not</u> be discontinued at this stage if it does not meet this DP alone as it is a Should DP[12]
7	Should minimise the impact of aircraft noise by;	Minimising the number of people newly overflown	Qualitative assessment of how closely aligned the option is to the baseline RAF Northolt traffic patterns.	The option is very closely aligned to RAF Northolt's existing traffic patterns and will minimise numbers of people newly overflown.	The option has some elements aligned to RAF Northolt's existing traffic patterns but could result in some overflight of communities not currently overflown by RAF Northolt's movements.	The option is significantly different to RAF Northolt's existing traffic patterns and would be expected to significantly increase the number of people newly overflown.	Option will <u>not</u> be discontinued at this stage if it does not meet this DP alone as it is a Should DP[9]
		Minimising the total number of people affected by noise	A qualitative assessment of the extent to which the options avoid areas of dense population where it is possible for the route to do so; defined as the areas outside of final approach or the immediate climb out.	The position of the tracks have been designed to avoid overflight of dense population where technically possible.	N/A - The tracks have either been designed to avoid population or they haven't. However, where different groups of tracks within an option have different evaluations, this will result in a partially met evaluation overall.	The position of the tracks have not been designed to avoid overflight of dense population where technically possible.	Option will <u>not</u> be discontinued at this stage if it does not meet this DP alone as it is a Should DP[9]
		Where possible minimise overflight of communities with multiple routes	Given RAF Northolt's proximity to Heathrow, Luton, and London City it is unlikely that no communities will experience overflight with multiple routes. This is a qualitative assessment of whether the option specifically conflicts with options from adjacent airports (where available) and/or whether there are characteristics of the option that could result in similar, more or less overflight of communities by multiple routes compared to today. Whilst design options are not available from Heathrow at the time of this evaluation, due to the proximity to RAF Northolt there is a confidence that where there is always going to be significant interactions between RAF Northolt/Heathrow based on geography and limited scope to change some of the existing interactions close to the airports.	The option does not currently overlap with options developed by adjacent airports (where available) and has characteristics that could result in less overflight of communities by multiple routes.	The option does overlap with options developed by adjacent airports and overflight from multiple routes could be expected to be similar today.	The option does overlap with options developed by adjacent airports and the option also contains characteristics which could increase overflight of communities with multiple routes.	Option will <u>not</u> be discontinued at this stage if it does not meet this DP alone as it is a Should DP[9]
	Subject to the overriding design principle of maintaining a high standard of safety, the highest priority principle of this airspace change that cannot be discounted is that it accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it.	Maintain and enhance high aviation safety standards	The outcome of DP1 will be used to evaluate this AMS objective	See DP1	See DP1	See DP1	Option <u>will be</u> discontinued at this stage if it does not meet this AMS objective owing to its relationship to DP1 which is a Must principle
		Secure the efficient use of airspace and enable integration	The outcome of DP3 will be used to evaluate this AMS objective	See DP3	See DP3	See DP3	Option will <u>not</u> be discontinued at this stage if it does not meet this AMS objective alone at this time

[12] Although the options will not be discontinued on the basis of this DP alone, their performance against this DP will be considered as part of their overall performance in the Design Principle Evaluation; please see the 'discontinuing methodology' section below for further details.

Design Principle		Approach to Evaluation	Met	Partially Met	Not Met	Criteria for Discontinuing
	Avoid flight delays by better managing the airspace network	The outcome of DP5 will be used to evaluate this AMS objective	See DP5	See DP5	See DP5	Option will not be discontinued at this stage if it does not meet this AMS objective alone at this time
	Improve environmental performance by reducing emissions and by better managing noise	The outcome of DP6 and DP7 will be used to evaluate this AMS objective	See DP6 and DP7	See DP6 and DP7	See DP6 and DP7	Option will not be discontinued at this stage if it does not meet this AMS objective alone at this time
	Facilitate defence and security objectives	The outcome of DP2 will be used to evaluate this AMS objective	See DP2	See DP2	See DP2	Option will be discontinued at this stage if it does not meet this AMS objective owing to its relationship to DP2 which is a Must principle

Table 8: DPE Methodology

Discontinuing Methodology and DPE Outcome

The DPE itself provides methodology for discontinuing options; at this early stage it provides a broad overview of an options' overall performance against all the Design Principles and allows us to identify any options that overall perform comparatively poorly.

As part of Step 1B, RAF Northolt's Design Principles 1 and 2 were prioritised above all others; these were defined as 'must' Design Principles. These Design Principles are 'Must be safe' and 'Must ensure continuation of military and governmental operational activity'. There is no priority accorded to the remaining Design Principles which were defined as 'should' Design Principles.

In the first instance, when determining which options to discontinue, the two 'must' Design Principles have been looked at. Any option that does not meet these two 'must' Design Principles will be discontinued.

Subsequently, the remaining five Design Principles (including the 3 sub-DPs associated with DP7) were looked at, and the options overall performance were reviewed against these. If an option has been evaluated as 'not meeting' 4 or more DPs (including the 3 sub-DPs) then it will be discontinued even if it meets the 'must' Design Principles. Any remaining options which have a mix of performance across the Design Principles will continue to the Initial Options Appraisal (IOA) for more detailed assessment. It is important to note that discontinued Design Options may need to be re-introduced after "integration" occurs in Stage 3 for Masterplan reasons.

Summary of Design Principle Evaluation

Option Name	DP1	DP2	DP3	DP4	DP5	DP6	DP7			Subject to the overriding design principle of maintaining a high standard of safety, the highest priority principle of this airspace change that cannot be discounted is that it accords with the CAA's published Airspace Modernisation Strategy (CAP 1711) and any current or future plans associated with it	Carried forward into IOA?
	Must be safe	Must ensure continuation of military and governmental operational activity	Should minimise impact on other airspace users	Should facilitate design using modern navigational technology	Should facilitate operational efficiencies to maximise benefits to as many stakeholders as possible	Should minimise fuel and greenhouse gases	a. Minimising the number of people newly overflown	b. Minimising the total number of people affected by noise	c. Where possible minimise overflight of communities with multiple routes		
Do Nothing											No
07 Arrv Option 1											Yes
07 Arrv Option 2											No - Discontinued as four or more 'should' DP categories have been evaluated as 'not met'
07 Arrv Option 3											No - Discontinued as does not meet DP2 (and four 'should' DP categories have been evaluated as 'not met')
25 Arrv Option 1											Yes
25 Arrv Option 2											Yes
25 Arrv Option 3											No - Discontinued as does not meet DP2 (and four 'should' DP categories have been evaluated as 'not met')
25 Arrv Option 4											Yes
07 Dep Option 1											Yes
07 Dep Option 2											Yes
07 Dep Option 3											No - Discontinued as does not meet DP2 (and four 'should' DP categories have been evaluated as 'not met')
07 Dep Option 4											No - Discontinued as does not meet DP2
25 Dep Option 1											Yes
25 Dep Option 2											Yes
25 Dep Option 3											No - Discontinued as does not meet DP2
25 Dep Option 4											No - Discontinued as does not meet DP2 (and four 'should' DP categories have been evaluated as 'not met')

Table 9: DPE Summary Table

Next Steps

The next stage of the ACP process involves undertaking an Initial Options Appraisal (IOA) of the options brought through from the DPE, to understand in further detail the benefits and impacts.