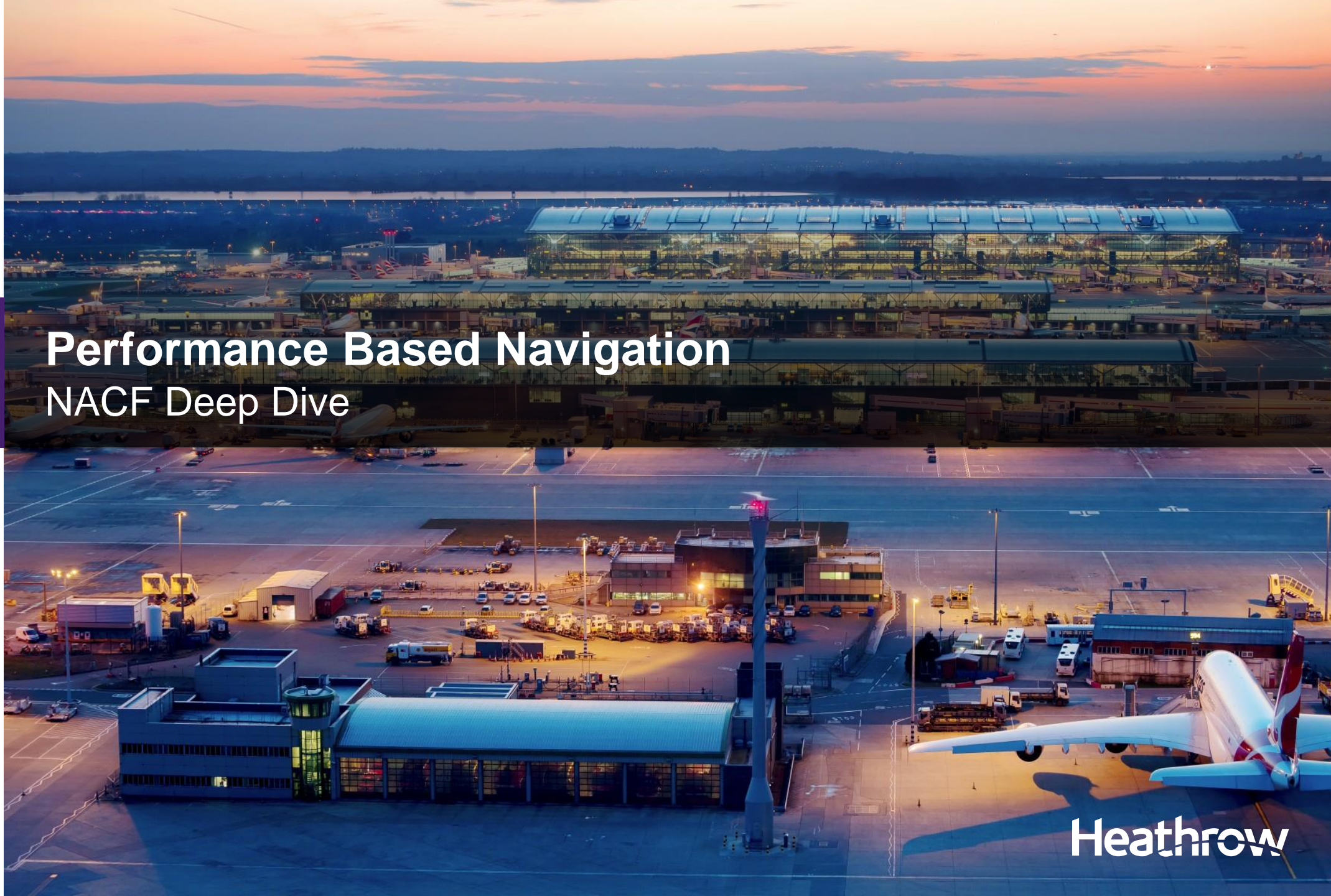


24 July 2024

Performance Based Navigation NACF Deep Dive

Heathrow



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OBJECTIVES OF THIS SESSION

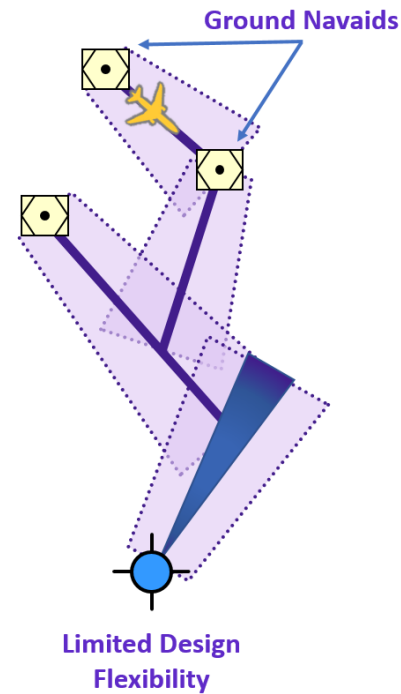
- To reach a common understanding of what PBN is
- To explore the benefits of PBN and why it is being introduced worldwide
- To discuss community concerns about the introduction of PBN
- To share lessons learnt: from Heathrow and other airports
- To explore ways in which Heathrow might be able to reduce concerns about PBN via:
 - Stakeholder engagement
 - Incorporating respite and relief into the airspace design
 - Application of lessons learnt and best practice
 - Further research

The introduction of PBN is fundamental to airspace modernisation and Heathrow needs to re-design our airspace to include PBN: the purpose of this Deep Dive is to discuss the ways in which the potential impacts of PBN might be mitigated or managed, and to consider specific concerns and lessons learnt from PBN implementation elsewhere

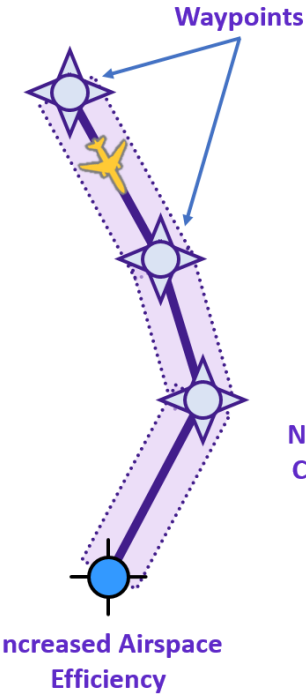
WHAT IS PERFORMANCE BASED NAVIGATION?

- Performance Based Navigation (PBN) is an advanced, satellite-enabled form of air navigation that can create precise three-dimensional (3D) flight paths
- The ability to have aircraft fly a precise flight path has benefits for Air Navigation Service Providers (e.g. NATS) and airlines
- PBN can enable several operational benefits, including enhanced safety, increased efficiency, reduced carbon emissions and reduced fuel cost

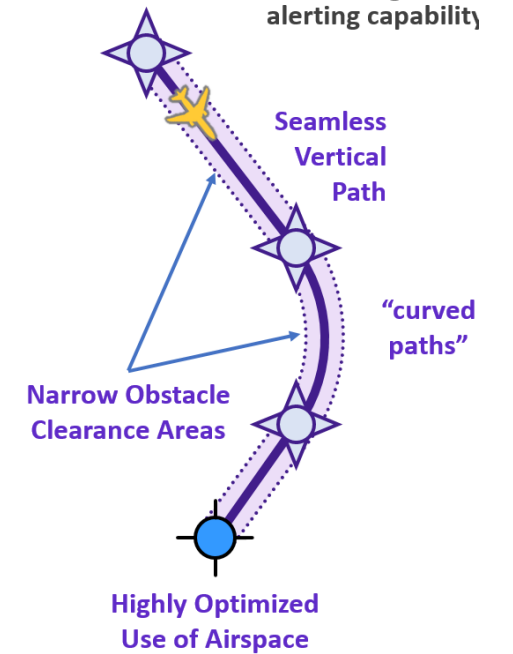
Conventional Routes



RNAV



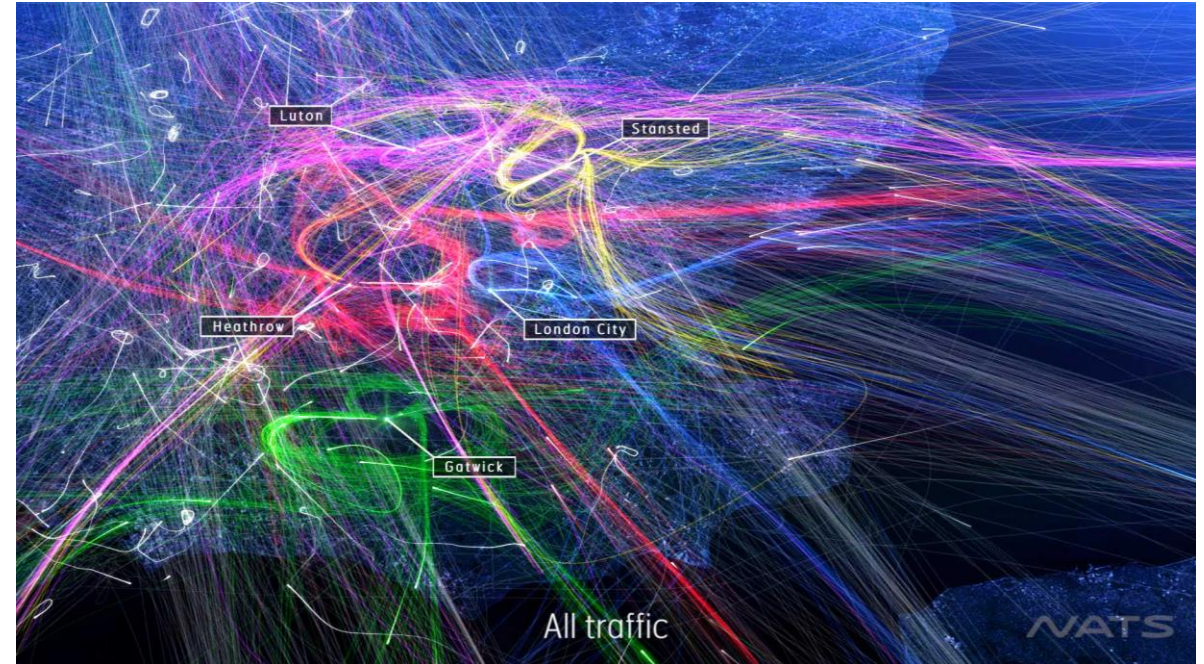
RNP (with on-board performance monitoring and alerting capability)



Navigation accuracy is improving and this increased concentration of aircraft on a route has been noticed by some local communities

WHY IS HEATHROW INTRODUCING PBN?

- UK Airspace Infrastructure hasn't changed for decades: today's flight paths were generally designed in the 1960s
- Since 1950, Air Traffic Movements have increased by more than 1000%
- Current navigational systems are becoming obsolete: ground-based navigation beacons are being withdrawn from service
- Heathrow has been directed by government to modernise its airspace in accordance with the CAA's Airspace Modernisation Strategy



PBN is mandatory:

- Pilot Common Project (PCP) Regulation (*Regulation 716/2014*)
- The PBN Implementing Rule (*Regulation 2018/1048*)
- CAA publication CAP 1378 (*Performance-based Navigation Airspace Design Guidance*) referenced in *Air Navigation Guidance 2017*

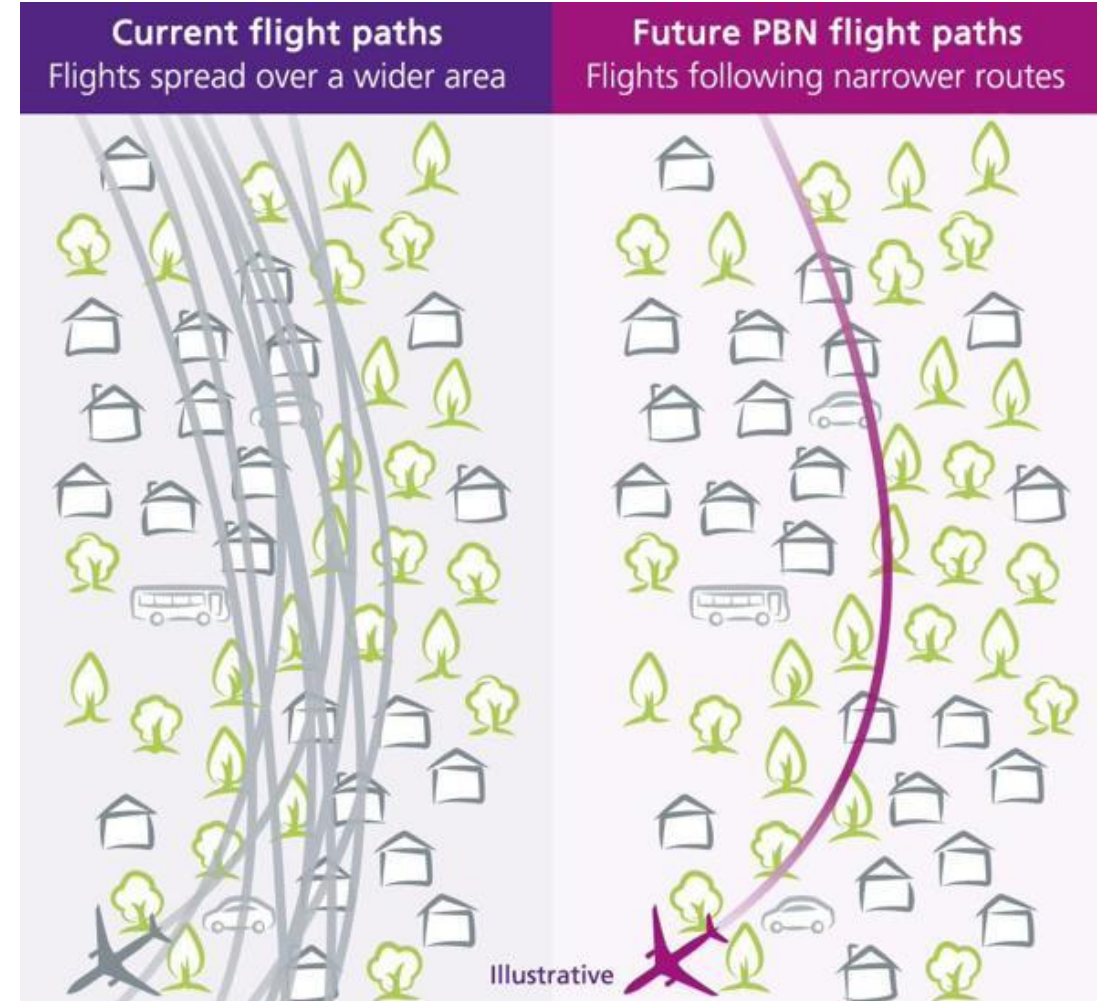
WHAT ARE THE BENEFITS OF PBN?

- PBN can enable **enhanced safety** and **greater capacity and resilience within the UK's airways***
- PBN can offer greater flexibility for **more efficient routings** throughout the entire flight and **reduced track mileage**, which **reduces flight times, associated CO2 and other greenhouse gas emissions**
- PBN can enable improved climb and descent operations (CCO and CDO) which can **reduce noise** for some overflowed communities
- **PBN can be used as a tool to provide respite or relief from noise for overflowed communities**
- PBN enables aircraft to fly routes with greater accuracy, which can **reduce the number of people overflowed**

* We do not expect PBN to increase capacity or resilience at Heathrow

CONSIDERATIONS FOR INTRODUCING PBN

- When re-designing airspace, we must consider the impacts of potential noise concentration on local communities
- We also need to understand if the improved accuracy of PBN routes might enable PBN to be used as a noise mitigation technique to offer respite and/or relief from aircraft noise for overflowed communities
- **Can PBN be implemented at Heathrow in a way that benefits those currently overflowed?**



INTRODUCING PBN AT HEATHROW

- There is various policy and guidance to be followed (e.g. Air Navigation Guidance, CAP1616)
- *“The government’s overall policy on aviation noise is to balance the economic and consumer benefits of aviation against their social and health implications... This should...recognise the additional health impacts of night flights. The impact of aviation noise must be mitigated as much as is practicable and realistic to do so, limiting, and where possible reducing, the total adverse impacts on health and quality of life from aviation noise.”**
- There are trade-offs to consider such as:
 - ? **Reducing the number of people affected by noise vs. Providing respite/relief to those affected by noise**
 - ? **Moving tracks away from noise sensitive areas vs. Exposing new communities to noise**
 - ? **Minimising noise vs Minimising CO₂ emissions (at 4000-7000ft)**
 - ? **Avoiding AONBs/National Parks vs. Avoiding homes and schools**
- Each airport needs to identify their own design principles, local circumstances and airspace design proposals

COMMUNITY CONCERNS ABOUT PBN

Heathrow recognises that some communities are concerned about the introduction of PBN: this generally relates to **concerns about increased concentration of flights over people's homes/schools/parks**

We are aware that concerns relate to:

- The 2014 PBN Trials at Heathrow
 - Experiences of PBN introduction at other airports (e.g. Next Gen in the US)
 - Potential for sleep disturbance and/or health issues
 - Fears about “noise sewers”
 - Fear of change and the unknown
-
- Through this ‘deep dive’ and subsequent engagement, Heathrow is committed to listening to the key concerns of communities living around the airport.
 - Heathrow will explore options for mitigating and minimising any impacts of this airspace change.

LESSONS LEARNT: HEATHROW AND NATS' PBN TRIAL 2014

The Trial:

- Trial of PBN Departures, initiated by NATS
- Meetings held between NATS, Heathrow, Airlines, CAA and HACAN in the lead up
- Trial was intended to test whether predictable respite could be achieved with PBN. NATS also collected data relating to spacing from the holding stack.

Impacts:

- Newly overflowed communities in areas of relatively low population and low ambient noise levels
- Large increase in noise complaints (Surrey & Berkshire): change triggered a strong and quick response
- No positive feedback received from communities overflowed less than before
- Trial stopped by Heathrow, earlier than planned
- Community noise groups were formed, and the Heathrow Community Noise Forum (HCNF) was set up
- Some communities interpreted their experience of PBN during the trial period as indicative of how they might be affected by airspace modernisation
- Mistrust from communities: Heathrow committed to engage more prior to any future airspace changes
- CAA subsequently issued new guidance for airspace changes or trials (CAP1616) with an onus on stakeholder engagement

LESSONS LEARNT: TAYLOR AIREY PBN BENCHMARKING, 2019-20

The Study:

- HAL engaged Taylor Airey to undertake an independent review of global PBN implementation to help us identify best practice
- The study was informed by stakeholder engagement with members of the Heathrow Community Noise Forum (HCNF)

Recommendations included:

- Recommended use of “more meaningful” metrics to assess noise impact
- Recommended that flight paths are identified and consulted on as early as possible
- Recommended that consultation and engagement are targeted at affected communities
- Recommended challenge to aircraft FMS* limitations, to allow for multiple PBN routes to be programmed
- Recommended greater clarity around governance of the airspace change process
- Recommended tighter Government Policy around: a) Preference for concentration/dispersion of flight paths b) Measurement of health impacts

LESSONS LEARNT: TAYLOR AIREY PBN BENCHMARKING, 2019-20

Case Studies:

- The benchmarking exercise ranked “best” performers and “worst” performers and identified key lessons
- The case studies most comparable to Heathrow were generally large airports located in major urban areas and located near to other large/medium airports where airspace is constrained

Airports in the study included:

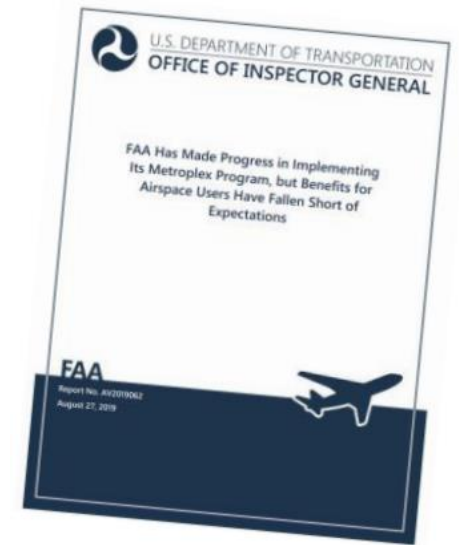
- London City Airport
- Sydney Airport
- Phoenix Airport
- Vienna Airport
- Auckland Airport

Not all of the recommendations or best practice were applicable to Heathrow:

1. We need to work within UK government policy and guidance
2. The congested airspace and urban conurbation surrounding Heathrow reduce airspace design flexibility

LESSONS LEARNT: USA 'NEXT GEN' PROJECT

- PBN implemented without community engagement or consultation on design options
- Little/no consideration given to what was on the ground when designing the new flight paths (e.g. population, new areas overflown, noise sensitive areas)
- Some flight paths were lower than they had been previously
- Project became political
- Challenges in court by multiple stakeholders: the Federal Aviation Administration (FAA) agreed to engage with affected communities whilst temporarily resuming the previous departure routes
- Trust lost between the airports, FAA and stakeholders



LESSONS LEARNT: INTRODUCTION OF PBN IN VIENNA

- Vienna airport is cited as best practice in terms of open, fair and transparent stakeholder engagement
- Improvements in stakeholder engagement were made in lead up to application for a third runway
- Local dialogue forums introduced to test and engage upon specific route options and on approaches to public consultation
- A "partial contract" agreed between airport and stakeholders with commitment of all parties for effective communication and working together
- PBN was introduced with clear operating restrictions and procedures to give local communities greater confidence on the impacts of new flight paths



RESPITE IN A PBN ENVIRONMENT: HEATHROW'S DESIGN PRINCIPLES

Our Design Principles were developed with community representatives and recognise the importance of noise mitigation and respite for our local communities:

Our new airspace design must:

3. Use noise efficient operational practices to limit and, where possible, reduce adverse impacts from aircraft noise

And should also:

6. Provide predictable and meaningful respite to those affected by noise from Heathrow's movements,

7. Seek to avoid overflying the same communities with multiple routes including those to/from other airports,

8. Contribute to minimising the negative impacts of night flights,

9. Keep the number of people who experience an increase in noise from the future airspace design to a minimum

10. Keep the total number of people who experience noise from the future airspace design to a minimum.

Addressing the Design Principles:

- Some of the Design Principles (DPs) can be addressed through design of the flight paths over the ground
- DPs related to respite are better addressed through operational concepts that could be applied to each option

RESPITE IN A PBN ENVIRONMENT: DEFINITIONS OF RESPITE

Heathrow commissioned Anderson Acoustics to undertake research into the meaning, value and definition of respite:

Respite is a break from or a reduction in noise from aircraft overhead.

Predictable Respite is scheduled respite from aircraft noise for a period of time.

Unpredictable Respite/Relief is unscheduled breaks from aircraft noise.*

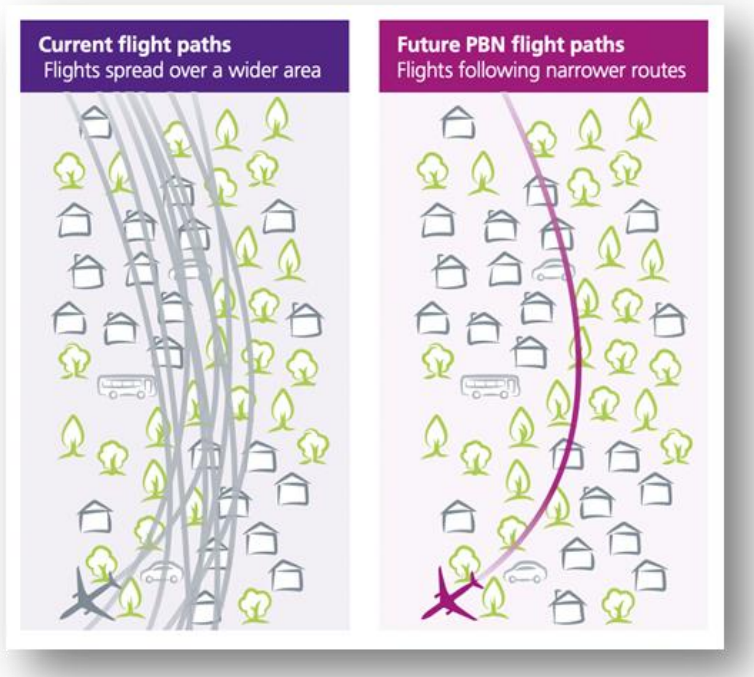
3 levels of Respite*:

1. Changes of less than 4 dB are considered “worth having”
2. Changes of 4-9 dB are considered “noticeable”
3. Changes of greater than 9 dB are considered “valued”

At the beginning of Stage 2, we set out a number of operational concepts for meeting the principles relating to predictable respite and minimising the negative impacts of night flights.

OPERATIONAL CONCEPT 1: DISPERSION WITHIN A PBN ENVIRONMENT

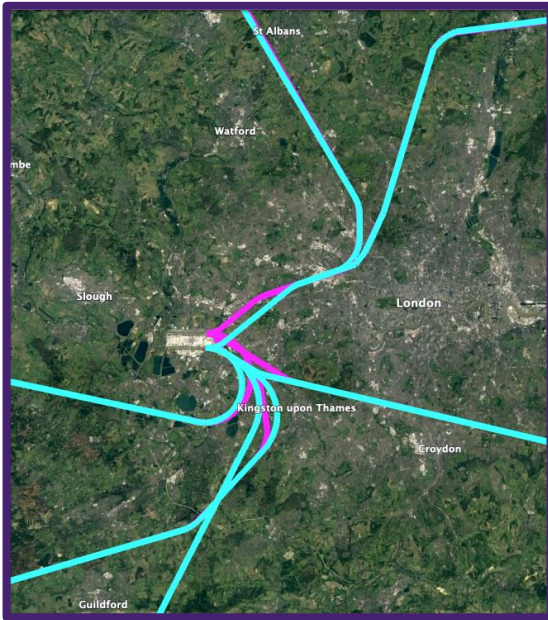
Looking at the feasibility of using techniques to enable dispersion within a PBN environment



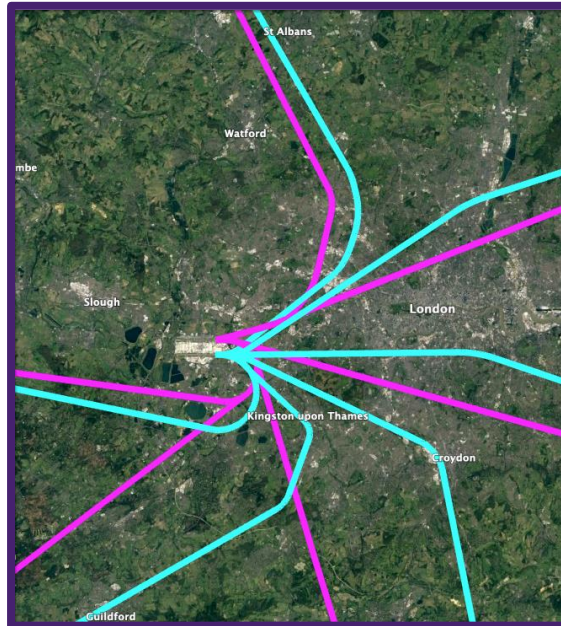
- The navigation of aircraft today is less precise than PBN, so leads to some dispersion of aircraft within today's routes: aircraft fly routes slightly differently so they tend to be spread over a wider area
- Heathrow is looking at the feasibility of using techniques to enable dispersion within a PBN environment
- Dispersion of flight paths within an allocated route would not give the significant break in noise required for "respite", but it could offer "relief" from noise for overflowed communities.

OPERATIONAL CONCEPT 2: RESPITE VIA RUNWAY ALTERNATION

Investigating whether departure routes from adjacent runways can follow different tracks for longer to increase the number of people who benefit from runway alternation



Today's easterly departure routes



Example of how we could design different flight paths to keep routes from the two runways separate

- Today's departure routes from adjacent runways merge shortly after departure. This means that communities underneath those departure routes don't always benefit from runway alternation to the same extent as communities under arrivals.
- We are investigating whether departure routes from adjacent runways can follow different tracks for longer, to increase the number of people who benefit from runway alternation.
- There are potential disbenefits for consideration too, since more people would be overflown.

OPERATIONAL CONCEPT 3: RESPITE VIA ROUTE ALTERNATION

Exploring whether we could use different flight paths for a Departure or Arrival route at different times of day, to offer respite to overflowed communities

- Heathrow is exploring whether we could use different flight paths for a Departure or Arrival route at different times to offer respite to overflowed communities.
- The image on the right provides an example where we might have 2 potential departure flight paths:

Route A could be used during Period 1

Route B could be used during Period 2



OPERATIONAL CONCEPT 4: REDUCING IMPACTS OF NIGHT FLIGHTS

Three concepts are being considered for reducing the impacts of night flights

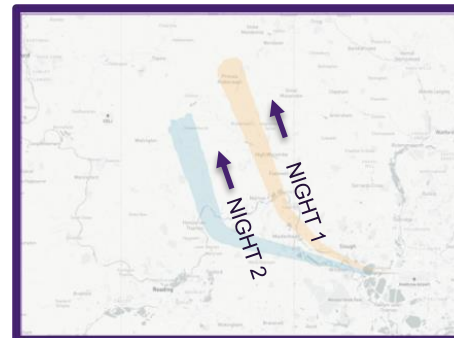
1

Use of PBN arrival flight paths for early morning (pre 6am) arrivals. Flight paths could be alternated to ensure the same communities are not overflowed each morning.



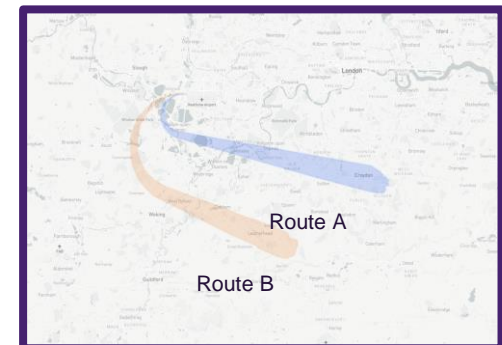
2

Use of bespoke departure routes for occasional late running departures at night. These routes could vary on a rotation pattern.



3

Use of 'extra' departure routes during or after periods of disruption (such as periods of bad weather) to minimise numbers of aircraft departing after 11pm.



Heathrow