



# Heathrow

# Operational Freedoms

Additional Report: Future Application of  
Operational Freedoms

Version V1.0

9<sup>th</sup> October 2013

## Executive summary

Heathrow Airport has written a supplementary report to the Operational Freedoms Trial Report.

The objective of this supplementary report is to position the measures recommended in the trial report against the other areas of research and development into air traffic management improvement at Heathrow.

The Operational Freedoms trial has highlighted the complexity of the Heathrow operation and the challenges of accurately recording and associating cause and effect; this has led to unexpected outcomes when the freedoms have been used.

Heathrow Airport is sensitive to the impact that the Operational Freedoms trial has had on local communities and this has led to a focus on ATM initiatives that achieve not only efficiency and capability but also improved respite and mitigated environmental impact.

Consequently, the recommended Operational Freedoms are seen as measures to be taken only during significantly disrupted operations and then only targeted to recover operational stability and no more.

Operational Freedoms are not and will not be used to exceed either the availability of hourly runway scheduling slots or the annual cap of 480,000 air traffic movements.

Heathrow Airport and its customer airlines are working collaboratively in pursuit of air traffic management measures that allow the airport to be run to an operationally sustainable plan, i.e. the collection of individual airline arrivals and departure schedules, as consistently and predictably as possible.

Details of the projects being run for air traffic management improvement are captured both in this document and the proposals for making best use of existing airport capacity in the short and medium term paper sent to the Airports Commission.

# Contents

- 1. Introduction**
- 2. Recap on Operational Freedoms and results of Trials**
  - 2.1. Conduct of the trials
  - 2.2. Conclusions drawn
  - 2.3. Recommendations
  - 2.4. Lessons learned
- 3. Key changes in future operational capability**
- 4. Developments at Heathrow and in surrounding airspace**
  - 4.1. Planning and control
  - 4.2. Airspace design and management
  - 4.3. Local systems, procedures and infrastructure
- 5. Future Baseline capability and implications**
  - 5.1. Synergies and efficiencies
  - 5.2. Obligations
  - 5.3. Implications for tactical capability
- 6. Operational Freedoms as envisaged in the future**
  - 6.1. Principles
  - 6.2. Concept of Operations
  - 6.3. Deployment
- 7. Transition**
- 8. Benefits evaluation**
- 9. Next steps**

# 1. Introduction

The concept of Operational Freedoms was introduced through the work of the South-east Airports Taskforce (SEAT), under the chairmanship of the then Minister of State, Theresa Villiers. The overall theme for the taskforce was “better, not bigger” and operational freedoms were intended as tactical runway operating procedures for alleviating actual or anticipated disruption to airfield operations. They are aimed at more flexible use of the runways and local airspace in certain defined circumstances. Trials were conducted over two main phases in the period November 2011 to February 2013 to assess the operational impacts and also the environmental effects, particularly the noise patterns experienced by local residents. The trials were accompanied by extensive measurement and reporting and have been documented in a major report which is currently in draft form but which has been communicated to local stakeholders via the Heathrow Noise and Track-keeping Working Group (NTKWG) and to the DfT and CAA. It should be underlined that Operational Freedoms were only ever intended as marginal measures to alleviate short-term disruption and do not address the chronic capacity issues at the airport. For scale, only 3% of the flights operated during the trial periods were the subject of applying a freedom.

The trials and the full report accompanying them attempted to construct and analyse statistically robust tests and to confirm or refute the value of the flexibilities being proposed. In practice, while their continuing use and development is justified, it proved very difficult to demonstrate clear cause and effect among the large range of factors which influence the airport’s performance on any given day.

In addition, the capital investment and development plans for the airfield over the next five years should have a significant beneficial effect on operations and will change the nature of appropriate Operational Freedoms and their deployment. These changes should facilitate more consistent operation in a fully segregated mode.

In considering the policy decisions surrounding the future of Operational Freedoms it is important to document some additional influences and considerations. There are a number of reasons behind preparing this report in addition to that accompanying the conclusion of the Operational Freedoms trials:

- Highlighting some of the underlying lessons from the trials which are not fully reflected in the measured statistical analyses;
- Anticipating developments at the airport over the next five years and the implications for the optimum design and deployment of Operational Freedoms;
- Outlining the transition from the trials and the lessons learned through to future operations;
- Encompassing the other complementary recommendations made by SEAT in the way forward; and
- Considering analogous options outside the core operational hours of 0700 to 2300 (which are the focus of normal segregated runway operations and were the limits of Operational Freedoms).

Finally, as the Airports Commission considers options for short- and medium-term operational improvements, it is appropriate to input all the relevant factors – and indeed this report should be read in conjunction with Heathrow Airport’s submission on those measures.

## 2. Operational Freedoms trials – results and lessons learned

### 2.1 Conduct of the trials

The Operational Freedoms trials, undertaken collaboratively by Heathrow and NATS, were based on the premise that a segregated mode of runway operation struggles to withstand or recover from typical fluctuations in air traffic demand caused by weather, schedule perturbations and network effects – particularly when continually operating at full capacity.

In collaboration with the Department for Transport and the CAA, Heathrow designed a series of operational freedoms involving more flexible use of the runway infrastructure to address these issues. These included the use of both runways for arrivals, the use of both runways for departures, redirecting departures after take-off to achieve early separation and hence increase runway throughput and the increased use of the southern runway for A380 aircraft, small and light aircraft and Terminal 4 traffic. Heathrow contracted Cambridge University's Institute for Manufacturing to provide independent oversight on the trial design and methodology.

During Phase 1, the freedoms were used regularly, whilst in Phase 2, the freedoms were staggered to provide, as far as possible, a means to assess the benefit of each freedom independent from the others.

Throughout the trial, regular communications were maintained between the Department for Transport, the CAA, Heathrow and NATS to ensure the progress of the trials was accurately tracked and to capture any feedback from regulators.

Heathrow supported an unprecedented level of community engagement throughout both phases of the trial consisting of detailed operational data reported daily on the company's public website, leaflets and advertorials in local newspapers, public meetings in local communities, engagement with politicians, and regular meetings and consultation with local authority experts.

It was to be anticipated that, with more flexible use of both runways, there would be a reaction from those residents in close proximity to the extended runway centrelines. The numbers of these complaints were tracked accurately and are reported in more detail in the body of the report.

All airports are affected to a great extent by weather conditions and the trial periods at Heathrow were no exception. At the beginning of the trial, the winds were predominantly easterly which meant that departing aircraft could be seen to the east and south east of the airport and whilst this is not unprecedented, would have appeared unusual. At the start of the second phase there were unusually high levels of poor weather and thunderstorms around Heathrow which meant that operations were highly disrupted. These factors would have contributed significantly to the complexities of matching freedoms with data on benefits and impacts.

## 2.2 Conclusions drawn

The conclusions drawn from the Operational Freedoms trial were that it could be demonstrated, in applying them, that perceptible material improvements could be made to the operation of the schedule. However, it was acknowledged that the complexities of Heathrow made analysis extremely challenging and that it was important not to lose sight of the benefits through over-simplification of the analysis of the data.

An example of this is that when the airport uses both runways for arrivals during TEAM (Tactically Enhanced Arrivals Mode), it is obvious that arrival flow will be increased. However, by being reliant on airborne holding delay as a measure, benefit may not be recorded. The same anomalies can be seen when proactive freedoms are used and when aircraft are vectored early yet improvements in flow in these two cases are obvious purely from a logical perspective.

In addition, the trial demonstrated from the application of some of the departure Operational Freedoms that Heathrow is constrained by airspace design, not simply the volume of the airspace but also the design of the departure routes within it.

What was equally clear was that in each of the cases above, reductions in respite and unusual departure tracks would have mitigated against the experience of noise to local communities.

## 2.3 Recommendations

It is recommended in the main report that the following operational freedoms should be integrated into standard procedures as soon as practically possible.

### **TEAM**

TEAM would continue to be used and would be triggered by actual or anticipated delays of 10 minutes or more to a maximum of 12 landing aircraft each hour as follows:

- Actual or anticipated departure or arrival delays that are likely to impact the operation.
- The actual headwind component on approach is forecasted to be at 20 knots or greater at 3000'.
- Aircraft are arriving on their assigned stand 30 minutes or more later than their scheduled time of arrival or if 30% of the overall schedule is running 15 minutes late or more.
- There is serious pan airport or network disruption.

### **Early Vectoring**

Normally aircraft follow standard instrument departure routes (SIDs) when leaving an airport until they reach 4000' after which they can be given more direct routeings (vectored) by air traffic control. Up until 4000', the aircraft are considered to be 'on track' whilst flying within a swathe 3 kilometres wide based on the centreline of the SID and this is referred to as the 'Noise Preferential Route' or NPR. With modern cockpit systems, navigational accuracy is considerably better which makes possible the use of the NPR for vectoring aircraft earlier after departure, achieving earlier separation and improved flow. Use of the early vectoring operational freedom would be made when:-

- Actual or anticipated departure or arrival delays are deemed likely to impact operations.
- The headwind component on approach to Heathrow is forecast to be 20 knots or greater measured at 3000'.
- Aircraft are departing from their stand 30 minutes later than their scheduled time of departure or if 30% the overall schedule are running 15 minutes late or more.
- There is serious pan airport or network disruption.

### **Proactive Use of the Southern Runway**

This final, third operational freedom was designed to be used tactically to land specific groups of traffic namely those flights arriving at Terminal 4 due to the proximity of the southern runway (when the northern runway is designated as the landing runway) thus avoiding extended taxi times and runway crossings, A380 aircraft due to increased wake vortex separation and general aviation aircraft for both wake vortex separation when following larger aircraft and for proximity to their parking positions south of the southern runway.

## **2.4 Lessons learned**

The Operational Freedoms trial report contains much data and statistical analysis. – However, over and above the information presented there are many learning points which have shaped Heathrow's current thinking on the management of air traffic through the airport and what key policies and objectives should be pursued going forward.

**The meaning of resilience** – Resilience can be defined as the difference between the potential capacity that the airport has for flying versus the actual take up of that capacity. The resultant headroom provides the leeway the airport has when the anticipated schedule is disrupted for a variety of reasons. Heathrow Airport has been, and will continue, working on initiatives which help to suppress variability in the schedule whilst creating more headroom for when things go wrong. Operational Freedoms has a part to play in this plan but is by no means the only or even a major part of what can be done to improve the operation.

**Lack of schedule conformity** – Heathrow's position as the UK's only hub airport means that global events and indeed weather can have a material impact on the running of the schedule. This may range from flight suspensions during the Arab Spring, to thunderstorms off the East Coast of the US to the repatriation of flights diverted en route to Heathrow, all will impinge on the running of the schedule. These are in addition to schedule perturbations which occur more routinely, some of which are within the control of the airport and its users but others such as the position and movement of the North Atlantic jetstream are clearly not. The magnitude of disruption to the schedule caused by these events can be illustrated by the remaining number of days within the season which can be classified as 'normal' For example, in the first three months of Summer 2013, only 13 out of a possible 91 days were not affected by low visibility, thunderstorms, strong winds or network disruption.

**The closed system of arrivals and departures** – As Heathrow is operated on the basis of segregated runways, one for arrivals and one for departures, and that the throughput is high, it follows that uncoordinated use of both runways for arrivals will quickly lead to departure delays as aircraft have extended waiting time at the runway holding point as an approaching aircraft passes them to land, brake and vacate. If this is done on an extended basis, then start-up delays on stand are experienced by the airlines and soon the schedule is out of kilter

for the whole day. The trial demonstrated how sensitive departure flow is to the limits of dual runway use and useful data has now been gathered to illustrate this. The learning here is that in order to make best use of this operational freedom, better predictive tools are required by the controllers to aid decisions to switch TEAM on and off so as to avoid consequential departure delays.

**The need for robust policies and procedures** - The trials were necessarily conducted under temporary and largely manual procedures and there was understandable variability in how the freedoms were deployed, sometimes due to pressures of other priorities. Automated and/or fully developed procedures would have contributed to more consistent application and therefore benefits. In practice, these guidelines and procedures can be developed through a comprehensive “Concept of Operations” for the airport.

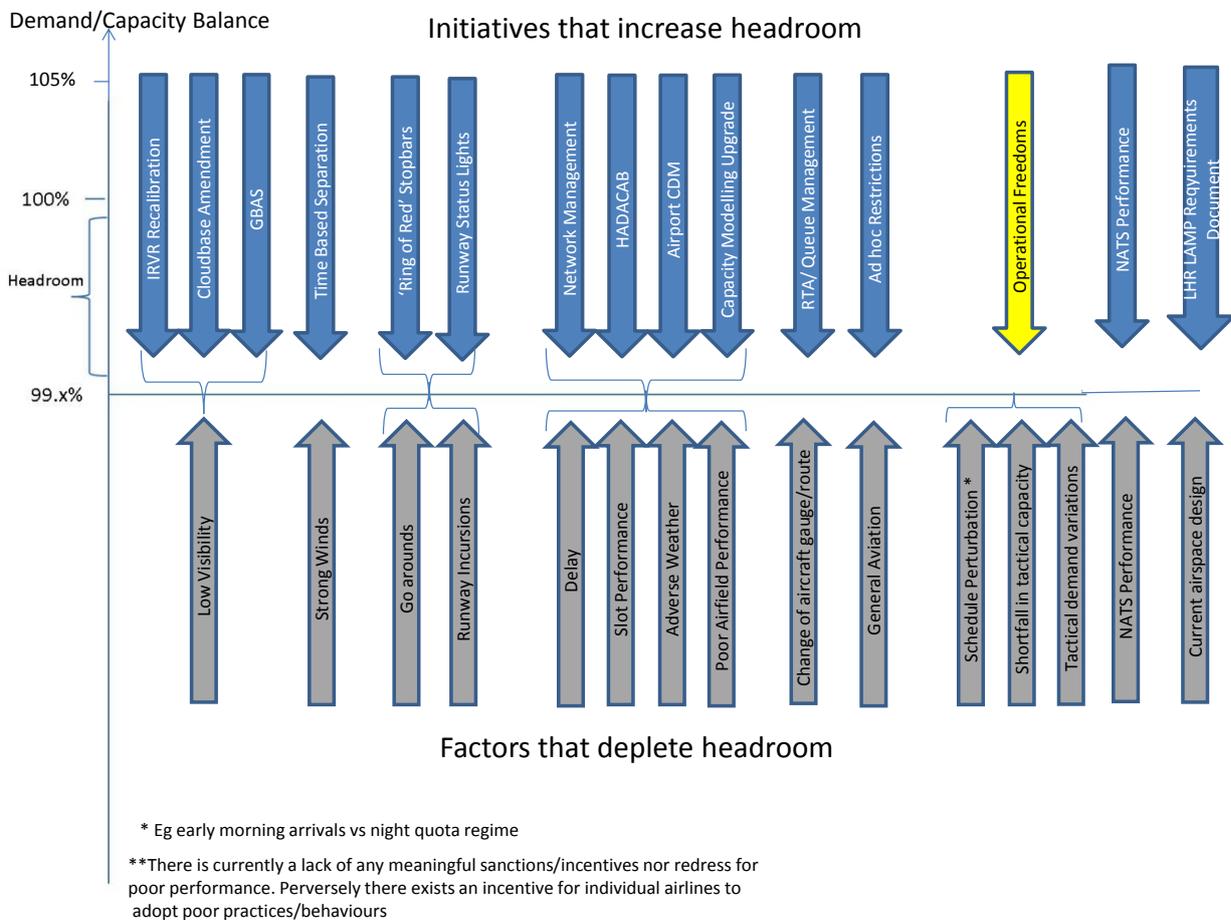
**Behavioural and cultural factors** – the trials also underlined the ways in which behaviours and custom and practice can influence performance e.g. in the desire to reach the head of an arrivals or departures queue, pilots can disturb what might be a more optimum aircraft sequence for the overall good of the airport. Processes such as Collaborative Decision Making (A-CDM) and the type of open reporting seen in the trials will help to alleviate these issues.

The common themes to all these lessons are the delicate balance of the Heathrow operation, the need to confront all the root causes of poor resilience and to enhance the quality of the operational responses available to manage tactical imbalances of demand and capacity.

### 3. Key changes in future operational capability

There will be a series of process, technology and infrastructure changes in the airfield and its operation over the next five years. These are confidently expected to facilitate a significant improvement in performance as measured in terms of punctuality, holding delays, emissions, noise and resilience. They will cover infrastructure, airspace design, operating procedures and planning and control organisation processes and systems and, in aggregate, will signal major differences in how the airfield and its wider system are managed – although they will clearly not address the basic lack of strategic capacity.

The initiatives are aimed at confronting the various factors which can cause an imbalance between the tactical capacity of the runways (i.e. the real-time flow-rate achievable) and the tactical demand (i.e. the real-time queue of aircraft wanting to use the runways). Under benign stable conditions, demand and capacity are planned to be in balance to within reasonable tolerances defined in the seasonal Runway Scheduling Limits process, which sanctions the planned airline timetables. These initiatives and the destabilising problems they are addressing are illustrated in the diagram below and described in more detail in the following chapter.



From the perspective of Operational Freedoms, this should reduce the frequency of their deployment but also make them more valuable when they are used, as they can make a bigger difference against the new higher targets implied by the change programme.

The assumption is made of continued (and indeed extended) Segregated Mode operation. Although Mixed Mode would undoubtedly increase operational resilience (for any given demand level) the airport continues to support the policy of Segregated Mode to provide noise respite for local residents.

Therefore, although the scale of the use of Operational Freedoms may be reduced by the fundamental improvements, the need for the flexibility they give to core segregated operations is increased.

Thus the applicability, deployment and value of Operational Freedoms may be different under these conditions and under future policies. The overall change programme for the airfield and the implications are outlined in the following chapters.

Development of Operational Freedoms would be integrated and phased with the new enhanced control capabilities.

## 4. Developments at Heathrow and in surrounding airspace

There are three themes to the change programme being introduced – each of which would influence the nature and deployment of appropriate Operational Freedoms

- Improved planning and control
- Airspace design and management
- Local systems, procedures and infrastructure

### *4.1 Improved Planning and control*

- a) Strengthening “Operating to Plan” - Essentially this means operating more closely to the schedule i.e. the aggregate of the airlines’ published timetables, or to an integrated tactical Airport Operating Plan, which has taken account of known likely variances. This apparently simple change will require a move away from “first come, first served” policies and requires enhanced procedures to optimise and control the sequence of aircraft for arrival and departure. There will also be more formalised processes for preparing operational plans for different time horizons which will help anticipation of problems and the use of more standardised templates for known scenarios e.g. weather disruption on the East Coast of North America
- b) Strengthening “Return to Plan” - Decision support technology and new organisational units will prioritise actions to recover the programme as quickly as possible. The airfield component of this would be integrated with terminal management, passenger information and support in time of disruption.
- c) Assuring an inherently feasible plan through better capacity assessment and management (another of the SEAT recommendations)
  - 1) Improved Schedule assessment and co-ordination processes e.g. including the potential to incorporate a wider range of planning parameters if necessary
  - 2) More active pre-emptive simulation to test “what-if” scenarios on possible infrastructure changes or the changes to fleet mix
  - 3) Control of ad hoc slots
- d) Performance Management against adherence to milestones and tactical plan requirements. This implies a broader range of metrics than the current basic punctuality and slot performance measures – and the potential for agreed sanctions and incentives with the airlines in line with the concept of a Performance Charter which was one of the complementary SEAT recommendations with Operational Freedoms. This will also extend to the ATC operations of NATS and the relevant performance measures for the airport.

### *4.2 Airspace design and management*

The next five years will see the continuing implementation of the CAA-led Future Airspace strategy. A number of aspects will benefit Heathrow:

- a) The eventual elimination of stackholding as part of routine operations for Heathrow arrivals. In conjunction with this, enhanced systems can further optimise the arrival sequence to minimise aircraft separation and therefore maximise the tactical demand which can be managed

- b) Airspace re-design, including raising of “transition altitude” to allow continuous climb departures and measures to avoid interference of optimum flight paths for arriving and departing aircraft – benefiting noise levels, fuel burn and capacity
- c) Departure routing changes to increase flight-track precision and to increase the tactical departure capacity on the runway.
- d) Integration with European developments – both at the strategic level and in the co-ordination of day-to-day operational planning and control
- e) The use of Time Based Separation for safe separation of arriving aircraft instead of distance-based. This is particularly beneficial in very windy conditions – one of the most frequent drivers of disruption at Heathrow.

#### *4.3 Local systems, procedures and infrastructure*

Within the airport, a number of initiatives and new tools will support the developments outlined above, for example:

- a) Software and processes to identify potential Demand: Capacity imbalances. This will help improve control over the deployment of non-segregated modes and ensure that it is only occurs when necessary and valuable.
- b) The design and build of an Airport Control Centre (APOC).
- c) Full implementation of A-CDM including amended procedures for snow and ice and other adverse conditions.
- d) The introduction of Ground-Based Augmentation navigation equipment (GBAS) which will increase the precision of track-keeping and the ability to fly approaches with a lower noise profile.
- e) Capacity modelling software to support scheduling and infrastructure option assessment.
- f) Infrastructure developments which streamline and safeguard elements of the airfield’s operation e.g. de-icing facilities, taxiway optimisation and runway control lighting.

Of course, there will be circumstances when weather, serious problems in the network, loss of infrastructure and so on, overwhelm these enhanced capabilities but, in general, the aim is to replace the current toolset for managing disruption (stackholding delay, TEAM, Eurocontrol imposed delay - “ATFM”, Minimum Departure Intervals – “MDIs”, delays into the night period and cancellations) with better approaches to enhancing tactical capacity and smoothing the demand pattern to avoid imbalances, which would be in operation all the time.

The above set of developments has been demonstrated to deliver considerable operational and financial value principally through reduced delay and associated costs such as fuel burn.

While there is a risk of double-counting benefits the aggregate numbers are significant and have been broadly accepted by stakeholders as a basis for investment in both Q5 and Q6 (the fifth and sixth quinquennial review periods of economic regulation which have been conducted by the CAA since 1986).

## 5. Future baseline capability and implications

The aggregate outcome of the development programme will be a higher-precision and more efficient operation with greater inherent resilience. However, there will still be a clear need for mitigation and recovery mechanisms although this will be against higher baseline standards – and should occur less frequently.

### 5.1 Synergies and efficiencies

Efficiency will be manifested in various capabilities:

- Precision of flight paths
- Reduced track miles
- Reduced noise contours
- Optimised sequencing and separations
- Ground handling to shorter turnaround times
- Ability to absorb greater variances than today in the tactical demand : capacity ratio - hence improved resilience.

These efficiency gains will present the opportunity to take time out of both air and ground processes (optimum flight paths, less holding, shorter ground movement and turnaround times). But more efficient operation also implies having less **planned** buffering inside block times and on the ground, as if time is not taken out of the planned phases of a flight, then it can lead to congestion (i.e. holding in queues) simply being moved rather than eliminated - perhaps to the stands. Therefore tactical tools will remain important - tactical buffering (effectively queue management) will be achieved by better flow management to a series of planned milestones.

### 5.2 Obligations

Opportunities and obligations will attach to scheduling in the future under this scenario – there is the opportunity to potentially re-shape schedules and increase aircraft utilisation and market fit, but it will put pressure on tactical capacity management and general airline punctuality to maintain adherence to a tighter plan.

Punctuality is often used as a short-hand measure of overall performance - currently the airport has a target for the airlines to achieve 80% Arrivals and Departures within 15 mins. Although performance has improved over recent years, the trend data suggests that 85% is the maximum sustainable performance under current operating methods – the improved operating environment should allow for a future Punctuality target of around 90%, perhaps expressed as number of days pa >90% or 95%.

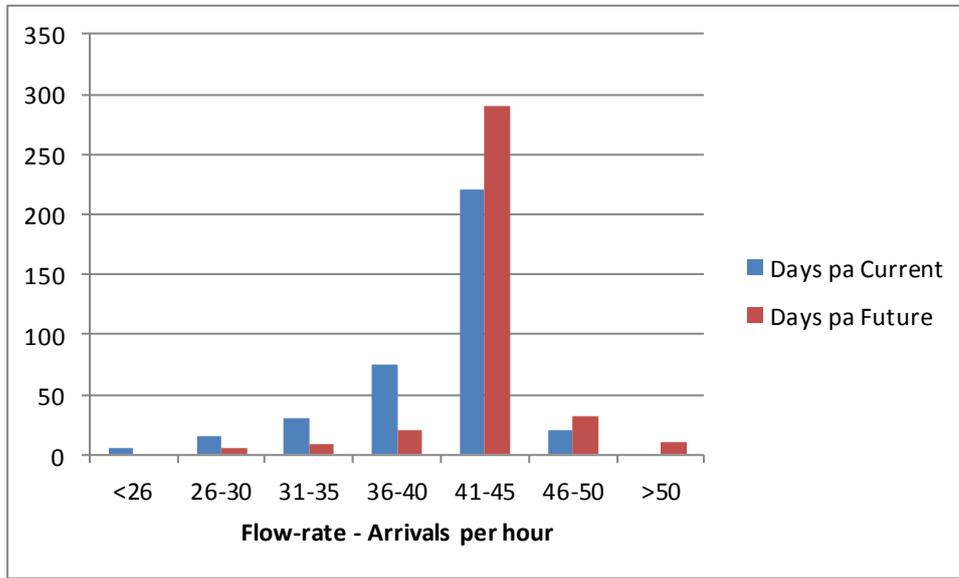
In practice, although punctuality will remain important for passenger satisfaction and high arrival punctuality is required for connections traffic, existing formal definitions of punctuality will be superseded by more granular measurement against the different milestones in a flight's progress.

In terms of resilience, there should be a drop in the number of times a significant imbalance is created between tactical demand and the tactical capacity available. The need for

additional tactical measures, i.e. Operational Freedoms, should therefore be concentrated into scenarios and days when significant holding delays are building up., whether on arrivals or departures.

### 5.3 Implications for tactical capability

One way of looking at this is to compare the likely distribution of tactical capacity capability in the future with that of today. The illustrative diagram below is for arrivals.



## 6. Operational freedoms as envisaged in the future

### 6.1 Principles

The underlying logic and the main uses of Operational Freedoms remain unchanged – i.e. coping with a spread of tactical demand : capacity ratios which is, firstly, outside the range used to define the strategic “declared” capacity and secondly, outside the range which the new tools are capable of absorbing on a routine basis.

The actual freedoms available would be very similar to those trialled or previously proposed, namely:

- Arrivals on the Departures runway to increase tactical capacity, assuming that any predicted knock-on effect on departures can be avoided or justified in benefit trade-off;
- Pro-active arrivals on the southern runway (when in Departures mode) to improve T4 punctuality and reduce runway crossings;
- Tactical use of additional SIDs to meet peak demand on particular routings or to avoid Cumulonimbus cloud activity;
- Management of the early morning arrivals peak to trade off respite against preventing a build-up of demand – this would also incorporate changes to the early morning schedule and consistent segregated mode, which was initially proposed for the trials but was not implemented due to the complexities of re-designing a schedule within the timescales of the trials;
- Dual departure mode to alleviate late-evening demand and avoid/reduce NJMs.

### 6.2 Concept of Operations

They would be incorporated into the airport’s standard procedures as part of a new joint Heathrow/NATS/Airlines Concept of Operations defining the available operating modes and procedures and the governance and deployment ruleset surrounding them. This is for development but the contents, relating to the freedoms might include the following features

- Early vectoring would employ established departure routings (SIDs) with associated procedures as part of a formal Airspace Change and re-designed roles and use of Noise Preferential Routes (NPRs).
- Non-segregated deployment would be controlled through decision support methodologies and joint governance.
- Interactions between the airport’s monitoring and control units (APOC/ATC/HOEC) and NATS Terminal Control at Swanwick (TC) would be strengthened as part of that decision support and the deployment protocols. This would include, for example, the use of TEAM and the algorithms for sequencing tools.
- Deployment triggers would initially be based on similar metrics to those of the trials but may be amended as more feedback data becomes available on trade-off situations e.g. around the interaction of arrival and departures delay and/or the impact on respite.

- The early morning period schedule would be developed and monitored on a new basis – probably over a number of years, depending on the pace at which changes from the established historic slot positioned could be achieved.
- There would be greater freedom to promote late-running aircraft in the queue – but obviously associated challenges about applying this in an equitable fashion.
- Non-segregated deployment would be the same for Easterly and Westerly wind directions.

On a day-to-day basis improved tracking and analysis of current and projected tactical demand and capacity will be the key to success.

### *6.3 Deployment*

Many of the circumstances which give rise to the potential use of freedoms today should have been obviated by the new baseline capabilities, for example:

- Early morning arrivals bunching
- Moderately high winds
- Departure route demand bunching
- Potential LVP (Low Visibility Procedures) situations avoided by new Runway Visibility and Cloud Base decision criteria
- Improved de-icing facilities and management

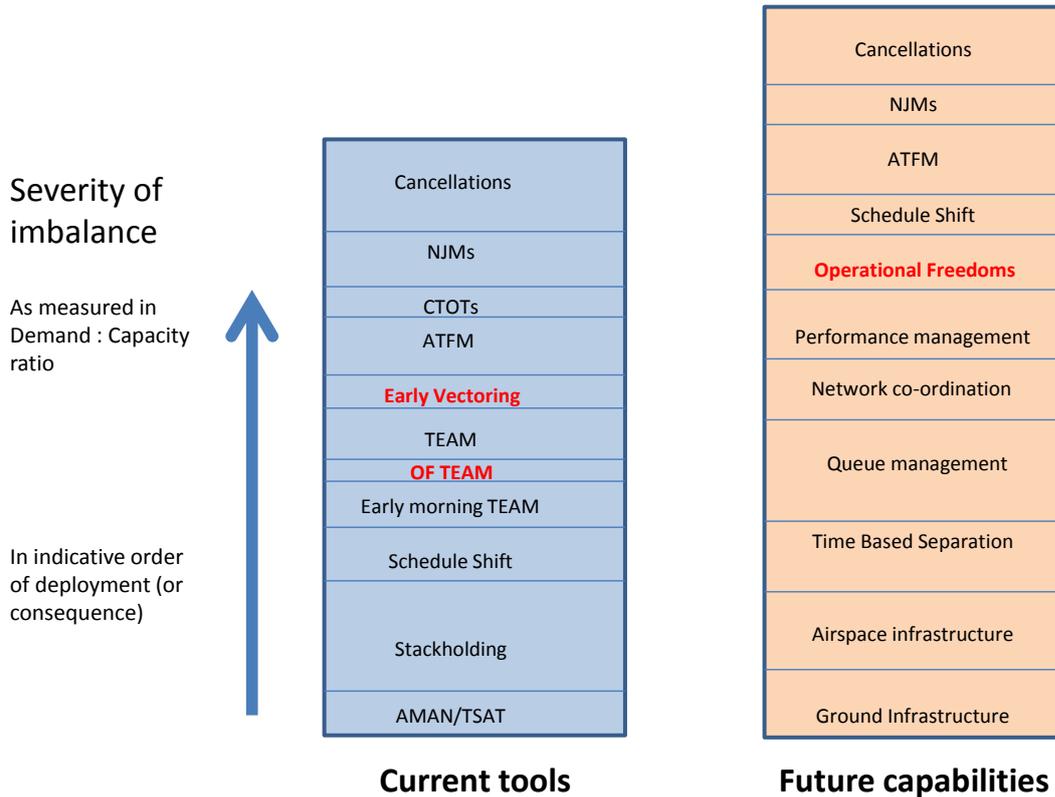
However, the increasing volume of A380 movements and the general increase on average fleet gauge will pose a counter-balancing threat. This will move the focus of deployment to a limited number of disrupted days with the freedoms playing a supporting role to the management of the airfield.

There will remain a range of root causes of unplanned peaks and troughs of tactical demand and/or capacity, for example:

- Winds – beyond Time Based Separation capability
- Declared Low Visibility
- Disruptions in the network – European or global
- Cumulonimbus weather conditions for departures
- Loss of infrastructure for a variety of potential reasons

The way in which Operational Freedoms are anticipated to play a role in the hierarchy of operational management of potential disruption is illustrated in the diagram below – which also highlights the difference from current circumstances.

## Hierarchy of Tactical Adjustment of Demand : Capacity Balance



*Legend of terms (not otherwise referenced in the report)*

Abbreviation	Term	Purpose
AMAN	Arrivals Manager	Sequencing arriving aircraft to minimise required separations
TSAT	Target Start Approval Time	Sequencing departing aircraft off-stand
ATFM	Air Traffic Flow Management	A control system used by Eurocontrol to relieve airspace congestion across Europe
CTOT	Calculated Take-off Time	The locally allocated take-off time generated by ATFM
NJM	Night Jet Movement	An unplanned runway movement which occurs within the defined night period
Schedule Shift		The collective operational delays picked up by aircraft during their working day

Triggers and impact measures would continue to be used and reported. Given the inherent difficulty in associating cause and effect, as indicated from the trials results, more

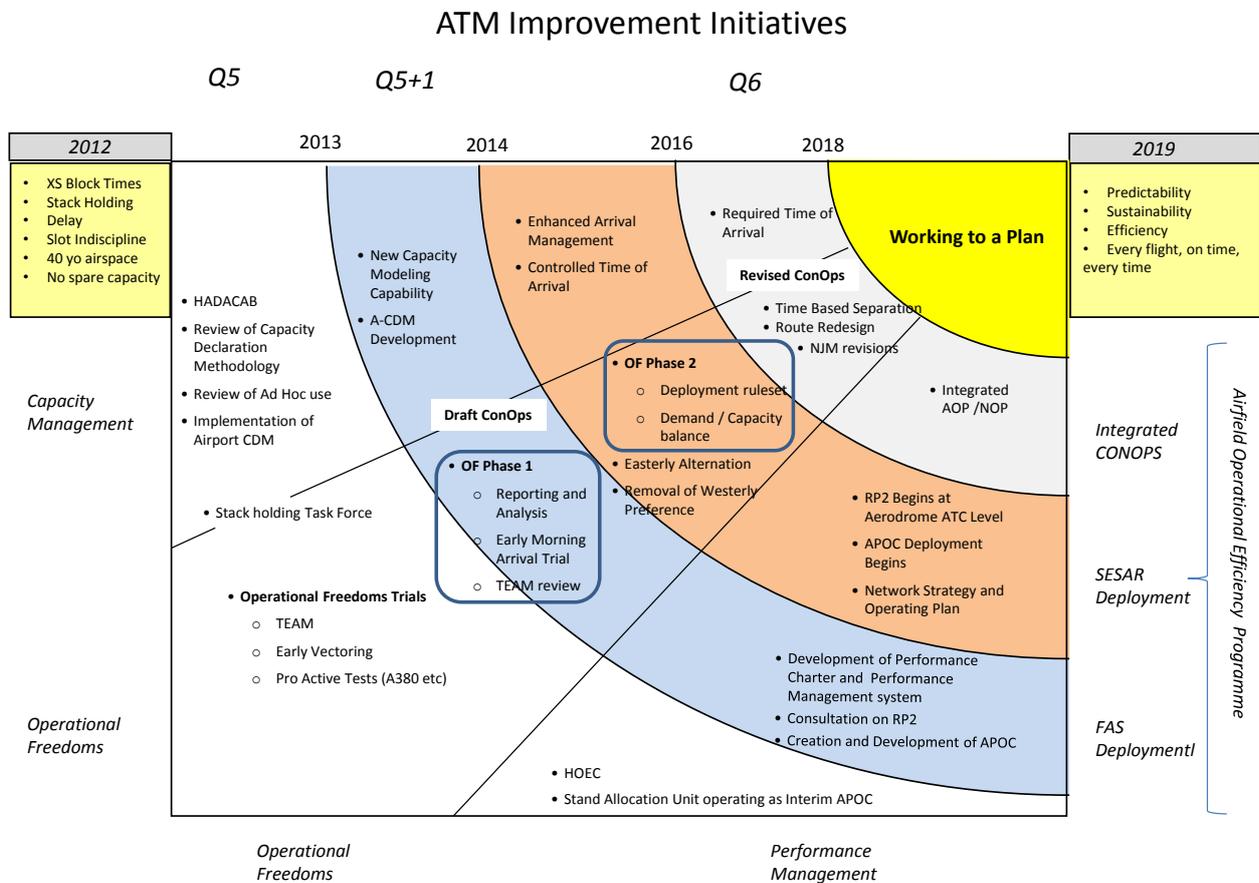
comprehensive modelling will be done using the new tools being developed. For example using more sophisticated modelling

- Different types of backlog of flows can be illustrated, and also where gaps and low demand can also occur
- The trade-off could be assessed of when increasing arrivals rates begin to seriously impact departures
- Lead indicators could be created for likely over-running of the programme into the Night Period, with and without the alleviation of, say, dual departures
- The respite levels could be more accurately assessed.

## 7. Transition

It can be appreciated from the developments outlined above that there will be a major transition in the way Air Traffic Management (ATM) is undertaken at Heathrow and the way it supports the fundamental shift in the airport's operating capability

This can be represented through the following diagram



Operational Freedoms can be seen to be an integral component of the overall transition plan. Of particular importance will be the linkages to

- A revised Concept of Operations for the airport, Contingency plan templates for common potential disruption scenarios, including the role and criteria for OF deployment
- New capacity modelling capability
- The APOC control centre
- Strengthened performance management

The more detailed development of specific revised deployment triggers and decision support would be organised into two main phases, accompanied, as previously, by extensive evaluation and reporting. The outline content of the phases would comprise:

## Phase 1

- Review of options for re-designing the early morning schedule and the ruleset for managing compliance to schedule (or revised operational schedule if e.g. Jetstream conditions cause widespread difficulties)
- Review of the governance and deployment of TEAM
- Simulation modelling of the impact of alternative approaches
- Development of Tower procedures to utilise revised SID designs
- Impact assessment on cost, performance, respite and environment

## Phase 2

- Full ruleset for deployment of non-segregated modes as part of new Concept of Operations
- Additional assessment to incorporate impact on compliance to revised NJM criteria

Each phase would incorporate appropriate review, reporting and consultation.

## 8. Approach to benefits evaluation

In addition to live trials it is expected that the new modelling capability will be used to assess the impact under a number of typical scenarios. This should allow for more accurate determination of the impact attributable to the freedoms than was achievable in the trials, although validation in operational trials will also be required. The dimensions for impact assessment will be broadly similar to the completed study but extended to the enhanced range of performance metrics available. Thus they will include:

- The tactical capacity increase which might be available, relative to the baseline for given conditions, due to OF deployment – i.e. maintaining maximum use of the runway within the ruleset and preserve connections. This assumes that the potential impact of increased arrivals on departures, and vice versa, has been mitigated by other action or trade-off
- Associated reduction in “buffer stock” levels as a result i.e. the actual queue or a computed one if speed control is being used to manage the queue – perhaps with an indication of the delay impact valued through standard delay curve figures relating holding delay to the demand: capacity ratio (although the delay curve will change under new baseline)
- “Return to Plan” benefits will be reflected as the value of completing the programme without recourse to cancellations or NJMs. It is difficult to quantify these benefits during the day owing to the wide range of scenarios
- Reduced runway crossings
- Tactical punctuality and connections benefits from proactive runway selection
- Any dis-benefits which may be logically associated (principally impact on departures, but after application of up-dated techniques for sequencing and holding/increasing departure rates through temporary SIDs)
- The overall impact on level of non-segregated modes and therefore on respite

It should be noted that any trade-off between Arrival and Departure holding will usually bias towards reducing in-bound holding, due to the higher fuel burn, unless the stands are full and/or there are particular connections difficulties.

Overall efficiency improvements will also present an opportunity for increases in aircraft utilisation – with substantial financial value. In practice airlines will need to build confidence that adherence to a tighter programme can be achieved at acceptable levels of risk – hence the needs for a high-precision operation, and tactical tools which can recover quickly. This will require the modifications in scheduling procedures mentioned earlier.

## 9. Next steps

As indicated in the report into the Operational Freedoms trials, there is a continuing benefit from deploying the freedoms in defined circumstances.

Assuming that the policy requirements are agreed then the immediate next steps will be a combination of:

- Communications and consultation with the local community and local authority experts
- Refining current Operational Freedom procedures and integrating them into the Airport's existing operating regime
- Detailed planning of the transition outlined above - in particular for the Phase 1 steps
- Reviewing and up-dating, if necessary, the decision processes and governance of TEAM deployment
- Re-visiting proposals and opportunities for re-balancing the early morning arrivals schedule
- Using the Demand: Capacity tool within A-CDM to assist in creating decision protocols which trade off arrival freedom impact on departures. This will be developed further under the APOC management structures
- Initiating the new Capacity Modelling capability to enhance the RSL process and by implication the inherent resilience of the schedule – again it will be developed further as part of the underpinning to ATM development and impact assessment
- Stakeholder discussions and agreement of the measurement and reporting which will accompany the transition plan – along the lines of the envisaged Performance Charter
- Drafting the first iteration of a new Concept of Operations.