# Heathrow Hub

## ATC & Airspace Feasibility Study

## Results of 4 Runway Capacity Modelling

**Produced by:**

**Think Research Ltd**

pete.blyth@think.aero

james.daley@think.aero

conor.mullan@think.aero

# Scope and Objectives of the Study

The high level objectives of the report were to:

- Assess the impact of a third 'in-line' runway at Heathrow on the current design and capacity of London airspace;
- Assess the impact of a third runway on Air Traffic Control Officer (ATCO) Human Factors and operating procedures;
- Discuss how future projects planned for implementation in the London airspace have the potential to offset various concerns;
- Identify the main safety concerns regarding missed approaches for the Heathrow Hub Concept;
- Estimate increases in runway capacity that could be provided by a fourth runway.

The study looked at current day operations, what impact a third and fourth runway might have and what mitigating solutions could potentially offset any increases in air traffic movements.

# Impact on Airspace Operations

## 1. EnRoute Operations

**No significant impact on operations**

- Traffic volumes in EnRoute airspace will inevitably increase;
- Enhanced conflict detection tools such as iFACTs already contribute to enhancing safety and capacity. EnRoute airspace capacity is still available for growth;
- No severe impact on controller workload;
- Hence new technologies or airspace redesign is not deemed to be a necessity;
- Adjacent ATSUs will face increased traffic volumes that may negatively impact traffic flow;

➢ **Mitigation**

- Future initiatives will further enhance safety and capacity. This includes 4D trajectory based operations to enhance network predictability and Demand and Capacity Balancing to reduce the traffic load in “hotspot” areas and stabilise workload.
- Co-operation and research into the impact of these traffic flows into adjacent ATSUs would be required to help to reduce workload and enhance airspace integration.



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# Impact on Airspace Operations

## 2. TMA Operations

**Limited impact mitigated by the addition of implementation projects to reduce controller workload and airspace pressure**

- Current restrictions and inefficiencies in the LTMA design mean it unlikely an extra 200,000 movements per year is feasible using current systems and procedures;
- Traffic growth due to this concept would be expected to the north of LHR and would increase aircraft interactions in the London airport system increasing airspace complexity;
- The ability of the controller to safely control traffic in the LTMA would be negatively impacted and reach critical levels without implementation projects;
- The option of a third runway at Heathrow and subsequently the permanent use of two landing runways during busy arrival flows has the potential to reduce the amount of time an aircraft is placed into a hold before commencing its approach;

➢ **Mitigation**

- Projects expected for implementation by 2023 such as LAMP, PBN and Advanced Controller tool support are considered important enablers to achieving the predicted growth in air traffic within the London TMA.



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# Impact on Airspace Operations

## 3. Approach Operations

**Marginal changes to controller working methods owing to the unique nature of the Heathrow Hub Concept**

— As the proposed new runway remains in-line with the current northern runway, the point at which approach controllers vector aircraft downwind, base leg and intercept will remain almost identical as it is in current operations;

— The workload of the INT and FIN controllers is expected to increase as a constant flow of arrivals will maintain a high workload. However due to the high throughput delivered to Heathrow's runways the approach controllers are accustomed to facilitating constant demand;

➢ **Mitigation**

— Due to the layout of the Heathrow Hub design it is anticipated that any changes to the way Approach control operate will be minimised.;

— Roles and operating procedures will change naturally as a result of implementation projects such as LAMP Phase 1 and 2 which is an enabler for this concept and the addition of any new capacity into the LTMA.

# Impact on Airspace Operations

## 4. Airport and Tower Operations

**Marginal changes primarily to operating procedures, controller working methods and training**

- The addition of a third runway at Heathrow Airport is likely to have an impact on the number of staff required during peak times;
- Tower controllers will see the biggest change to operating procedures although it is expected this will involve a transition and training stage to enable controllers to feel comfortable with the new layout;
- Working methods for the transitions between the operational modes that may be applied under the concept will require development;
- The current tower at Heathrow may not be in a suitable location to support landings in low visibility conditions on 27Rext/09Lext;

➢ **Mitigation:**

- Various projects are underway at R&D or implementation stages that aim to increase the efficiency of operations at airfields and reduce workload for the aerodrome controller. This includes conflict detection and conformance monitoring tools;
- The addition of a remote camera closer to the 27Rext/09Lext threshold may provide mitigation. Together with technological enhancements being developed for use in Remote Towers to potentially enhance ATCO situational awareness and improve safety.

# Missed Approaches

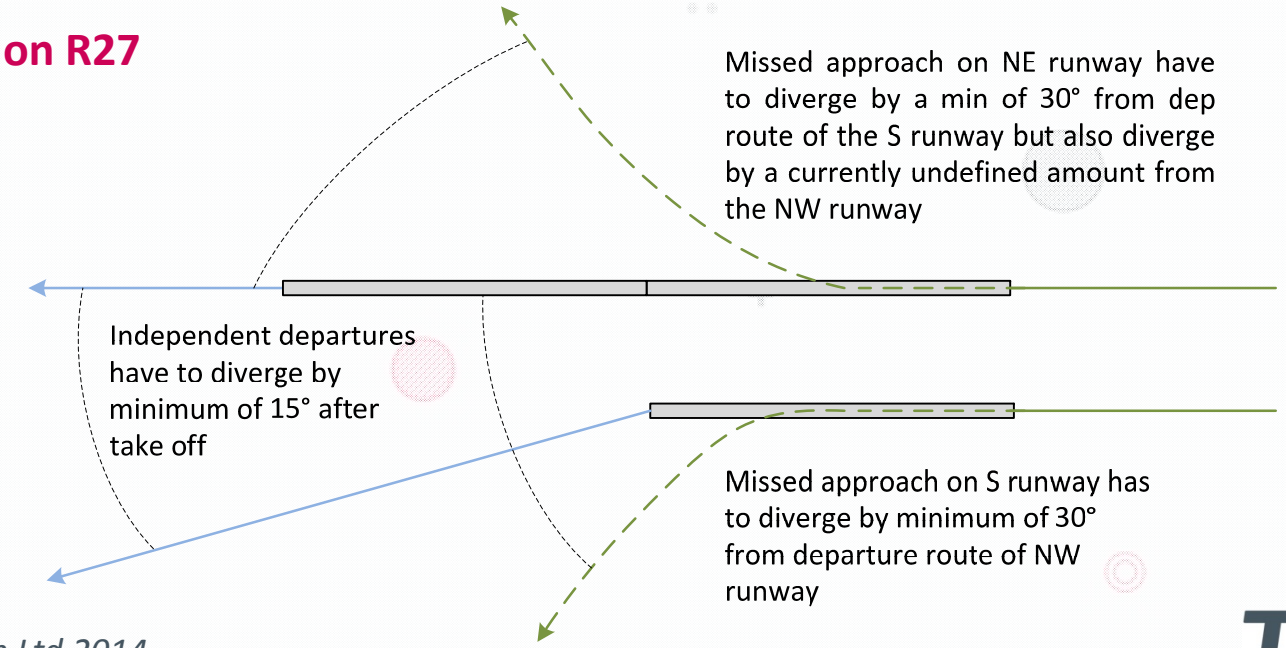
## Adherence to existing regulation

The suggested method for implementing missed approaches is largely compatible with current ICAO recommendations with the exception of missed approaches on the inline runways as current guidance does not cover a scenario of two independent inline runways.

## Proposed missed approach procedures

- Consideration is given to a full mixed mode operation from parallel runways;
- The missed approaches discussed will initially climb on runway heading until passing a minimum of 500ft before turning onto a diverging heading. The details of the diverging heading in each example are discussed below.

## Operations on R27



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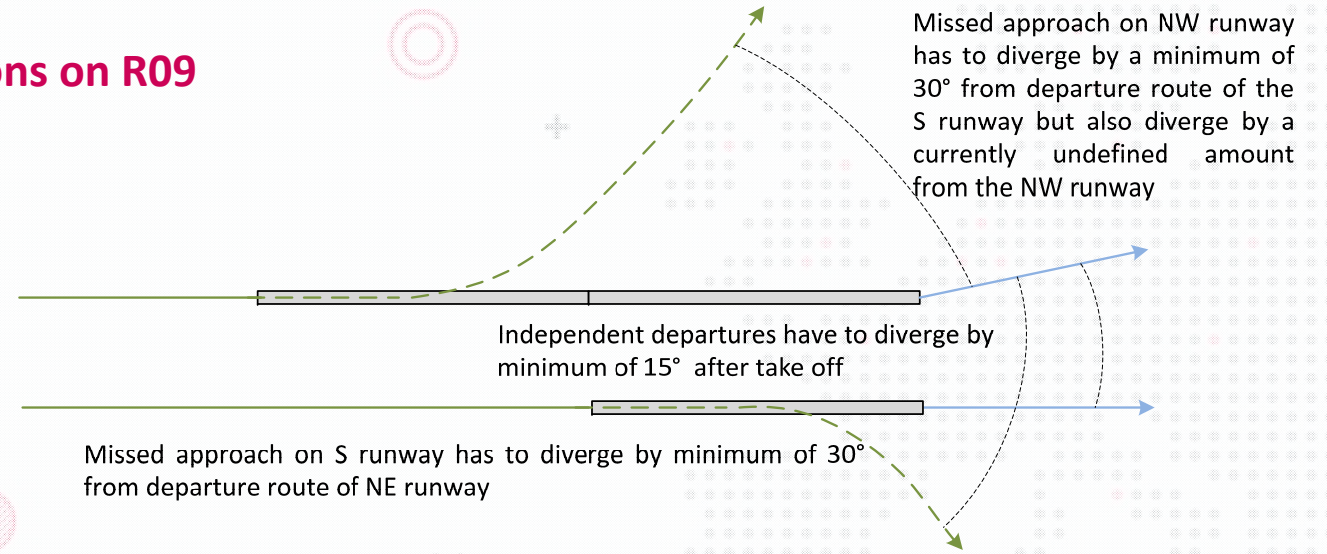
# Missed Approaches

## Operations on R09




### Similarity to current operations

On a mixed mode single runway there is the possibility of a “piggy back” scenario where a missed approach occurs behind a departure. However in this scenario there is a natural dependence between arrivals and departures whereas the Heathrow Hub concept is ideally independent between the inline runways.

A safety case would be required to show that this independence can be achieved between missed approaches on the NW runway and the departure track of the NE runway.

### Further work

To continue improving the maturity of this concept it is recommended computer modelling is carried out to assess different divergence angles and to determine key metrics over a range of scenarios.

# Four runway capacity modelling

## Peak hour Arrivals:

Two dedicated independent arrival runways, modelling independence in both directions.

- Average Peak hour Arrival capacity would range from **85 to 94 ATMs;**
- An increase in proportion of Large and Very Large Aircraft will reduce the overall capacity, and an increase in Medium Aircraft will increase capacity, due to wake vortex.

Two arrival runways, modelling independent westerly operations and dependent easterly operations with a 70% Westerly :30% Easterly split.

- Peak hour Arrival capacity would range from **80 to 87 ATMs;**
- When arrival dependence between runway 26L and 27L-W is assumed, due to the convergence of arrival flight paths, there is a relatively large capacity reduction
- Minimal impact on the median number of movements is due of the biased towards westerly operations (70:30).

## Peak hour Departures:

Departures are considered to be independent in both directions.

- Departures assume independence and the existence of split SIDS that would allow for 60 second separations for aircraft travelling to the same initial fix. There is very little difference between peak hourly departures with traffic mix;
- Average peak hour departure capacity would range between **96 and 98 ATMs**;
- It seems that departures under the assumptions stated would not limit capacity; arrival capacity would likely be the limiting factor.



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# Four runway capacity modelling

## Treatment of declared arrival capacity:

- Two capacities may be declared, one for each runway direction.
- For the purposes of scheduling a conservative approach may be taken and capacity based on the lower capacity due to dependency. This would underestimate the maximum capacity of westerly operations by up to 24 movements per hour.
- A lower declared arrival capacity would ensure that resilience was inbuilt into airline schedules in the event that easterly operations dominated for a sustained period, thus generating a more robust capacity assumption.
- A further approach would be to produce forecasts of the utilisation of easterly operations, based upon past use. The model considers that easterly operations are used 30% of the time. This percentage could hence be used to weight the declared capacity in favour of westerly operations. However the proportion of westerly and easterly operations is likely to shift from 70:30 in the long term to 2050.

## Annual Capacity

- **Heathrow Airport operating with 4 runways should be capable of supporting 950,000 to 1.05 million ATMs per annum on runways with independence in arrivals and departures in all directions**.
- It is considered likely that if operating with an Easterly Arrival Dependence annual movements would drop to between 890,000 and 975,000 ATMs.
- Further analysis would be required if movements in excess of 750,000-800,000 ATMs were envisioned to ensure resilience exists within the system.



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# Benefits of the Heathrow Hub Concept

1. The intended third runway design will use the same centerline as today's northern runway. This should enable some of the ATC infrastructure to remain the same
2. There is potential that the necessary SID/STAR redesign will have less of an impact on the rest of the TMA and other airfields than other third runway options. A westward shift in the SIDS has the potential to have less of an impact on the LTMA than other third runway options.
3. Deep landings on 27Rext will be possible without the added complexity of displaced thresholds.
4. An adjacent and in-line fourth runway can be added to further increase capacity if required and would maintain a compact hub;
5. Heathrow Hub Concept is uniquely placed to handle changes in fleet mix over other current proposals. By introducing a concept of a dedicated runway for heavys and super heavys when these aircraft types are in excess, delays in the air can be minimised;
6. The layout of a centralised terminal between the southerly and northerly runways helps reduce taxi times on the ground and eliminates the need for aircraft to cross active runways thereby reducing controller workload



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# Conclusions

- Due to current restrictions and inefficiencies in the LTMA design, expert opinion has deemed it unlikely that an extra 200,000 movements per year is feasible using today's systems and procedures. Controller workload is very high and rapidly approaching levels where any extra demand in the TMA cannot be met. However multiple projects are underway which ultimately aim to increase capacity and reduce controller workload. LAMP and PBN are the biggest enablers for increasing capacity within the TMA whilst maintaining/improving safety standards.

- **A third runway solution, regardless of layout is critically dependent on long term projects delivering the expected increase in capacity.**

- Overall, the option of a third in-line runway at Heathrow does not present any major obstacles that cannot be overcome. Although the workload of Tower, Approach and TMA controllers will increase, sometimes substantially, various projects including Advanced Controller Toolsets will help offset the associated increase in workload.

- **The findings of this report conclude that the option of a third in-line runway at Heathrow is feasible from an ATM perspective.**

# Further Information

— ATC & Airspace
- Pete Blyth, Operational Expert
- pete.blyth@think.aero
- +44 (0) 1202 765 654
- +44 (0) 7595 303 452

— 4 Runway Capacity Modelling
- James Daley, Modelling Expert
- james.daley@think.aero
- +44 (0) 1202 765 654
- +44 (0) 7842 666 623

— Account Manager
- Conor Mullan, Managing Director
- conor.mullan@think.aero
- +44 (0) 1202 247 204
- +44 (0) 7779 662 330



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