MAYOR OF LONDON

Transport for London

Inner Thames Estuary Feasibility Study

Response to Airports Commission Call for Evidence

The Mayor of London's Submission:
Supporting technical documents

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Title: **Low Visibility Procedures**

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Purpose of paper: **To explain how and when low-visibility procedures are implemented at airports, the key factors that cause delays, and the ease of recovery to normal operations.**

Key messages:

- Greater aircraft separation is required during low visibility procedures to ensure safety, and contingency plans must be in place to mitigate impact of low-visibility.
- There is a strong correlation between high runway utilisation levels and weather-related delays. Heathrow, even with a third runway, would operate at high levels of utilisation (therefore remaining at high risk of delay).
- A new hub airport with four independent runways would be far more resilient to fog and low visibility events thanks to overall throughput capacity, and could return to normal operations more quickly, allowing a more predictable and efficient recovery and lowering overall impact to airlines and passengers.

Mayor's Aviation Works Programme - New Hub Airport

Technical Note – Low visibility procedures

Transport for London

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Summary

- All airports that wish to continue operations in conditions of low cloud and poor visibility are required by the CAA to apply Low Visibility Procedures to ensure operational safety. These procedures instigate a substantial increase in the spacing between aircraft while conditions persist. Runway capacity is reduced by up to 50%.
- All airports need operational contingency plans for low visibility procedures to mitigate the impact of the reduced runway capacity on operations. At Heathrow, because normal runway utilisation is so high, this contingency is achieved using agreements with airlines for the tactical cancellation of large numbers of flights.
- In conditions of low visibility, analysis shows that there is a strong correlation between high runway utilisation levels (> 75%) and weather related delays.
- Ultimately, a new hub with four independent runways would prove far more resilient to low-visibility conditions thanks to its overall throughput capacity during a low-visibility event, and faster return to normal operations afterwards due to it being designed to operate at 75% runway utilisation.

1. Introduction

Low visibility procedures exist to support low visibility operations at aerodromes when either surface visibility is sufficiently low to prejudice safe ground movement without additional procedural controls, or the prevailing cloud base is sufficiently low to preclude pilots obtaining the required visual reference to continue to landing at the appropriate Decision Height (normally 200 feet above the runway). On aerodromes where the ground marking and lighting is adequate, ground traffic at reasonable flow rates can often be sustained safely in reduced visibility.

Making the necessary transition to visual reference during the final stages of an approach to land in poor visibility is critical and certain requirements must be met to reduce the risk of a runway excursion. As the visibility deteriorates, the potential for runway incursions by aircraft, vehicles or personnel also increases.

Aerodromes that wish to continue operating in poor visibility or are available for instrument approaches in conditions of low cloud are required to develop and maintain Low Visibility Procedures (LVP).

The point at which LVP are implemented may vary from one aerodrome to another depending on the local obstacles, conditions and the facilities available. It will usually be determined by a specific Runway Visual Range (RVR) or cloud base measurement. Typically RVR below 550 metres or a cloud base below 200 feet above aerodrome level will trigger LVP. At Heathrow, the visibility trigger is RVR 600 metres and / or 200 feet cloud base. Safeguarding is commenced when the visibility or cloud base is falling and is forecast to reach the LVP minima.

The impact of LVP on the operation and throughput of an airport is largely dependent on the planned level of runway utilisation in normal conditions. The Eurocontrol report on Airport level - ANS performance monitoring 2013 illustrates that the airports with very high levels of planned runway utilisation experience very high levels of delay. Airports with planned runway utilisation of less than 75% experience little or no delay. LVP will always reduce the maximum operating capacity of any runway.

The IoG is anticipated to attract more occurrences in the year when low visibility conditions (visibility of less than 600m) occur than Heathrow and Gatwick but less than Stansted. However over a 10 year period low visibility conditions were recorded at Shoeburyness which is taken as a proxy for the IoG (as it is the closest estuary weather station) on 1108 occasions or 1.28% of all observations recorded. Such a small percentage of time in low visibility conditions is not anticipated to have a significant impact on punctuality and delays. As Table 1 below shows there is little or no correlation between low visibility and delays but there is a high level of correlation between high levels of runway utilisation and delays. Heathrow has the lowest number of low visibility observations, yet the highest utilisation percentage and the greatest proportion of delays attributed to weather; conversely Stansted has the greatest number of low visibility observations, yet the lowest utilisation and weather attributed delays. Admittedly wind, snow, thunderstorms can cause delays but they affect Heathrow more than other London airports because of the unsustainably high planned runway utilisation. Reasonable levels of runway utilisation (circa 75%) during normal conditions permits quick recovery after disruption whatever the cause.

Airport	No. of observations of visibility <600m over 10yrs	% of all observation with visibility <600m over 10yrs	Runway utilisation 2013	% of delays attributed to weather
Heathrow	385	0.44%	92%	86.4%
Gatwick	760	1.18%	73%	68.1%
Isle of Grain	1108	1.28%	74%	n/a
Stansted	1390	2.25%	30%	7.7%

Table 1-1 Comparison of low visibility utilisation with weather delay

2. Impact of LVP on runway throughput

Aerodromes should determine the movement rate that they wish to sustain and develop Low Visibility Procedures that will support the desired movement rate. These procedures will vary with each aerodrome and are subject to acceptance by the CAA prior to inclusion in the Aerodrome Manual and the unit Manual of Air Traffic Services Part 2 and their subsequent implementation.

Experience shows that the maximum runway utilisation rate is typically reduced by up to 50% in low visibility. For safety reasons, the typical separation between aircraft is doubled during LVP; hence the maximum runway capacity is halved.

The landing and departure rate is reduced for two primary reasons; firstly to protect the critical areas of the precision approach system (normally the ILS) serving the runway from interference, secondly, because the ability of the pilots and controllers to use visual reference to assure safe operation is impaired.

The actual reduction in runway utilisation in low visibility is a function of the runway slot occupancy planned by the airport for normal operations, as well as the extent of any deterioration in visibility. A typical high utilisation single runway operating in mixed mode would be expected to handle about 50 aircraft per hour in normal visibility. In LVP conditions this figure would reduce to about 25 aircraft per hour. In this case an aerodrome with more than 25 allocated slots planned in the hour will naturally experience accumulating aircraft delays and flight cancellations.

Analysis of airports in the UK and elsewhere in Europe by Eurocontrol indicates that airports with planned runway utilisations of less than 75% can absorb the impact of LVP without onerous consequences. The Atkins technical note “Runway Utilisation” provides more details.

In future, airports, instead of using ILS for precision approach guidance, will be making use of Performance Based Navigation (PBN) approaches. This will be routine when an IoG airport opens. PBN precision approach guidance has a reduced need for protected critical areas on the ground. The need for visual reference for pilots does not change, so low visibility will continue to require special procedures, although landing rates may be improved.

3. Impact of LVP on runway capacities in London

The declared runway capacity of an airport will reflect operations in good weather and standard separation procedures. The achieved throughput will be impacted by the mix of wake turbulence category of aircraft, wind conditions and other factors. These same factors will also impact the achieved throughput rates in low visibility.

As with aerodromes elsewhere, LVP at London’s airports will include the setting of a safe movement rate by air traffic control at the aerodrome affected. This rate will be lower than the declared capacity and maybe lower than the planned utilisation rate for normal operations. Inbound aircraft will be allocated planned arrival slots on a tactical basis; aircraft departing an airport with LVP in place will be allocated a planned take-off time. European Air Traffic Control uses flow regulation operated by the Central Flow Management Unit (CFMU), under the jurisdiction of the European Network Manager, Eurocontrol. The CFMU regulates the flow of aircraft to affected airports, by using en-route holding and delayed take-off times. This flow management will help to deliver aircraft to the airport operating under LVP at an acceptable rate.

3.1. Gatwick

According to Airport Coordination Limited, the declared landing rate for the single runway at Gatwick is planned at up to 32 per hour, aircraft wake category and the planned timings of departure/arrival waves will be considerations.

According to the UK Aeronautical Information Publication (CAP 032) at Gatwick[1], when LVP are in force a much reduced landing rate can be expected due to the requirement for increased spacing between arriving aircraft. In addition to the prevailing weather conditions, such factors as equipment serviceability may also have an effect on actual landing rates. For information and planning purposes, the approximate landing rates that can be expected are:

RVR (m)	Expected Landing Rate
Greater than 1000	24
Between 1000 and 600	20
Between 550 and 350	15
Less than 300	12 or less

Table 3-1 Gatwick low visibility landing

3.2. Heathrow

The design, operation and use of Heathrow Airport are such that it has extremely limited ability to absorb any event that reduces operational throughput. Poor visibility, low cloud, high wind, thunderstorms, snow and ice, incapacitated aircraft and vehicles, unserviceable equipment such as ILS or surface movement radar will all impact the airports ability to sustain its normal movement rate. At Heathrow even the spacing of the parallel runways is insufficient to permit simultaneous parallel approaches (with current radar capability), further limiting the airport's resilience and recovery time.

Where all the aircraft movement slots are allocated for a particular runway, this will have a profound impact on the resilience of any operation for the duration of the low visibility event, or indeed any event that reduces runway availability. Runway utilisation at Heathrow is currently 92%. The planned arrival rate in normal conditions at Heathrow is typically 42 aircraft per hour.

According to the UK Aeronautical Information Publication (CAP 032)[2] at Heathrow, when LVP are in force a much reduced landing rate can be expected due to the requirement for increased spacing between arriving aircraft. In addition to the prevailing weather conditions, such factors as equipment serviceability may also have an effect on actual landing rates. For information and planning purposes, the approximate landing rates that can be expected are:

RVR (m)	Expected Landing Rate
Between 1000 and 600	34
Between 600 and 150	24
Less than 150	Less than 20

Table 3-2 Heathrow low visibility landing rates

Accordingly the airport has governance procedures established [3] with its airlines, to cancel large numbers of operations when circumstances require a temporary reduction in the number of flights.

It follows that by adding a third runway, Heathrow would gain the resilience to operate normally with today's traffic levels of 480,000 ATMs in LVP. Even with a 3rd runway, any growth in the number of flights at Heathrow would reduce resilience of the runway throughput to sub-optimal levels during any event impacting runway utilisation, including LVP.

[1] NATS AIP London Gatwick – EGKK – Textual Data Section 2.20

[2] NATS AIP London Heathrow – EGLL – Textual Data Section 2.20

[3] http://www.acl-uk.org/UserFiles/File/Heathrow%20Procedures%20For%20Temporarily%20Reduced%20Capacity%20v10%20internet%20version.pdf

3.3. Isle of Grain – Inner Thames Estuary Hub

A 4 runway IoG hub airport with a planned normal utilisation of 75% can be expected to have substantially more runway throughput resilience than alternate airports and hence will also have a reduced abnormal operations impact in LVP. Heathrow currently and in the future is expected to operate with average utilisation in excess of 90%.

Four parallel runways, with spacing for parallel approach operations, used in either segregated or mixed mode will provide the flexibility necessary to sustain operations. Further because of this resilience, it will be much less likely to create backlog and delay circumstances which correspondingly disrupt the air transport operation across Europe.

The planned runway utilisation rates for the IOG hub airport, reflects those used at Paris CDG, Frankfurt and Amsterdam airports. These consistently demonstrate better resilience capabilities in abnormal operations than Heathrow. Yet by definition the effect of LVP on maximum capacity at each airport will be very similar. The key aspect is that each of these European airports and the IoG has a minimum of 4 runways to underpin operational resilience. The Heathrow and Gatwick proposals do not offer this robust operational capability.

References:

1. UK CAP 168: Licensing of Aerodromes, Appendix 2B
2. European Action Plan for the Prevention of Runway Incursions
3. ICAO Doc 9870 App B - Best Practices on the Flight Deck
4. European Action Plan for the Prevention of Runway Incursions App D - Flight Crew Best Practices
5. ICAO Doc 7013 "European Guidance Material On Aerodrome Operations Under Limited Visibility Conditions
6. UK Aeronautical Information Publication CAP 032
7. Airport Coordination Limited : http://www.acl-uk.org/
8. Eurocontrol Delay Publications: http://www.eurocontrol.int/articles/coda-publications

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