A Second Runway for Gatwick

Appendix

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Performance through Innovation

Gatwick Airport 'Runway 2' Airspace Management Options Review

Final Version
31 March 2014

Prepared by
NATS Services

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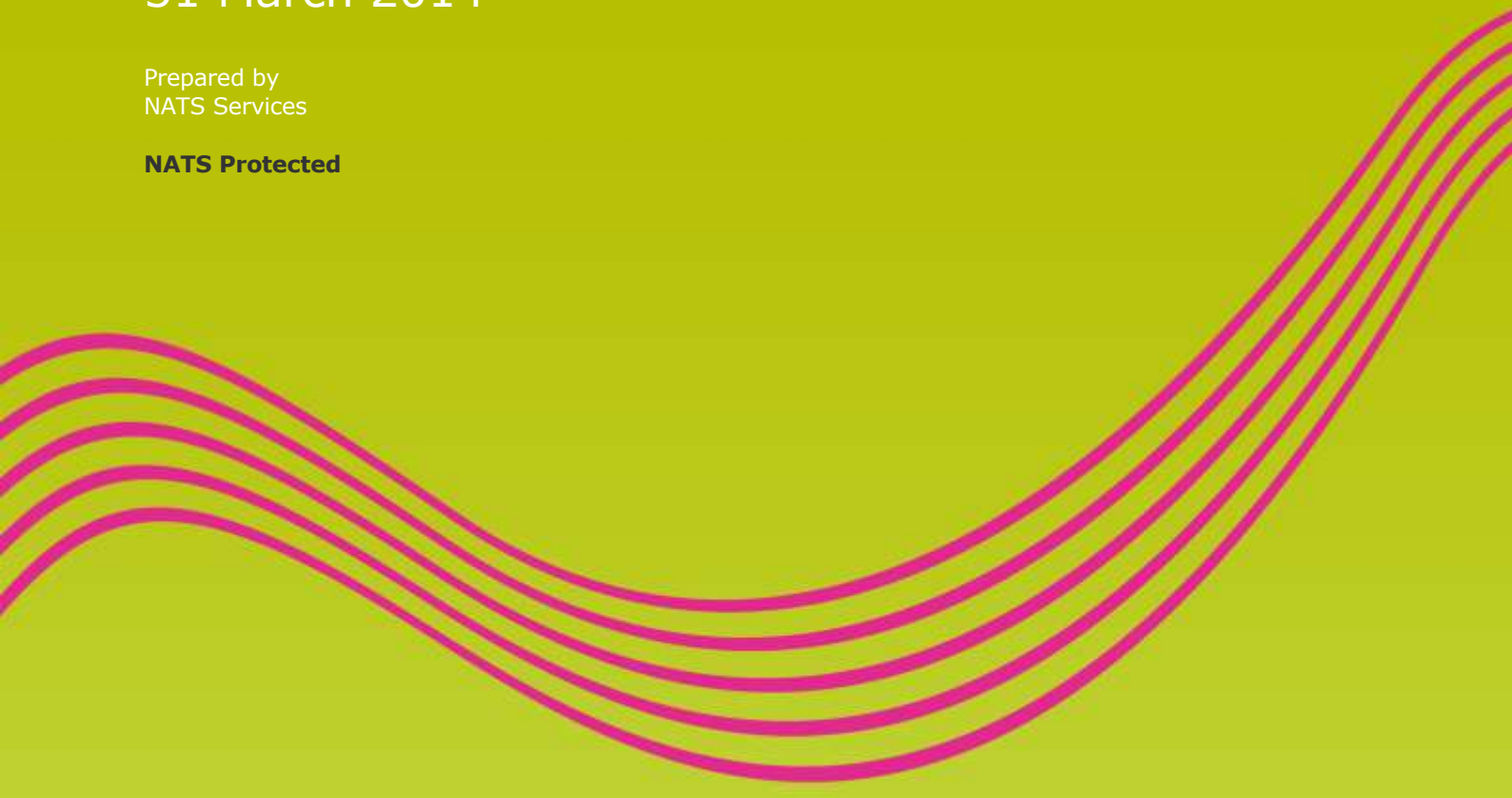

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Background

Gatwick Airport Ltd. (GAL) has developed a number of dual runway ground infrastructure layouts and associated aircraft ground movement designs. This review focusses only on the wide spaced independent mixed mode parallel runway designs which GAL are considering; in particular the associated concept airspace management options for arrival and departure traffic flows within the London TMA/Gatwick Radar Manoeuvring Area.

This Operational Concept Review is intended to further inform GAL's Runway 2 design team in finalising its ground infrastructure development strategy, particularly with regards to their planning of acceptable levels of required runway crossings.

The scope of this review is not intended to determine the absolute final airspace concept to be employed as a result.

A workshop was held at NATS Swanwick Centre with attendance from operational staff from NATS Terminal Control, NATS Gatwick and members of GAL's Runway 2 team, along with third party (ARUP) consultants as observers. GAL's draft ground infrastructure designs for "RWY 2" were reviewed in order to determine a finite number of standard operating concepts that could be employed within the immediate airspace around Gatwick, and within the London Terminal Manoeuvring Area (LTMA). These standard operational concepts were then further refined to determine, in qualitative terms, the optimal option(s) and limitations. This document serves as summary report of these findings and is not a formal NATS statement on actual airspace changes required to incorporate an additional runway at Gatwick Airport or within the London TMA.

NATS operational expert workshop participants included

3x Terminal Control ATCOs

1X Gatwick Tower ATCO

1X ATCO Facilitator

1.1 Executive Summary

Three airspace management options were reviewed at the workshop;

Option A, Terminal based runway allocation of departures and arrivals

Allowing any departure route from either runway, departure runway and arrivals runway being determined by parking position,

Option B, Compass based allocation of runway for departures, terminal based runway allocation of arrivals

Allowing deconflicted departure routes (based upon points of the compass) from each runway, while arrivals are allocated a runway specific to parking position, and

Option C, Compass based allocation of runway for departures, free flow arrivals to any runway

Allowing deconflicted departure routes from each runway, while arrivals can be allocated any runway

Option A was determined to be non optimal, from an airspace management perspective, due to the impact of crossing departure paths causing DEP-DEP defects, high ATC workload/coordination and safety concerns (level busts, pilot error and go around conflicts)

Option B was determined to be an optimal solution, from an airspace management perspective, as departure management is independent between runways and arrivals can be flexed from one runway to the other (if parking in midfield location) to maintain balance of demand (based on GAL forecast traffic for midfield parking area).

Option C was determined to be an optimal solution, from an airspace management perspective, as it has no specific ATC management issues for departing or arriving traffic.

Note: ATC require dedicated timely/stable information on runway allocation (based upon parking area) for both Options A and B. This information is not currently supplied to/available in NATS TC Operations

All options require further work to determine the method for safely delivering two streams of arriving traffic from the south (due to airspace limitations to the north) onto the parallel approach paths.

1.1.1 Definitions

ATCO = Air Traffic Control Officer

LAMP = London Airspace Management Programme

LTMA = London Terminal Manoeuvring Area

TC = NATS Terminal Control, Swanwick

CAA/SARG = Civil Aviation Authority/Safety and Airspace Regulation Group

DfT = Department for Transport

SID = Standard Instrument Departure (route)

CAP 725 = Civil Aviation Publication document, number 725, "Airspace Change Procedure Requirements"

CDA = Continuous Descent Approach technique, which avoids level segments of flight during the approach

PBN = Performance Based Navigation, which utilises satellite and on board flight management computer software technology to navigate accurately instead of conventional ground based navigation beacons

RNAV1 = Area Navigation, which is a form of PBN commonly in use at Gatwick since introduction in 2013

Level Bust = Unauthorised/erroneous climb or descent by the flight crew, resulting in the aircraft proceeding beyond the instructed safe altitudes

Packing = spacing aircraft on final approach to land at minimum distance (either based on radar separation standards or wake turbulence separation standards, such that the maximum number of arrivals can land in the minimum time interval (used when arrival demand is greater than departure demand)

1.1.2 Assumptions

The following assumptions have been made in order to simplify the assessment process;

1 LAMP Phase 2 airspace changes are in place, reducing impact of London Heathrow traffic on Gatwick flows.

2 No additional runways operational at any other airport within the LTMA, as LAMP Phase 2 scope does not include additional runways.

3 Farnborough Airport controlled airspace change is in place

4 Traffic growth predictions, as supplied by GAL, are correct. These include forecasts of the maximum hourly traffic to be managed by ATC, in terms of totals, breakdown of Arrivals/Departures including averages and maximum Arrival/Departure rates. Traffic mix (including numbers of Super Heavy, Code F types) and directional loading (i.e. if required to arrive or depart a specific runway for a specific terminal/parking area or departure routing, at least in terms of north/south/east/west if not in terms of SID route)

1.2 Detailed Option Review

The following section contains more detailed notes of the workshop session review of options broken down into arrivals management and departures management issues and benefits

1.2.1 OPTION A

GAL Concept: Departing aircraft are allocated to either runway, based upon parking area (northern apron depart northern runway and midfield apron depart either northern or southern runway). Arrivals are allocated runway based upon parking area).

Arrows are indicative, and do not represent the exact flight paths expected to be flown

Figure 1

1.2.1.1 Arrivals management (Option A)

- Overall, there are no ATC issues specific to this option (in comparison to other operational concepts), though ATC requires additional, timely, accurate and stable information supply on the runway allocation, based upon parking stand, from GAL in order to achieve the correct flow to each runway

- There could be flexibility (not show on diagram) with arrivals for midfield apron being accommodated on northern runway if imbalance in demand for north/south runway identified.

- When operating at or near to peak arrival capacity, there would be a need for proactive management of arrival runway 'switching' to optimise throughput.

- Runway switching can have an impact on crew briefing of the appropriate missed approach procedure (missed approach point, decision height applicable, altitude, turn point, direction and tracks) to be flown. This is particularly acute in design Option A as there are crossing departure tracks and de-confliction of missed approaches is a critical safety risk area.

1.2.1.2 Departures management (Option A)

- Diverging or parallel departure routes (meeting simultaneous independent criteria) are possible, though bunching of flights departing on the same SID routings (e.g. a SID route towards DVR from one runway and the corresponding SID route to DVR from the other runway) from the two departure runways would be sub optimal and would require de-confliction through CDM departure sequencing and/or coordination techniques.

- Crossing departure routes from the two departure runways require increased separations and potentially have a significant impact on capacity/throughput and would require de-confliction through departure sequencing and/or coordination techniques. The current roll out of CDM procedures and tools at Gatwick (as part of the A-CDM55 Programme), results in pre-departure sequencing of aircraft to a tolerance of +/-5mins for each aircraft (i.e. the flight receives a specific Target Take Off Time (TTOT) which allows it to be airborne any time between TTOT+/-5mins; a 10 minute window). This 10 minute window would be insufficient to successfully de-conflict crossing departure routes as the sequencing would need to be to the exact minute. The complex overlapping departure route structure would require additional work to ensure that safe handling of missed approaches from either runway can be accommodated such that one runway controller does not place a missed approach into conflict with a departure form the other runway (under control of a second runway controller) while de-conflicting it from the preceding departure from his/her own runway.

- Staggered approaches (whereby aircraft are positioned such that they are never side by side while on parallel final approach paths; see Figure2) might assist in de-conflicting missed approaches or departures, though this would require more detailed design of routes and modelling of traffic flows. Flexibility of independent approaches may be lost as a result in order to maintain the staggered pattern (i.e. 'packing' arriving flights on one runway subject to higher inbound demand may compromise the stagger by placing aircraft

alongside each other on the approach such that in maintaining a staggered flow may reduce possible throughput)

- Departure routes could be incorrectly loaded by flight crew (e.g. a DVR SID with a left turn out from the southern runway could be incorrectly loaded instead of the appropriate DVR, right turn out, from the northern runway such that the aircraft gets airborne and turns unexpectedly across the path of traffic from which it should be separated)

- Crossing routes may be de-conflicted by holding down one runway's SID climb profile below the other as they cross, though this would have environmental impact (noise, fuel and emissions) and result in potential safety implications (level bust)

- Departures from the northern runway via the "BOGNA" route to the south are likely to be most problematic (as they would cross all SID routes from the southern runway) and as they are the most commonly used SID route due to the high demand of departures to south-west and central Europe .

- A mitigation of impact of high loading of southerly departure SID routes could be to park flights which are due to depart via the SAM/BOGNA southbound SID routes on the midfield apron and ensure that departures via BOGNA route have to depart from the southern runway as this would avoid the most complex crossing of SID routes. However this may be impractical as apron assignment will depend on how terminals are allocated to the different airlines.

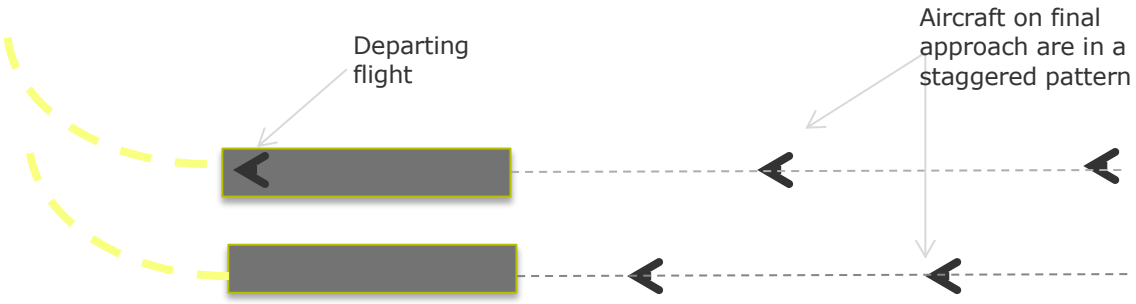


Figure2; Aircraft are established on the grey final approach paths in a staggered fashion resulting in either an arrival or a departure movement occurring simultaneously, never two simultaneous departures or arrivals

1.2.2 OPTION B

GAL Concept: Departing aircraft are allocated to either runway, based upon compass departure route (right turn out depart northern runway and left turn out depart southern runway).). Arrivals are allocated a runway based upon parking area (northern apron arrive northern runway and midfield apron have the flexibility of being allocated to northern or southern runway).

Arrows are indicative, and do not represent the exact flight paths expected to be flown

Figure 3

1.2.2.1 Arrivals management

› Same as Option A

› Good Flexibility – could pack on one runway or switch traffic destined for midfield apron between northern and southern runways to maintain demand/throughput and reduce airborne arrival delay

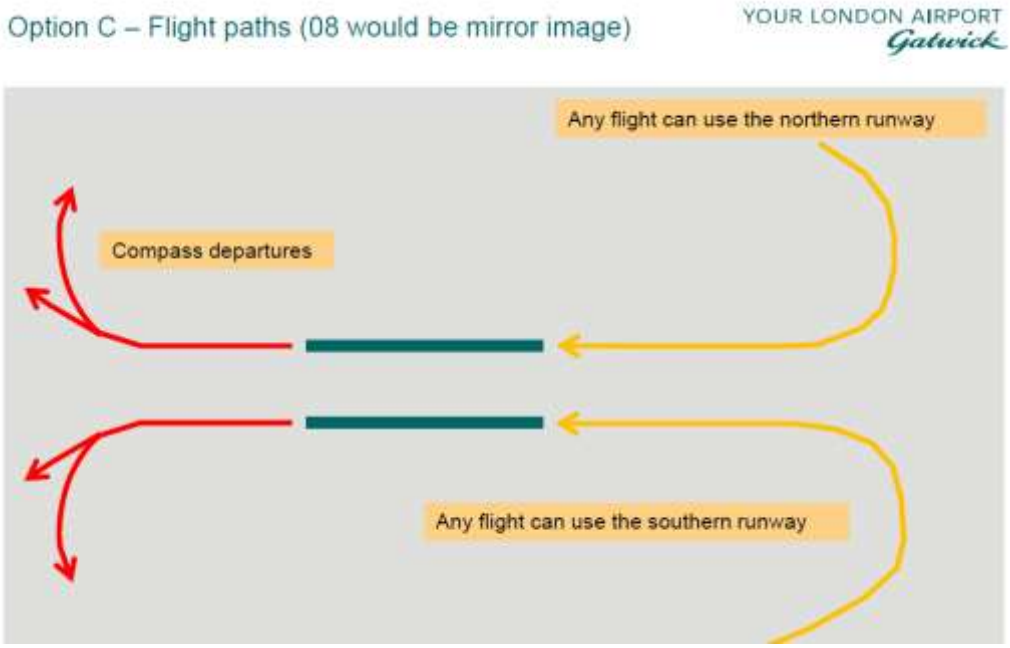
› Runway switching can have an impact on crew briefing of the appropriate missed approach procedure (missed approach point, decision height applicable, altitude, turn point, direction and tracks) to be flown

1.2.2.2 Departures management

› No ATC issues specific to this option

1.2.3 OPTION C

GAL Concept: Departing aircraft are allocated to either runway, based upon compass departure route (right turn out depart northern runway and left turn out depart southern runway).). Arrivals can be allocated any runway.



Arrows are indicative, and do not represent the exact flight paths expected to be flown

Figure 4

1.2.3.1 Arrivals management

- No ATC issues specific to this option with regards to airborne flows.
- Flexible loading of either runway possible to maintain throughput/reduce airborne delay
- No additional information on runway allocation/parking area required in ATC

1.2.3.2 Departures management

- No ATC issues specific to this option (as per Option B above)

1.3 Common Issues for all options of dual independent mixed mode operation

As already described, the aims of the workshop were to review and identify issues and provide a qualitative assessment of the current options for airspace management under development. There are a number of common factors which were identified in the workshop that result from simultaneous independent dual runway options in the LTMA around Gatwick

1.3.1 Point Merge or Similar PBN Concept

Point Merge could provide a potential stream from which a 'packed' flow could be split to provide a gapped stream for each runway on base leg, though further consideration is required of benefits of a second point merge structure or other form of PBN arrival management structure to determine optimal solution.

This work would need to also focus on potential impact of departure streams. The simpler the departure route option selected, (see Options B and C above) the less complex this would be to incorporate.

Easterly configuration at Gatwick is the most complex due to airspace limitations, especially with regards to Farnborough traffic should the position of the Gatwick base legs need to be extended to separate the two runway arrival streams (until both streams are established on final approach) – see Section 1.3.2.

1.3.2 Separation of Gatwick Traffic on Base Leg

The method of providing vertical separation of arrivals to the two parallel approaches requires further assessment to determine overall optimal solution as part of a full airspace design concept. A common way of dealing with two such streams is to maintain vertical separation of 1000' between traffic being positioned onto mirror image base legs. This is usually achieved through a trade off in optimal vertical profile (CDA of one stream). However, this style of operation may be limited at Gatwick due to both proximity of Heathrow traffic to the north and also the 'wrap around' SID routes to the east (see figure 5) and to the west (from easterly runway)

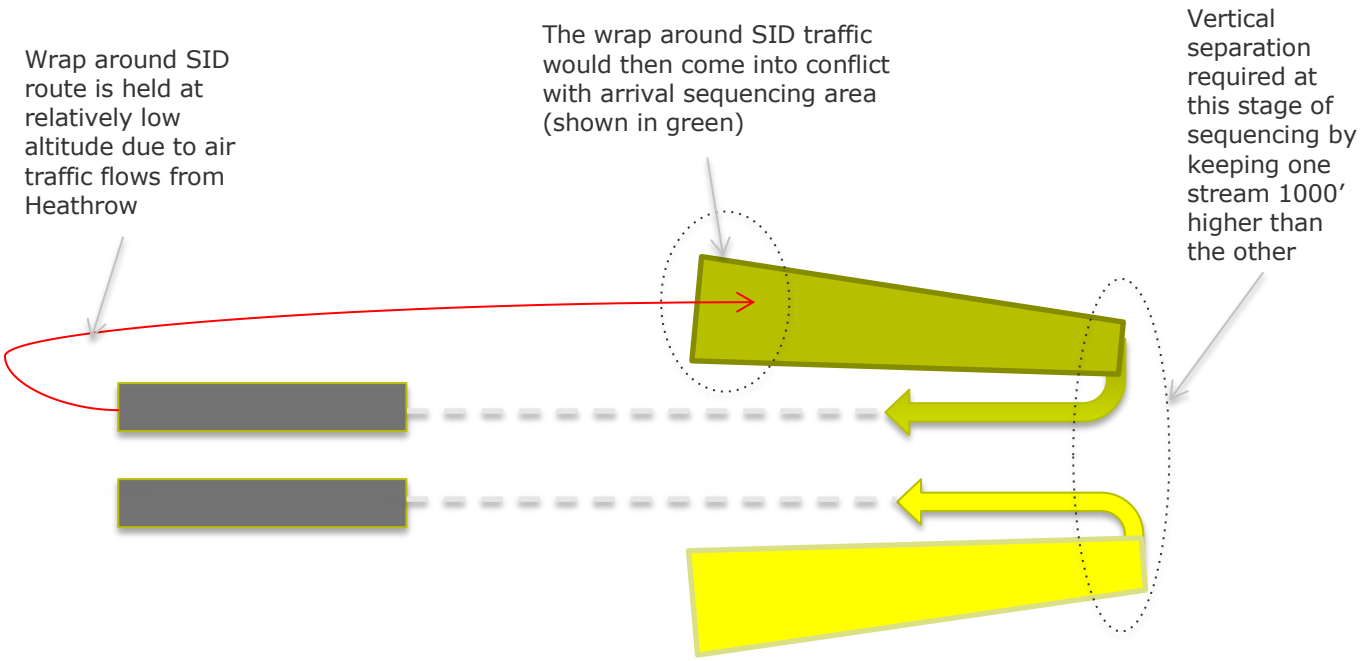


Figure 5 above shows a standard 'mirror image' arrival stream delivery to parallel approaches and the potential conflict with wrap around SID routes. Diagram shows a westerly traffic pattern, but easterly pattern has similar issues

The main issue of two arrival streams from the same direction would be to resolve the conflict between traffic that has established on final approach to one runway against the traffic, which is heading towards it on the base leg, prior to establishing on the parallel approach path (see Figure 6 below).
The NATS Operational ATC experts at the working group working group did not feel that this ruled out any of the high level Airspace Options under their consideration and suggested some possible solutions to this issue (requiring further analysis) including, use of a steeper approach transition to one runway (which may be particularly useful for easterly arrivals due to airspace limitations) or staggered base legs/arrivals from one stream downwind (see point merge point section above) onto alternate final approaches.

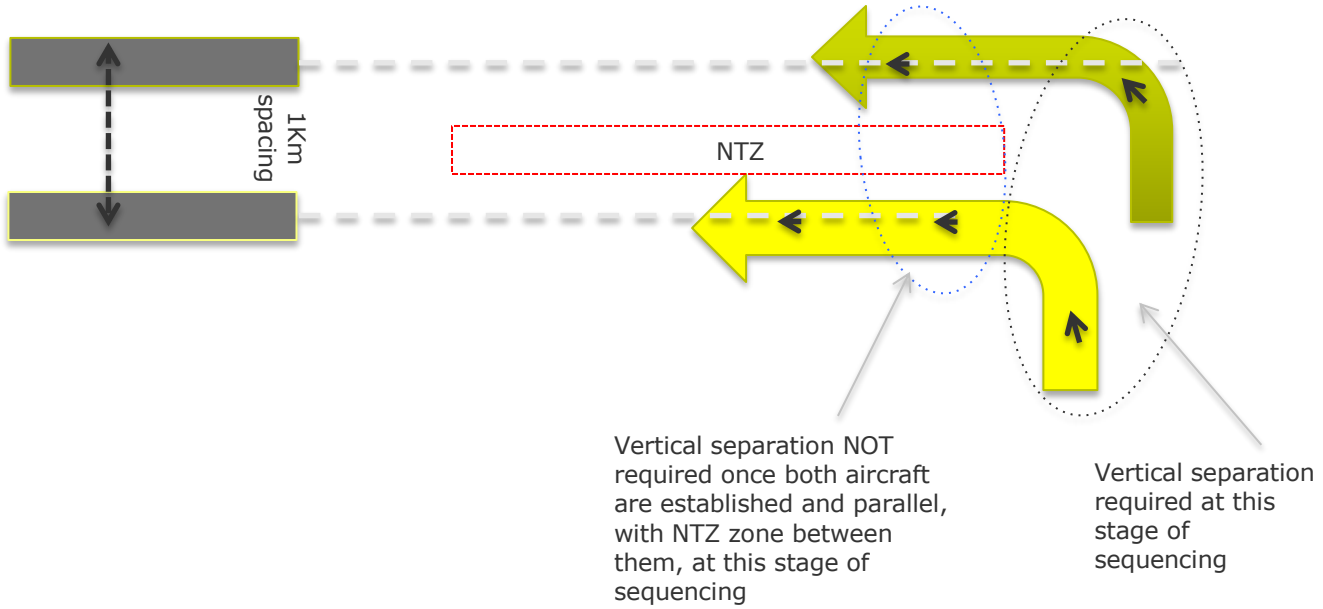


Figure 6 above shows the requirement to provide 1000' vertical separation (while aircraft are less than 3nm laterally separated, until established on independent parallel final approach tracks, protected with mandatory No Transgression Zone (NTZ)

1.3.3 Wrap Around SID Routes

Wrap around SID route (to the north) was considered as valuable in optimising flexibility of the departure options, though this does result in a conflict with LGW arrivals base legs (if extended further from the airport and therefore joining final approach at a higher altitude, or if mirrored base legs are employed.

1.4 Incremental Growth of each Option

The working group was also asked to consider a first phase of implementation based upon an assumed initial traffic/PAX growth in order to shake down any issues that may be encountered as a result of an unbalanced demand as shown:

Incremental growth to each option
1st Phase = 20m PAX capacity in mid field/45m PAX capacity in northern apron

The expert opinion conclusions of this traffic loading are as follows:

1.4.1 Option A (1st Phase Traffic Demand)

Arrival loading would be acceptable, though southern runway underutilised

Departures from southern runway would have both a positive (tactical departures offloaded from main runway) and negative (crossing tracks and missed approach conflict issues described in full traffic loading scenario – see section 1.2.1.2 above)

1.4.2 Option B (1st Phase Traffic Demand)

No specific ATC issues beyond section 1.2.2 above, though one runway would again be underutilised at times

The option does however give flexibility to swap midfield arrivals between runways and would have potential to reduce peak airborne delays as a result

1.4.3 Option C (1st Phase Traffic Demand)

No ATC issues specific to this option.

1.5 Questions Arising/Suggestions for further study

As already described, the aims of the workshop were to review and identify issues and provide a qualitative assessment of the current options for airspace management currently under development. The workshop also identified areas for which further study is recommended as detailed below;

1.5.1 Airspace Concept Development

Point Merge could provide a potential stream from which a 'packed' flow could be split to provide a gapped stream for each runway on base leg. Further consideration is required of benefits of a second Point Merge structure over other forms of PBN arrival management structure in order to determine the optimal solution.

1.5.1.1 Airspace Concept Questions

- How many holds/point merge structures? Replacement with PBN based 'tromboning' arrival routes?
- Two Point Merge structures with a parallel intercept of final approach?
- Kinked final approach to avoid late vertical separation?
- Simulation of a single base leg operation is recommended together with a review of other multiple parallel runway operations (HKG 3rd runway etc., whereby both mirrored and single shared base legs are employed, as three or more parallel runways cannot be fed from two mirrored base legs alone)
- Environmental impact study of CDA to dual runways versus track mileage
- Options for steeper approach transition to one runway, increased glide path angle?

1.5.1.2 Airline Feedback

Airline input is also required on;

- Use of steep arrival route transitions to final approach path
- Use of late switch of approach/runway
- Appetite for RNP[1] approach implementation
- Predicted RNP 0.3Certification level of fleets by 'O' date as the higher level of navigation accuracy of RNP 0.3 over RNAV1 or RNP1 may provide opportunity for improved separation of arrival and departure streams

[1] RNP is an advanced form of Performance Based Navigation (PBN), beyond the standards for RNAV1, and is classed in terms of RNP1 standard and the more accurate RNP0.3 level which allow a deviation of no more than 1nm and 0.3nm respectively.