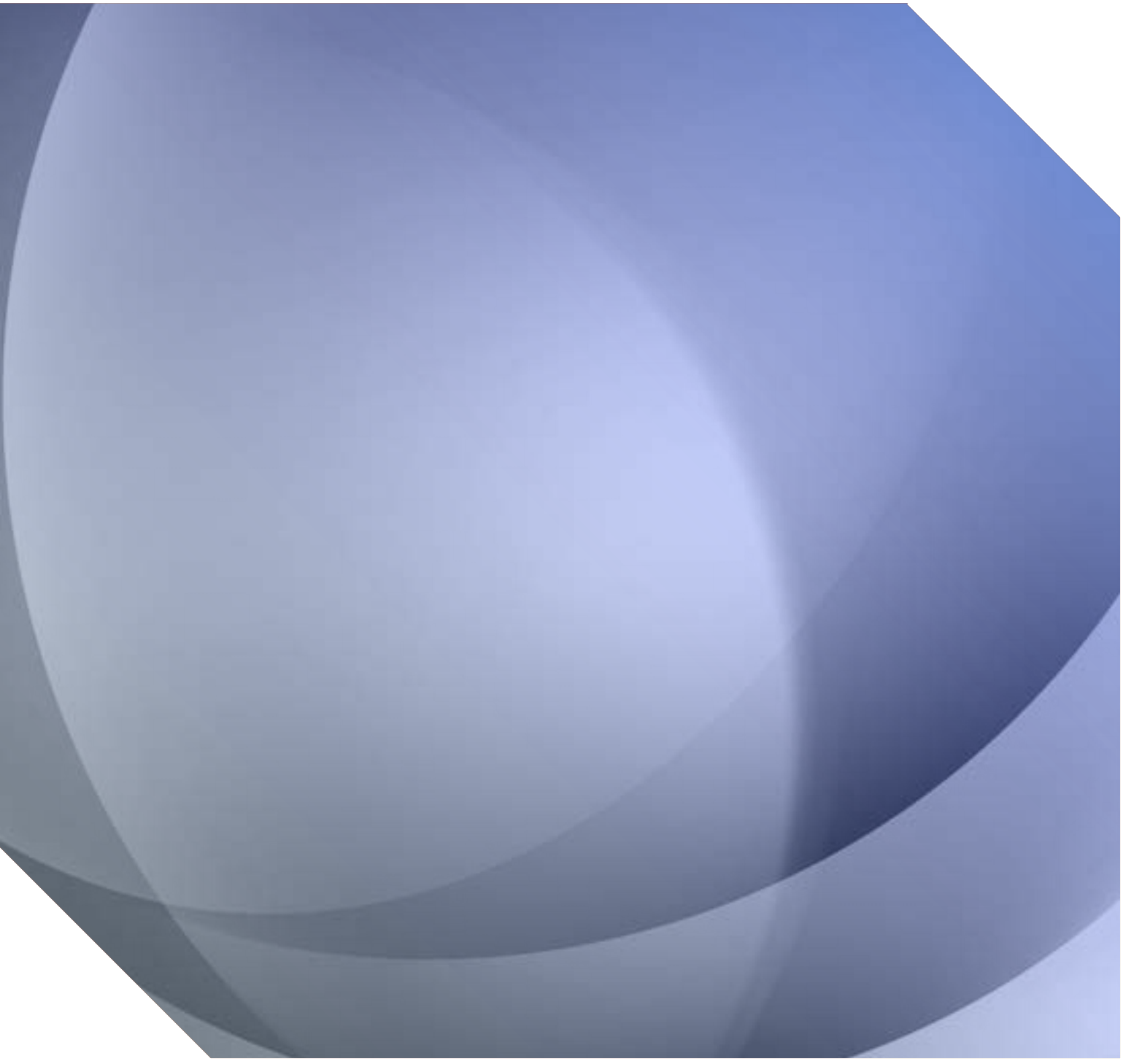
Airports Commission shortlisted options

Module 14: Operational Efficiency

preliminary safety review

CAP 1215



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CHAPTER 1

Context

Introduction

1.1 The UK has an enviable aviation safety record of which the industry is rightly proud. Civil aviation safety oversight arrangements in the UK are divided principally between the DfT and the Civil Aviation Authority (CAA). Increasingly, however, the European Commission (EC) and the European Aviation Safety Agency (EASA) are playing a significant role.

1.2 The Air Navigation Order (ANO) 2009 requires that, in the UK, flights for the public transport of passengers, or for certain types of flying instruction, take place only at a licensed aerodrome or a government aerodrome. The CAA currently issues licences to aerodromes which establish that they have been inspected and found to meet safety requirements. This licensing process ensures continuous oversight of safety standards at civil aerodromes.

1.3 Commission Regulation (EU) No. 139/2014 on aerodromes was published on 14 February 2014 and came into force on 6 March 2014. This contains EASA Implementing Rules and Acceptable Means of Compliance. Existing CAA-issued aerodrome licences will be converted between 2014- 2017. The Regulation also contains the application process for an aerodrome certificate and describes standards required relating to its management systems, operational procedures, physical characteristics, assessment and treatment of obstacles, visual aids, rescue and fire-fighting services and medical services. The CAA is the designated competent authority for this Regulation.

1.4 The CAA is also the Airspace Approval and Regulatory Authority for the UK and is designated as the National Supervisory Authority (NSA) by the DfT for the purposes of Single European Sky legislation. The CAA, as specialist regulator;

- Owns, and is fully responsible for, the airspace change process as set out in CAP724 and CAP725.
- Provides assistance on the application of the process and guidance on fulfilling the operational, environmental and consultation requirements.
- Scrutinises and assesses the formal airspace change proposals from sponsors of airspace proposals e.g. NATS, airport operator etc.
- Ultimately approves or rejects a formal proposal.

Safety assurance

1.5 Although the UK has an excellent safety record we cannot be complacent. Serious incidents do still occur and the CAA and industry work together to reduce the number and impact of these.

1.6 The CAA announced its intention to move to a regime of 'performance based' oversight earlier this summer and has now published further details for the airlines, aerodromes and ground handling organisations affected. The move aims at regulating in a more proportionate, effective and risk-based way, whilst ensuring that the regulatory obligations in the EASA and SES regulations are met. Performance based oversight will draw upon information generated by organisations' own safety management systems, as well as other sources of relevant data, to identify, and then tackle, those areas that generate the greatest risks to safety.

1.7 Whilst data is being correlated on these potential risks, the CAA and industry have previously targeted key risks to fixed-wing commercial air transport safety, known as the 'significant seven', which are as follows:

- Loss of control
- Runway excursion
- Runway incursion
- Controlled flight into terrain
- Airborne conflict
- Ground handling
- Fire

1.8 It is considered that these remain appropriate but the emphasis may change over time as the sector risk pictures are developed.

1.9 In order to be licensed to operate, all aerodromes and associated Air Traffic Control (ATC) units are expected to meet safety standards or put in place mitigations addressing the risks that the standards intend to alleviate. Often the safety mitigations required will have an effect on other operational performance such as the likely capacity, noise footprint, or use of the aerodrome. The more well established a procedure is at other airports or through the availability of international standards and recommended practices, the easier it will be to determine whether the mitigation is a) suitable for the risk it is trying to address and b) anticipate other impacts. Conversely, the more innovative a proposal, the greater the task of safety assurance (i.e. will the proposed mitigation address the risk) and the harder it will be to predict the suitability of any particular mitigation measure.

1.10 Safety assurance can only be accepted after the proposer approaches the approving authority (almost certainly to be the CAA) with a fully detailed concept of operations for how it intends to meet the various safety requirements placed on it by the applicable rules and regulations. Since these details may change, for example as a result of the conditions placed on an operator by planning consent, this can only happen following the Airports Commission's final report, the Government's publication of its Airports National Policy Statement and planning consent is granted. Also, some sign-offs might not be possible until the operation itself can demonstrate compliance – permission to operate can sometimes be given so that the operator can demonstrate that the concept works as intended (potentially with further mitigating action required to ensure the concept meets all requirements).

Purpose of document

1.11 The purpose of this document is to provide preliminary safety review for each of the options currently under consideration by the Airports Commission and to comment on, where possible, the likelihood of being able to mitigate perceived risks and the potential effects they could have on the scheme in terms of capacity, cost or environmental issues.

1.12 The following sections provide the following;

- A preliminary safety assessment of the Airports Commission's shortlisted proposals.
- Identification of key interdependencies and delivery risks.
- Identification of further information likely to be required to enable these risks to be assessed in more detail.

1.13 This preliminary assessment is based on information provided at an early stage and does not constitute any form of 'approval' by the CAA. A full concept of operations and safety justification will need to be provided by promoters at the appropriate stage in the future, which as described above, could be after planning permission or for certain elements, even once opened. In this case the scheme would need to be assessed against the requirements in place at the time.

CHAPTER 2

Airports Commission short-listed options

Introduction

2.1 The following sections provide a brief summary of the key areas identified in a preliminary safety review of aerodrome, air traffic and airspace risks for each short-listed option. This has been based on the following information;

- Scheme promoter submissions to the Airports Commission May 2014.
- Responses to CAA questions sent to scheme promoters by the Airports Commission in April 2014 (see Appendix A).
- Briefings by NATS and Leigh Fisher, the Airports Commission's consultants, on 4th July 2014.
- Initial discussions with scheme promoters to clarify assumptions and discuss specific scheme risks, where requested.

2.2 Further details of the preliminary safety review are included in Appendix B.

Gatwick 2nd runway

Aerodrome

2.3 The current ICAO separation for allowing independent approaches with no mitigations is 1525m.The proposed runway separation is 1045m from the existing runway. The proposer must demonstrate that the design meets the requirements of ICAO Document 9643 The Manual on Simultaneous Parallel or Near Parallel Instrument Runways (SOIR) for all possible modes of operation. This will require appropriate mitigations to be provided otherwise Gatwick would operate with dependent runways and a lower capacity.

2.4 The promoter has yet to confirm if the scheme proposal includes taxiways to enable the movement of aircraft on the ground without runway crossings ('End Around Taxiways' or EATs). Where they are possible, EATs are preferred by the CAA as they provide safe movements with the potential to operate Compass arrivals and departures (less crossing of aircraft in the air), whilst avoiding runway crossings and maximising runway capacity. In this particular case the inclusion of EATs would also result in inset thresholds, which has the added safety benefit of moving higher risk areas of the Public Safety Zone (PSZ) further into the airport site, and an existing infringement of the Approach surface to runway 26L would no longer be an issue. The runway would be extended to provide appropriate declared distances. If EATS are not provided, the CAA would expect the

aerodrome's concept of operations to incorporate features and / or equipment to mitigate any increased risk posed by a commensurate increase in runway crossings.

Air traffic management

2.5 If the airport was operated in segregated mode it would have less of an effect on the surrounding airspace except that the airport would generate a lower number of movements. Though more complex than a segregated mode operation, an independent mixed mode operation provides fairly straightforward ATC procedures and therefore reduces workload and risk. However, as already described above, the separation of the runways will require mitigations to be put in place.

2.6 The proposer will in due course need to provide an ATC strategy to align with the Concept of Operations, including Missed Approach Procedures (MAPs) and helicopter crossings. This is considered unlikely to present significant challenges.

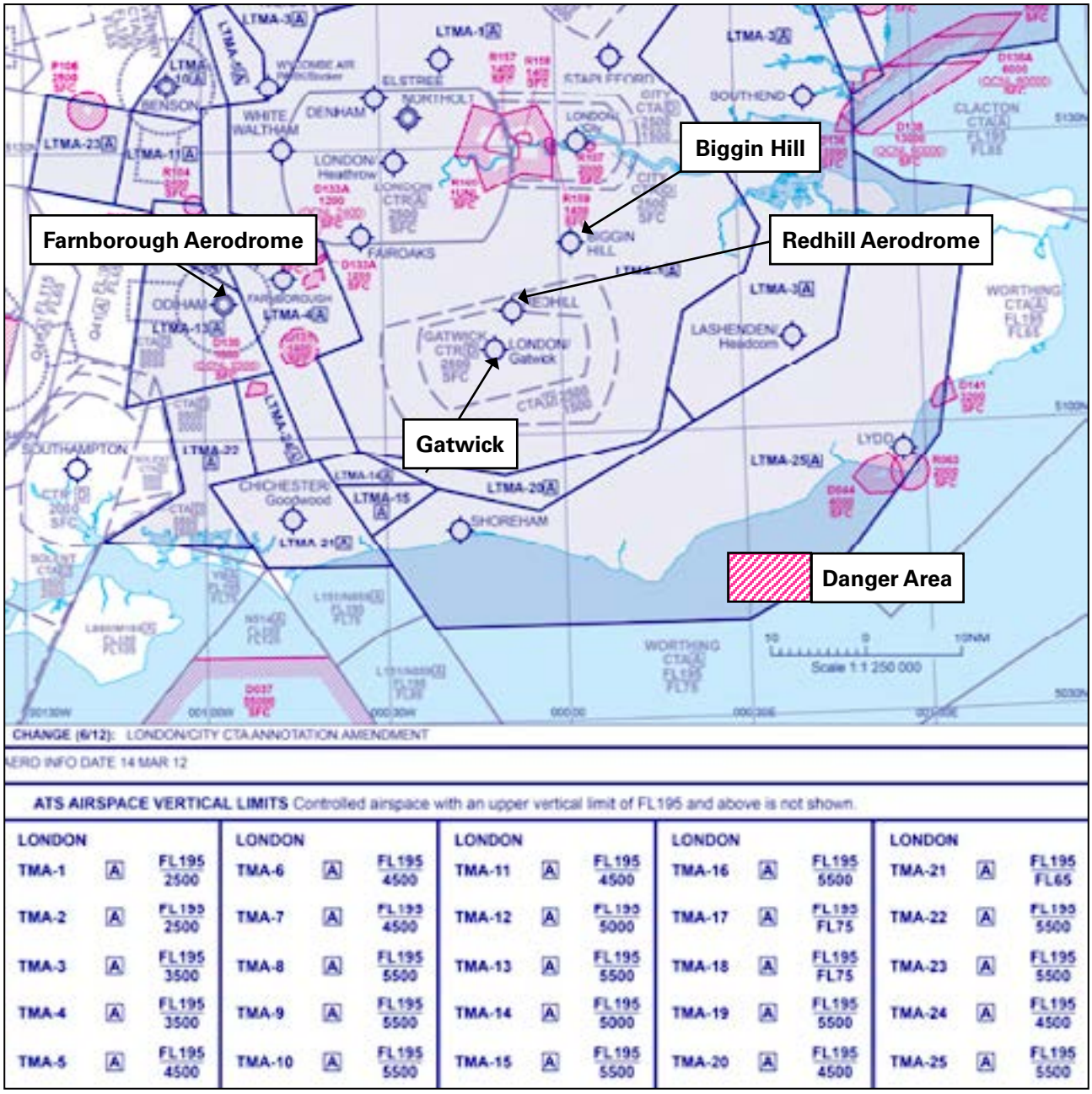
Airspace

2.7 There is currently a lack of detail available at this early stage regarding airspace designs. However, an initial informal assessment of some of the impacts is provided below.

2.8 Gatwick is on the Southside of the London Terminal Manoeuvring Area and is sufficiently displaced to the south of Heathrow to have a relatively lower impact on other aerodrome procedures and knock on effects to other airports.

2.9 Standard Instrument Departure Routes (SIDs) would need to be redesigned to avoid conflicts associated with having two runways providing arrivals and departures. However, the position of the runways and a compass departure operation is unlikely to be a significant challenge. There is a potential issue of standard arrival routes (STARs) to parallel runways and the transitions flown, with potential for confusion if runway alternation (or Terminal arrivals) is likely to be a feature of the operation - if the existing runway is always the arrival runway this is less of an issue as arriving aircraft would not be required to cross in the air.

Figure 1: Gatwick Control Area (CTR)



2.10 Farnborough aerodrome is currently in the process of developing new procedures and has just completed consultation on a new airspace design. The outcome of this is not yet determined. With revisions to arrival and departure procedures for an expanded Gatwick, there could be requirements for some additional controlled airspace to the west. Until designs are formalised, it is not possible to determine what impact, if any, new Gatwick procedures would have on Farnborough operations. Operations at Shoreham (south of Gatwick) are unlikely to be affected. Redhill (north of Gatwick) and Biggin Hill (north of Gatwick) are unlikely to be affected.

2.11 The Terminal Manoeuvring Area (TMA) and London Airspace Management Programme (LAMP - which does not include an additional runway) would need to be redesigned. The airspace change development work could take 3-5 years to complete due to the position of Gatwick on the southside of the TMA (LAMP Phases 1 & 2 are expected to take 5 and 9 years respectively).

Heathrow 3rd runway - north west

Aerodrome

2.12 The current ICAO separation for allowing independent approaches with no mitigations is 1525m. The existing runway separation is approximately 1450m and the proposed northern runway separation is 1035m from the existing northern runway. The proposer must demonstrate that the design meets the requirements of ICAO Document 9643 The Manual on Simultaneous Parallel or Near Parallel Instrument Runways (SOIR) for all possible modes of operation, in particular given the stagger of the proposed northern runway. Appropriate mitigations will need to be provided.

2.13 The CAA's policy is currently to allow appropriately certificated aircraft to operate on existing 45m width runways. The proposal includes a new 60m runway which is consistent with EASA requirements.

2.14 The Air Traffic Control (ATC) Tower currently infringes Obstacle Limitation Surfaces at Heathrow. This was accepted by the CAA based on the existing operational modes and an assessment of the likely number of missed approaches. The proposal changes the character of the airport operation. This would therefore require a new safety assessment to be undertaken by the promoter. There is a risk that this may not justify an EASA derogation, and could result in the need for alternative tower arrangements.

2.15 The CAA welcomes the inclusion of taxiways to enable movement of aircraft on the ground without runway crossings ('End Around Taxiways' or EATs). EATs are preferred by the CAA as they provide safe movements as well as the potential to maximise runway capacity. All taxiways should meet EASA design requirements at the time of certification.

2.16 The proposal includes an area of car parking within the airfield area assumed to be accessed via a landside road link. This area is likely to be within the 1:10,000 Public Safety Zone contour. The type of parking proposed should be restricted to ensure low concentration of numbers of people.

Air traffic management

2.17 The proposal is likely to require new procedures and mitigations to ensure safety of the ATC operation. Due to the intensive and complex nature of the current Heathrow operation, the development of a new 3rd runway will require a complete review and update of the entire operation. There can be no automatic reliance on previous mitigations which are likely to have been designed for different scenarios. This could provide an opportunity to exploit safety enhancements that may be now available with an expanded infrastructure and increased resilience.

2.18 **Note:** The operation associated with noise respite periods 2 and 3, where aircraft are departing from adjacent runways may be particularly difficult to achieve given the staggered position of the northern runway. Further work will be required to understand whether these modes are viable.

2.19 In normal operations RAF Northolt is likely to become dependent with the proposed northern runway from an ATC perspective. This may limit flexibility for Heathrow or RAF Northolt. Further work will be required to understand the effects on capacity for Heathrow and RAF Northolt.

2.20 Missed Approach Procedures (MAPs) for both Heathrow and RAF Northolt will need to be developed and assessed in detail, particularly given the different operational modes and the proximity to RAF Northolt. Any impacts on RAF Northolt procedures need to be understood and assessed.

2.21 Helicopter crossing operations are a routine feature of the Heathrow operating environment because of the proximity to the established helicopter route structure. It will be necessary to review these operations and to understand their likely impact on the reconfigured airport. It may be necessary to determine if crossing arrangements remain viable with the revised operation.

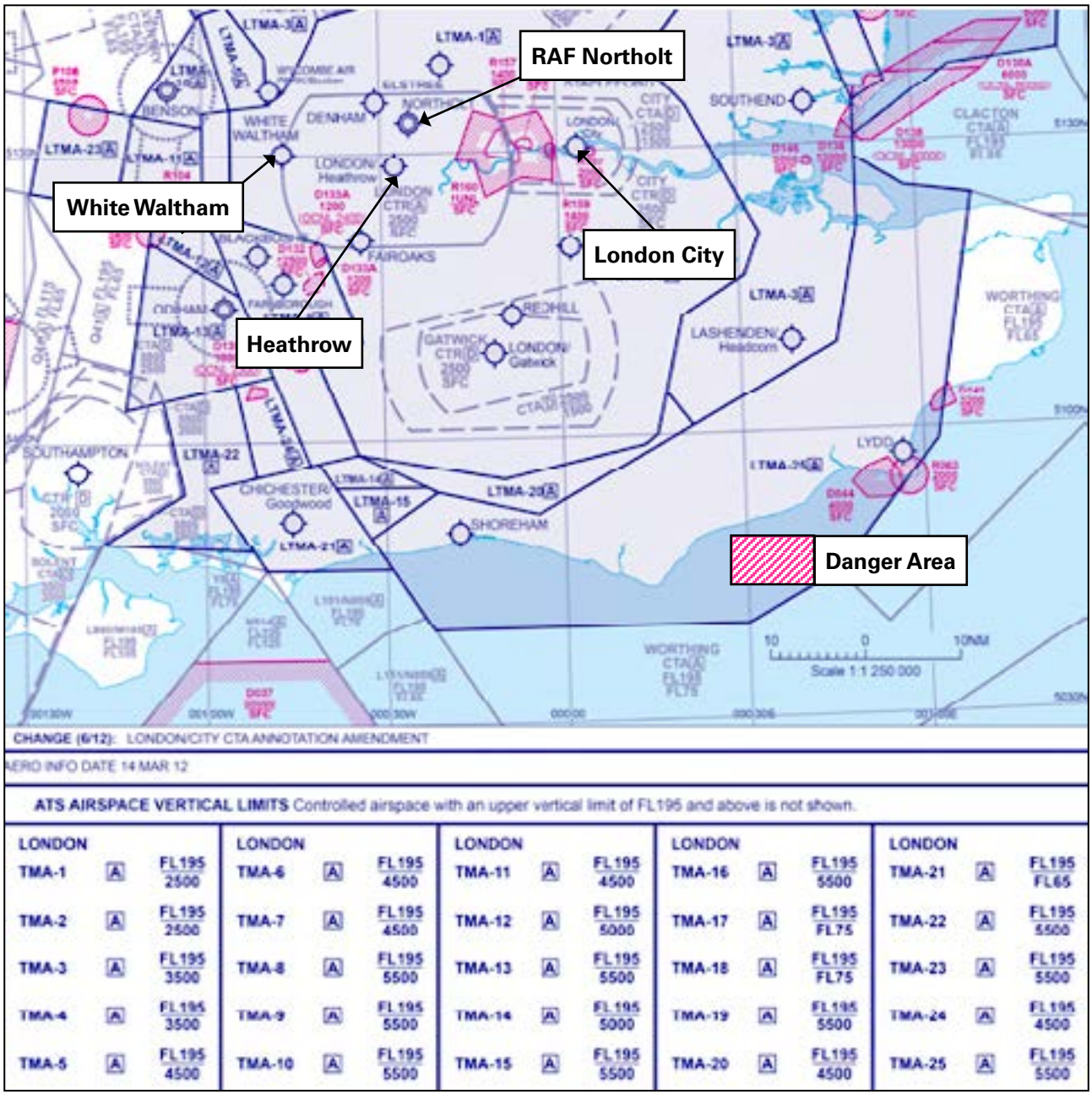
Airspace

2.22 There is currently a lack of detail available at this early stage regarding airspace designs. However, an initial informal assessment of some of the impacts is provided below.

2.23 The design is likely to require a dependency with RAF Northolt to ensure safe separations, which could reduce capacity at either or both airports. Any impacts on RAF Northolt procedures need to be understood and assessed.

2.24 Missed Approach Procedures for both Heathrow and RAF Northolt remain a major design issue and a major challenge to deliver a safe and operationally effective environment due to close proximity of RAF Northolt and its runway axis (25/07).

Figure 2: Heathrow Control Area (CTR)



2.25 SIDs would need to be redesigned to avoid conflicts associated with having two runways providing departures and the issue of the third runway being further west. It is unclear whether further controlled airspace to the western extremity of the Heathrow CTR is required to accommodate both arrival and departures for the proposal. The impact (if any) on operations at White Waltham and Denham aerodromes is unclear given that flight path vertical profiles are unknown at this stage. The impact on London City operations is also unclear as precise arrival and departure flight paths are unknown at this stage.

2.26 The Inner Core Terminal Manoeuvring Area (TMA) and London Airspace Management Programme (LAMP - which does not include an additional runway) would need to be redesigned with fairly significant new procedures and knock on effects to other airports likely. This process could take 5-7 years (LAMP Phases 1 & 2 are expected to take 5 and 9 years respectively).

Heathrow Hub - 6650m northern runway

Aerodrome

2.27 The design of the two in-line northern runways is a novel concept without any pre-existing standards or experience globally. The CAA is open minded to the proposal subject to appropriate safety assurance. Nevertheless, a particular safety concern that must be resolved and fully articulated by the proposer is the safety risk between missed approaches and departures. The CAA will need to review this argument and make a decision on the tolerability of the safety risk the operation generates. In the event that the safety risks cannot be mitigated sufficiently, it is expected that dependant operations could be conducted, but this would result in lower capacity and/or less operational flexibility.

2.28 The current ICAO separation for allowing independent approaches with no mitigations is 1525m.The existing runways are separated by approximately 1450m. The proposer must demonstrate that the design meets the requirements of ICAO Document 9643 The Manual on Simultaneous Parallel or Near Parallel Instrument Runways (SOIR) for all possible modes of operation, in particular given the separation and stagger of the northern runways in relation to the southern runway. Appropriate mitigations will need to be provided. The existing ATC Tower currently infringes Obstacle Limitation Surfaces at Heathrow. This was accepted by the CAA based on the existing operational modes and an assessment of the likely number of missed approaches. The proposal changes the character of the airport operation. This would therefore require a new safety assessment to be undertaken by the promoter. There is a risk that this may not justify an EASA derogation, and could result in the need for alternative tower arrangements or limitations on certain modes of operation for example 'deep-landings'.

2.29 ILS localiser interference is a potential safety risk of in-line runways. The proposal includes two additional localisers in between the northern runways. These will need to be frangible from impact in both directions (currently ILS localisers are designed to be frangible in one direction). The localisers will also need to be positioned so that they are not damaged by jet-blast.

2.30 Approach lighting begins 900m before the threshold and for occasions when the second section of the northern runway is used for landing, the lighting will encroach onto the prior landing runway. Approach lighting would therefore need to be inset into the surface of the pavement area and co-ordinated with other equipment that may need to be placed within the RESA e.g. ILS localisers and near field monitors. If this is not resolved, there may be restrictions on some of the respite modes proposed such as early morning 'deep landings'. It is noted that 27Rext (extended section) will be limited to CAT 1 operations.

2.31 The design of the in-line runways, if operating independently, will mean that an aircraft waiting to depart would be within the PSZ of the arrival runway. This may not be consistent with DfT's PSZ policy which aims to minimise the number of people congregating within higher risk areas. It may also be necessary to consider further the climb gradient associated with missed approaches from the landing portion of the runway in terms of the physical obstructions introduced by large aircraft waiting at the departure end of the extended runway.

Air Traffic Management

2.32 The proposal is likely to require new procedures and mitigations to ensure safety of the ATC operation. Due to the intensive and complex nature of the current Heathrow operation, the development of an additional runway will require a complete review and update of the entire operation. There can be no automatic reliance on previous mitigations which are likely to have been designed for different scenarios. This could provide an opportunity to exploit safety enhancements that may be now available with an expanded infrastructure and increased resilience.

2.33 In normal operations RAF Northolt is likely to have a form of dependency from an ATC perspective, although further work is required to understand the impacts fully.

2.34 The promoter is suggesting up to 5 different modes of operation a day which has the potential to increase risk of human error. A human factors assessment will be required to ensure that that pilots land on the correct section of the northern runways. The proposal is likely to require methods of interlocking the ILS and lighting as a minimum.

2.35 In-line runways introduce additional work and risk for missed approach procedures where compliance is not always possible or could contribute to human error (a recent example of non compliance was an Etihad aircraft at Manchester August 2013). The in-line runway layout would require a fairly immediate turn on missed approach and may have an impact on RAF Northolt (and vice versa). Analysis of vertical and lateral distances between aircraft conducting a missed approach against aircraft departing from the upwind runway extension will need to be developed by the promoter. This needs to consider normal and abnormal operations; identify the dependencies that such distances are based on; consider

the effects of non compliances; identify potential mitigations that could be applied. The analysis also needs to be supported by human factors assessment for the flight deck and Air Traffic Control to assess the operational impact of the proposed procedures. Combined, these activities should enable the promoter to develop a safety argument supporting the proposed concept of operation.

2.36 If the missed approach procedure cannot be adequately resolved then the two northern runways will require dependency. For example departing aircraft may need to be held until an arriving aircraft has touched down and is under safe braking control. This is likely to reduce the capacity of the two northern runways (or reduce the opportunity for respite), and will require further modelling.

2.37 The interaction of new SIDs and Missed Approach Procedures (MAPs) with existing/revised procedures will need to be examined in detail to determine whether proposals are viable. Additionally, the impact to RAF Northolt arrival and departure procedures, including RAF Northolt MAPs needs to be considered and procedures adequately managed.

2.38 Helicopter crossing operations are a routine feature of the Heathrow operating environment because of the proximity to the established helicopter route structure. It will be necessary to review these operations and to understand their likely impact on the reconfigured airport. It may be necessary to determine if crossing arrangements remain viable with the revised operation.

Airspace

2.39 There is currently a lack of detail available at this early stage regarding airspace designs. However, an initial informal assessment of some impacts is provided below as follows.

2.40 The design may introduce the requirement for dependency with RAF Northolt, which could reduce capacity at either or both airports. The impact on existing RAF Northolt procedures would need to be determined.

2.41 SIDS would need to be redesigned to avoid conflicts associated with having two runways providing departures and in the case of westerly operations, the northern runway being further west. The result would be that SIDS would be pushed further to the west to avoid conflicts. The impact (if any) on White Waltham and Denham aerodromes is unclear at present. The impact on London City operations is also unclear as precise arrival and departure flight paths are unknown at this stage.

2.42 The Inner Core Terminal Manoeuvring Area (TMA) and London Airspace Management Programme (LAMP - which does not include an additional runway) would need to be redesigned with new procedures and knock on effects to other airports. This could take 5-7 years (LAMP Phases 1 & 2 are expected to take 5 and 9 years respectively).

Summary of key issues

2.43 Safety assurance can only be accepted after the proposer provides a fully detailed concept of operations (encompassing the entire operation) for how it intends to meet the various safety requirements placed on it by the applicable rules and regulations. This can only happen following planning consent and potentially after a permit to operate is in place. In this case the scheme would need to be assessed against the requirements in place at the time.

2.44 However, in initial safety assessment has been undertaken much earlier to establish key safety issues, potential mitigation and further work required in order to demonstrate compliance and to support the Airports Commission's appraisal framework. This is summarised in the table below.

2.45 The preliminary assessment of the short-listed options from an Aerodrome, Air Traffic Management and Airspace safety perspective illustrates that no outright showstoppers have been identified at this stage. However there are a number of risks that may have impacts on cost, capacity or the environment.

2.46 At this stage, and on the basis of the limited information that is currently available, Gatwick appears to have few complex safety and deliverability risks, however, more detailed analysis will be required to confirm this with any degree of certainty.

2.47 For both Heathrow options, Missed Approach Procedures for both Heathrow and RAF Northolt remain a major design issue and a major challenge to deliver a safe and operationally effective environment due to close proximity of RAF Northolt and its runway axis (25/07).

2.48 In addition, the Heathrow Hub proposal is a new concept which will require the safety risk between missed approaches and departures to be articulated as well as a human factors assessment. In general for Heathrow options helicopter interactions / crossings will also need to be addressed.

Summary of key safety issues

Scheme	Aerodrome	Air traffic management	Airspace
Gatwick 2R	Runway separation requires mitigations for independent operations. CAA preference is for taxiways to avoid runway crossings - tbc by promoter.	ATC procedures including missed approaches likely to be relatively straight forward, although the operation of mixed mode arrival procedure is not yet clear	Impacts on other airspace users yet to be determined Low complexity and impact to other airspace users. Southern TMA redesign, 3-5 years.
Heathrow 3R - NW	Runway separation requires mitigations for independent operations. The ATC Tower currently infringes the Obstacle Limitation Surfaces at Heathrow. New safety assessment required - may require alternative tower arrangements. End Around Taxiways welcomed.	Proposed runway likely to be dependent with RAF Northolt. Worst case circa one movement lost for each movement permitted at RAF Northolt – tbc. Certain noise respite modes may be difficult to achieve due to runway stagger. Missed approach procedures and 3 runway concept of operations complex.	Impacts on other airspace users yet to be determined Interactions with RAF Northolt remain a challenge to resolve. Significant Inner Core TMA redesign, 5-7 years.
Heathrow Hub	Runway separation requires mitigations for independent operations. The ATC Tower currently infringes the Obstacle Limitation Surfaces at Heathrow. New safety assessment required - may require alternative tower arrangements or restrictions on modes of operation. Potential ILS co-ordination issues. In-line threshold potentially inconsistent with DfT's PSZ policy.	Missed approach procedures - detailed analysis on the proximity of aircraft conducting missed approaches and departures from the upwind extension including human factors assessment required. If unable to resolve capacity and/or respite opportunity maybe reduced. RAF Northolt dependency to be resolved. May further reduce capacity and flexibility.	Impacts on other airspace users yet to be determined Interactions with RAF Northolt remain a challenge to resolve. Significant Inner Core TMA redesign, 5-7 years.

APPENDIX A

Promoter responses to CAA questions

Commission objective	CAA question	LGW R2	LHR R3	Heathrow Hub
To ensure individual airport and airports system efficiency (Operational Efficiency)	What requirement is there for aircraft movements to and from the new runway(s) to cross other runways – at any stage as traffic builds towards maximum capacity?	Appendix A5 - 4.2.1 Two Runway Mixed Mode Operation	No requirement to cross the existing northern runway to reach the new runway is envisaged due to the around-the-end-taxiway provision. 3.4.1.1 A safe, resilient and efficient airfield operation (P.172).	No new requirements are assumed for crossing runways (beyond those currently existing to T4). It is recognised that planned traffic growth may mean additional traffic crossing the southerly runway to T4. However, it is expected that the new runway configuration will give more options to sequence T4 traffic onto the southerly runway, thus reducing runway crossings and at least negating the impact of the additional T4 traffic overall.
	To what extent can the proposal be developed as an evolution of the current ATC operation?	Appendix A26	The addition of any airport infrastructure at Heathrow has to be managed as an evolution of the current system; NATS and Heathrow both have expertise in facilitating such a progression and would continue to work together to define processes and procedures that ensure a safe transition to a 3 runway environment; 3.5.1 Designing airspace for expansion (P.176);6.8.1.4 Risk assessment for specific features (P.397)	From a perspective of airspace and airport design, it is an evolution of existing operations. The in-line runway should mean less changes to airspace design beyond those already planned to assist in meeting capacity needs. The TWR may require some assistance to 'see ' the far end of the in-line runway (e.g. remote cameras or secondary control tower) - this is not unusual and is e.g. in use at AMS.
	To what extent can the proposal be delivered without significant effect on adjacent aerodromes and/ or adjacent airspace structures, which would require procedures and processes to be developed to ensure safety was maintained?	tbc	3.5.1.3 Airspace design principles (P.177); The current assessment by NATS indicates that other airports will not be affected by this expansion. Effects on the Northolt airfield have not been assessed in the proposal.	NATS stated in their initial submission that 'a third runway at Heathrow would increase capacity to 700k ATM pa and such an increase could be accommodated without an adverse impact on other airports ' (p41), and this is in line with our assessment.

Commission objective	CAA question	LGW R2	LHR R3	Heathrow Hub
To meet present industry safety and security standards (Operational Efficiency)	Does the aerodrome design meet established safety standards, requirements and criteria (ICAO, EASA, CAA)? Or might it feasibly meet them by the point of entry into operation?	Appendix A5 - Appendix B Safety and Compliance Report - Annex B1 Planning Parameters and Design Criteria	6.8.1.2 Compliance with CAP168 and EASA aerodrome regulation (P.396); 6.8.1.3 Compliance with engineering standards (P.397).	Almost all elements of the new concept will be in line with existing regulatory material. We have not found any SARPs or EASA or CAA regulations or guidance which does not permit in-line runway operation with a spacing of 600m (i.e. RESA). We recognise that existing safety standards have not been predicated on this concept, and that a full safety assessment will need to be developed to ensure fully robust evidence.
	Can the method of operation be delivered using established safety standards, requirements and criteria (ICAO, EASA, CAA)? Or might it feasibly be so by the point of entry into operation?	Appendix A5 - 4.2.2 Runway separation Appendix A5 - Appendix B Safety and Compliance Report - Annex B1 Planning Parameters and Design Criteria	6.8.1.2 Compliance with CAP168 and EASA aerodrome regulation (P.396); 6.8.1.3 Compliance with engineering standards (P.397)	We believe that our concept can be delivered using existing standards and criteria. This will be validated further as the concept is refined, for example checking the Missed Approach Procedure standards and guidance which may not fully cover the in-line runway case (e.g. in ICAO).

Commission objective	CAA question	LGW R2	LHR R3	Heathrow Hub
(continued) To meet present industry safety and security standards (Operational Efficiency)	Has the design proposal and method of operation explicitly taken account of and addressed the following aviation safety threats: ▪ Runway incursion ▪ Runway excursion ▪ Airborne conflict ▪ Ground handling ▪ Controlled flight into terrain – including go-around safety?	**Runway incursion** Appendix A5 - 4.2.1 Two Runway Mixed Mode Operation. Appendix A5 - 4.2.5 End-around taxiways (EATs). Appendix A5 - Appendix B Safety and Compliance Report - 5 Taxiway System (End Around Taxiways and Runway Crossings) **Runway excursion** Appendix A5 - Appendix B Safety and Compliance Report - 2 Proposed Runway 08S 26S **Airborne conflict** Appendix A5 - 4.2.1 Two Runway Mixed Mode Operation. Appendix A26 - 1.2.2 Option B **Ground handling** Appendix A5 - 4.5.3 Ease of access within the airport. Landside roads. Appendix A5 - 4.6.5 Other airside and support facilities CFIT tbc	3.5.1.2 Runway operating procedures (P.176) with reference to missed approach on P.177; 3.9.1.3 Airside roads (P.195); 6.8.1.2 Compliance with CAP168 and EASA aerodrome regulations (P.396); 6.8.1.3 Compliance with engineering standards (P.397); 3.4.1 Our vision for the airport (P.172)	See the detailed appendix on safety assessment for more details. Runway excursion has been considered, and minimised with the creation of a long runway (27R + 27R-ext) joined by a paved RESA. The likelihood is statistically low for an operation such as Heathrow, and is further reduced by the length of the runways and 600m Runway End Safety Area. Risk of runway incursions will be modelled in the next phase including ground movements. Airborne conflict will be modelled within the full safety assessment - initial high level assessment show no undue risk is added. Ground manoeuvring will be modelled in the next phase. Ground handling (i.e. operations in and around the aircraft) will be carried out according to existing regulations and standards. Go-around safety is being considered. There has been a high level assessment of go-arounds, including late one-engine-out go-arounds, and it is not thought undue risk will be added under this concept.

Commission objective	CAA question	LGW R2	LHR R3	Heathrow Hub
To maintain and where possible enhance current safety performance with a view to future changes and potential improvements in standards (Operational Efficiency)	Has the proposed design and methods of operation been considered as part of the proposer's Safety Management System for the current operation?	Appendix A26	6.6.1 Short and medium term measures (P.381); Steeper approaches have been considered.	The reason behind the question requires further clarification. HHub are not the operator of the aerodrome, and do not maintain an SMS. Nevertheless, the concept safety review will be developed in accordance with the latest guidance in ICAO Annex 19, CAP760 etc, applied at a concept feasibility stage.
	To what extent can the proposed concept be progressed without the need for prior safety analysis of the concept to prove that it can be delivered safely without subsequent safety mitigations restricting traffic capacity and flow further than already assumed?	Appendix A5 - Appendix B Safety and Compliance Report - 5 Taxiway System (End Around Taxiways) Appendix A5 - Appendix B Safety and Compliance Report - 12 Aerodrome Safeguarding	6.8.1.2 Compliance with CAP168 and EASA aerodrome regulation (P.396); 6.8.1.3 Compliance with engineering standards (P.397); Our design is based on current rules with opportunities to enhance and improve as technology becomes available	A slightly unclear question. Will the concept require additional mitigations? - possibly, as with any concept at the feasibility stage. The areas of particular investigation during the next few months include the issues with ILS siting and operation, and the full safety assessment / collision risk model (including go-arounds). Will these impact throughput on the runways? We do not know yet - the work still needs to be done. It should be stressed that an initial safety assessment suggests the concept can be acceptably safe. However further analysis and consideration of human factors issues need to be undertaken

APPENDIX B

CAA preliminary safety assessment

LGW 2R - preliminary safety assessment, September 2014

Assumptions

- The Airports Commission is considering the addition of a new runway of 3400m length to the south of the existing. The new runway would be separated by 1045m to the south of the existing runway.
- The two runways are assumed to operate in independent mixed mode with Compass departures and Terminal arrivals.
- The capacity assumed by the promoter is up to c560,000 ATMs (Air Transport Movements) per annum.
- The proposal does not yet include 'End Around Taxiways' (EATs) to enable movement of aircraft on the ground without crossing the existing runway. Gatwick are still consulting on this issue and have yet to confirm.
- If EATs are included by Gatwick the thresholds of the existing runway would be inset to allow taxiing underneath landing aircraft. The EATs have not been designed for independent Code F (A380 size aircraft) operations.

Notes: The criteria below are categories for a pragmatic qualitative assessment. This initial assessment is based on information provided at an early stage and does not constitute any 'approval' by the CAA. A full concept of operations and safety justification will need to be provided by promoters at the appropriate stage in the future, which could be after planning permission or for certain elements, even once opened. The impact of each criteria is not necessarily equal and would require further consideration for their relative weighting.

Ref.	Criteria	Yes / No / TBC	Comments
1	**Aerodrome design and operation**		
1.1	Does the aerodrome design meet established safety standards, requirements and criteria (ICAO/EASA/CAA)?	TBC	The current ICAO separation for allowing independent approaches with no mitigations is 1525m. The proposed runway separation is 1045m from the existing runway. The proposer must demonstrate that the design meets the requirements of ICAO Document 9643 The Manual on Simultaneous Parallel or Near Parallel Instrument Runways (SOIR) for all possible modes of operation. This will require appropriate mitigations, otherwise Gatwick would operate with dependent runways and a lower capacity. The promoter is yet to confirm if the proposal includes taxiways to enable movement of aircraft on the ground without runway crossings ('End Around Taxiways' or EATs). If EATs are provided thresholds would be inset and the runway will be lengthened to 3500m to enable the appropriate landing distance of 2500m to be provided. The proposed ATC Tower is likely to infringe the Obstacle Limitation Surfaces at Gatwick. This has been allowed at other airports in similar positions, however a safety assessment will be required in conjunction with the revised concept of operations and resulting procedures. It appears that not all taxiways are designed to be EASA Code F compliant, and this will restrict the movements of A380 to specific routes. It is possible that requirements for Code F clearances may reduce in the future. There is the potential for congestion at the 26R threshold with aircraft holding and using the EAT (if provided). This may present a risk, particularly in low visibility.
1.2	Can aircraft movements to and from the new runway(s) be accommodated without the need for crossing of other runways – at any stage as traffic capacity builds towards maximum capacity?	TBC	The promoter has yet to confirm if the scheme proposal includes taxiways to enable the movement of aircraft on the ground without runway crossings ('End Around Taxiways' or EATs). Where they are possible, EATs are preferred by the CAA as they provide safe movements with the potential to operate Compass arrivals and departures (less crossing of aircraft in the air), whilst avoiding runway crossings and maximising runway capacity. In this particular case the inclusion of EATs would also result in inset thresholds, which has the added safety benefit of moving higher risk areas of the Public Safety Zone (PSZ) further into the airport site, and an existing infringement of the Approach surface to runway 26L would no longer be an issue. If EATS are not provided, the CAA would expect the aerodrome's concept of operations to incorporate features and / or equipment to mitigate any increased risk posed by a commensurate increase in runway crossings. There may also be a loss of peak movements of c3-4 per hour if a potential 100+ runway crossings are expected to take place per day.

Ref.	Criteria	Yes / No / TBC	Comments
2	**Air Traffic Control**		
2.1	Can the method of operation be delivered using established safety standards, requirements and criteria (ICAO/EASA/CAA)?	Yes	If the airport was operated in segregated mode it would have less of an effect on the surrounding airspace although the airport would generate a lower number of movements. Though more complex than a segregated mode operation, an independent mixed mode operation provides fairly straightforward ATC procedures and therefore reduces workload and risk. However, the separation of the runways will require mitigations to be put in place as this is less than 1525m. The proposer will in due course need to provide an ATC strategy aligned with the Concept of Operations, including missed approach procedures and helicopter crossings/operations. This is not considered to present significant challenges.
2.2	Can the proposal be developed as an evolution of the current ATC operation?	Yes	The proposal includes a secondary control tower. A single tower is generally preferable where space is available. This may be achieved by providing remote equipment or remote ground control positions. This is not considered to be a significant issue at present. The proposer will need to in due course confirm the concept of operations for Aerodrome Control on site and Approach Control provided from Swanwick to deal with the increased number of aircraft movements. This would need to include projected plans for controller work positions.

Ref.	Criteria	Yes / No / TBC	Comments
3	**Airspace**		
3.1	Can the proposal be delivered without significant effect on adjacent aerodromes and/ or adjacent airspace structures, which would require procedures and processes to be developed to ensure safety was maintained?	Yes	LGW is on the southside of the London TMA and is sufficiently separated to have a relatively low impact on current procedures and knock on effects to other airports. The airspace changes could take 3-5 years due to the position of Gatwick on the southside of the TMA (LAMP Phases 1 & 2 are expected to take 5 and 9 years respectively). SIDS would need to be redesigned to avoid conflicts associated with having two runways providing arrivals and departures. Arrival routes are likely to be required from the south and will need to be designed to avoid crossing conflicts. There is a potential issue of STARs to parallel runways and the transitions flown, with potential for confusion if runway alternation (or Terminal arrivals) is likely to be a feature of the operation - if the existing runway is always the arrival runway this is less of an issue. More controlled airspace may be required which may have an effect on Farnborough operations e.g. potential rerouting or procedures. Shoreham and Redhill are unlikely to be affected due to their locations but this needs to be confirmed.
3.2	Can the proposal be delivered in the surrounding airspace in accordance with Future Airspace Strategy principle to 'enhance safety by reducing controller and pilot workload and designing out risk factors'?	Yes	The LAMP proposal will enable LGW and LHR to operate together and should enable adequate holding areas to be provided. Compass arrivals and departures at LGW would minimise controllers having to cross aircraft movements in the air. Gatwick are proposing Terminal arrivals which will require controllers to cross traffic in the air to ensure they arrive on the correct runway. Both SID and arrivals routes have yet to be designed therefore precise impacts have yet to be determined. From a design perspective, arrival and departure procedures are unlikely to present major difficulties but this will need to be confirmed.

Ref.	Criteria	Yes / No / TBC	Comments
4	**Safety management**		
4.1	Has the aerodrome design proposal and method of operation explicitly taken account of and addressed the following aviation safety threats:		
4.1a	Runway incursion?	TBC	The promoter has yet to confirm if the scheme proposal includes taxiways to enable the movement of aircraft on the ground without runway crossings ('End Around Taxiways' or EATs). Where they are possible, EATs are preferred by the CAA as they provide safe movements with the potential to operate Compass arrivals and departures (less crossing of aircraft in the air), whilst avoiding runway crossings and maximising runway capacity. If EATS are not provided, the CAA would expect the aerodrome's concept of operations to incorporate features and / or equipment to mitigate any increased risk posed by a commensurate increase in runway crossings.
4.1b	Runway excursion?	Yes	Length of RESA of 240m confirmed.
4.1c	Airborne conflict?	TBC	Missed approach procedures would need to be modified but these are not considered to be difficult to achieve. New arrival, Missed Approach and Departure procedures need to be designed and integrated with the existing runway. The impacts on Farnborough and other adjacent aerodromes will need to be assessed and confirmed. At this stage impact would appear not to be significant, but for Farnborough impacts would be dependent on any increase in controlled airspace to the west. Impacts would only become clear during the design phase of the airspace change process.
4.1d	Ground handling?	Yes	The design of the airfield includes a large number of remote stands. The promoter suggests however that these will be used mainly as holding stands before the aircraft is towed to the pier. This should be considered further in later stages. Ground handling regulations and standards are not envisaged to be impacted by scheme design at this stage. The promoter has considered apron space requirements for ground handlers in Appendix 5/B Safety Compliance report.
4.1e	Obstacles	TBC	Gatwick confirm that their plans conform to CAP168 (**Note:** should be EASA). The potential impact of a second Air Traffic Control Tower will need to be assessed. There is a possibility that a new energy centre may infringe the Obstacle Limitation Surfaces (Appendix 5/B) and this will require a risk assessment in due course. Detailed topographical survey data will be required to check the obstacles outside the aerodrome.

Ref.	Criteria	Yes / No / TBC	Comments
4.2	Has the proposed design and methods of operation been considered as part of the Safety Management System for the current operation?	Yes	The promoter is the aerodrome operator and has set out a number of areas requiring risk assessments in Appendix 5/B.
4.3	Can the proposed concept be progressed without the need for significant safety analysis of the concept to prove that it can be delivered safely without subsequent safety mitigations restricting traffic capacity and flow even further than already assumed?	Yes	There are a number of areas to be designed and developed, but at this stage the proposal appears to have the ability to be delivered safely without a major impact on capacity and flow.

LHR North West Runway - preliminary safety assessment, September 2014

Assumptions

- The Airports Commission is considering the addition of a northwest staggered runway with a length of 3500m. The new runway would be separated by 1035m to the north of the central runway (existing northern runway).
- The proposal includes a number of 'respite' modes which do not include operating mixed-mode on the central runway.
- The capacity assumed by the promoter is c740,000 ATMs (Air Transport Movements) per annum.
- The proposal includes inset thresholds of 700m on all runways.
- Compass departures and Terminal arrivals are assumed.
- The proposal includes Around the End Taxiways (ATETs which are also known as End Around Taxiways or EATs) to enable movement of aircraft on the ground without crossing the central runway.
- The CAA recognises the current Heathrow operation's dependence upon some 'features' which have evolved over time, and which are collectively considered as 'Grandfather Rights '. The CAA is expecting the scheme promoter to want to take advantage of some (or all) elements of these legacy features, but will expect robust and comprehensive safety assurance for the continuance of any 'Grandfather Rights ' which form part of the new airport configuration and all of its perceivable modes of operation.

Notes: The criteria below are categories for a pragmatic qualitative assessment. This initial assessment is based on information provided at an early stage and does not constitute any 'approval' by the CAA. A full concept of operations and safety justification will need to be provided by promoters at the appropriate stage in the future, which could be after planning permission or for certain elements, even once opened. The impact of each criteria is not necessarily equal and would require further consideration for their relative weighting.

Ref.	Criteria	Yes / No / TBC	Comments
1	**Aerodrome design and operation**		
1.1	Does the aerodrome design meet established safety standards, requirements and criteria (ICAO/EASA/CAA)?	TBC	The current ICAO separation for allowing independent approaches with no mitigations is 1525m.The existing runways are <1525m at c1450m and the proposed runway separation is 1035m from the existing northern runway. The proposer must demonstrate that the design meets the requirements of ICAO Document 9643 The Manual on Simultaneous Parallel or Near Parallel Instrument Runways (SOIR) for all possible modes of operation, in particular given the stagger of the new runway. Appropriate mitigations will need to be provided. The CAA's policy is currently to allow appropriately certificated aircraft to operate on existing 45m width runways. HAL have clarified that their proposal includes a new 60m runway which is consistent with EASA requirements. The ATC Tower currently infringes the Obstacle Limitation Surfaces at Heathrow. This was accepted based on an assessment of the number of missed approaches. The proposal changes the character of the airport operation. This would therefore require a new safety assessment to be undertaken by the promoter. There is a risk that this may not justify an EASA derogation, and could result in the need for alternative tower arrangements. The detailed design of the airfield should meet EASA requirements at the time of certification. The proposal includes an area of car parking within the airfield area assumed to be accessed via a landside road link. This area is likely to be within the 1:10,000 Public Safety Zone. The type of parking proposed should be restricted to ensure low concentration of numbers of people.
1.2	Can aircraft movements to and from the new runway(s) be accommodated without the need for crossing of other runways – at any stage as traffic capacity builds towards maximum capacity?	Yes	Heathrow are proposing to minimise any additional runway crossings with ATETs. Runway crossings will still be required for Terminal 4 traffic. It is unlikely that this will result in significant additional runway crossings, however the proposer should confirm that the respite rotation will not result in increases in crossings of the southern runway.

Ref.	Criteria	Yes / No / TBC	Comments
2	**Air Traffic Control**		
2.1	Can the method of operation be delivered using established safety standards, requirements and criteria (ICAO/EASA/CAA)?	TBC	The proposal is likely to require new procedures and mitigations to ensure safety of the ATC operation. Due to the intensive and complex nature of the current Heathrow operation, the development of a new 3rd runway will require a complete review and update of the entire operation. There can be no automatic reliance on previous mitigations which are likely to have been designed for different scenarios. This could provide an opportunity to exploit safety enhancements that may be now available with an expanded infrastructure and increased resilience. **Note:** The operation associated with noise respite periods 2 and 3, where aircraft are departing from adjacent runways may be particularly difficult to achieve given the staggered position of the northern runway. Further work will be required to understand whether these modes are viable. In normal operations RAF Northolt is likely to become dependent with the proposed northern runway from an ATC perspective. There are also capacity risks associated with busy arrival or departure periods to/from Heathrow i.e. as today there are peaks in demand. This may limit flexibility for Heathrow or RAF Northolt. Further work will be required to understand the effects on capacity for Heathrow and RAF Northolt. A worst case impact may be one movement less at Heathrow for every movement permitted at RAF Northolt. Missed Approach Procedures will need to be developed and assessed in detail, particularly given the different operational modes and the proximity to RAF Northolt. Any impacts on RAF Northolt procedures need to be understood and assessed. Helicopter crossing operations are a routine feature of the Heathrow operating environment because of the proximity to the established helicopter route structure. It will be necessary to review these operations and to understand their likely impact on the reconfigured airport. It may be necessary to determine if crossing arrangements remain viable with the revised operation.

Ref.	Criteria	Yes / No / TBC	Comments
2.2	Can the proposal be developed as an evolution of the current ATC operation?	TBC	The proposal is likely to require new procedures and mitigations to ensure safety of the ATC operation. The proposal includes a secondary control tower. A single tower is generally preferable where space is available. This may be achieved by providing remote equipment or remote ground control positions. This is not considered to be a significant issue at present. The proposer will need to in due course confirm the concept of operations for Aerodrome Control on site and Approach Control provided from Swanwick to deal with the increased number of aircraft movements. This would need to include projected plans for controller work positions.
3	**Airspace**		
3.1	Can the proposal be delivered without significant effect on adjacent aerodromes and/ or adjacent airspace structures, which would require procedures and processes to be developed to ensure safety was maintained?	No	The design is likely to require a dependency with RAF Northolt to ensure safe separations, which could further reduce capacity at either or both airports. Any impacts on RAF Northolt procedures need to be understood and assessed. SIDs would need to be redesigned to avoid conflicts associated with having two runways providing departures and the issue of the third runway being further west. It is unclear whether further controlled airspace to the western extremity of the Heathrow CTR is required to accommodate both arrival and departures for the proposal. The impact (if any) on operations at White Waltham and Denham aerodromes is unclear given that flight path vertical profiles are unknown at this stage. The impact on London City operations is unclear as precise arrival and departure flight paths are unknown at this stage. Inner Core TMA / LAMP would need to be redesigned with new procedures and knock on effects to other airports. This could take 5-7 years (LAMP Phases 1 & 2 are expected to take 5 and 9 years respectively).

Ref.	Criteria	Yes / No / TBC	Comments
3.2	Can the proposal be delivered in the surrounding airspace in accordance with Future Airspace Strategy principle to 'enhance safety by reducing controller and pilot workload and designing out risk factors'?	TBC	The go-around procedures and likely dependency with RAF Northolt would need to be considered in detail. Procedures and mitigations at both airports need to be understood and assessed. Compass arrivals and departures would minimise controllers having to cross aircraft movements in the air. The consequence would be more taxi-ing on the ground, although Heathrow are proposing ATETs in order to minimise any additional runway crossings.
4	**Safety Management**		
4.1	Has the aerodrome design proposal and method of operation explicitly taken account of and addressed the following aviation safety threats:		
4.1a	Runway incursion?	Yes	Around the end taxiways (ATETs) proposed.
4.1b	Runway excursion?	Yes	Adequate RESA provision.
4.1c	Airborne conflict?	TBC	Go-around procedures for a three runway airport are likely to be challenging to design and could be complex to achieve safe separation against adjacent operations at RAF Northolt, particularly given the runway operating modes and likely dependency with RAF Norholt. Currently the published go-around procedures for Heathrow northern runway are to continue straight ahead to a specified altitude followed by a turn, which should be followed where communications are lost, although this is frequently amended by tactical ATC instructions. Outer runway go-arounds may need to be published with a turn at low level. The effects of different published procedures for pilot workload or human error would need to be assessed. The impact on London City operations is unclear as precise arrival and departure flight paths are unknown at this stage.
4.1d	Ground handling?	Yes	Ground handling regulations and standards are not envisaged to be impacted by scheme design at this stage. The promoter confirms that the airport will comply with CAP642. This should be considered further in later stages.
4.1e	Obstacles?	TBC	The proposer will need to ensure that obstacles are identified and then potential hazards either removed or mitigated. In particular the impact of the existing and a second Air Traffic Control Tower will need to be assessed.

Ref.	Criteria	Yes / No / TBC	Comments
4.2	Has the proposed design and methods of operation been considered as part of the Safety Management System for the current operation?	TBC	The aerodrome operator has provided some degree of consideration. However this could provide an opportunity to exploit safety enhancements that may be now available with an expanded infrastructure and increased resilience.
4.3	Can the proposed concept be progressed without the need for significant safety analysis of the concept to prove that it can be delivered safely without subsequent safety mitigations restricting traffic capacity and flow even further than already assumed?	TBC	Missed Approach Procedures (including when procedure is not followed) and likely dependency with RAF Northolt needs to be assessed further to understand the risks and effects on capacity. A worst case impact may be one movement less at Heathrow for every movement permitted at RAF Northolt. Some proposed modes of operation and runway separation/stagger may be difficult to operate safely and could therefore limit respite opportunities.

Heathrow Hub - preliminary safety assessment, September 2014

Assumptions

- The Airports Commission is considering the lengthening of the northern runway only. The scheme provides two northern runways each 3000m, with a fixed Runway End Safety Area (RESA) in between. The lengthened northern runway provides arrivals on the first section and departures from the second section in peak operational mode with mixed mode on the southern runway. The proposal includes a number of 'relief' modes including deep landings and mixed mode on the extended section of northern runway.
- The capacity suggested by the promoter is c700,000 ATMs (Air Transport Movements) per annum assuming the above relief modes.
- The proposal includes two ILS localisers in between the two northern runways.
- The CAA recognises the current Heathrow operation's dependence upon some 'features' which have evolved over time, and which are collectively considered as 'Grandfather Rights '. The CAA is expecting the scheme promoter to want to take advantage of some (or all) elements of these legacy features, but will expect robust and comprehensive safety assurance for the continuance of any 'Grandfather Rights ' which form part of the new airport configuration and all of its perceivable modes of operation.

Notes: The criteria below are categories for a pragmatic qualitative assessment. This initial assessment is based on information provided at an early stage and does not constitute any 'approval' by the CAA. A full concept of operations and safety justification will need to be provided by promoters at the appropriate stage in the future, which could be after planning permission or for certain elements, even once opened. The impact of each criteria are not necessarily equal and would require further consideration for their relative weighting.

Ref.	Criteria	Yes / No / TBC	Comments
1	**Aerodrome design and operation**		
1.1	Does the aerodrome design meet established safety standards, requirements and criteria (ICAO/EASA/CAA)?	No	The design of the two in-line northern runways is a novel concept without any pre-existing standards or experience globally. The CAA is open minded to the proposal subject to appropriate safety assurance. Nevertheless, a particular safety concern that must be resolved and fully articulated by the proposer is the safety risk between missed approaches and departures. The CAA will need to review this argument and make a decision on the tolerability of the safety risk the operation generates. In the event that the safety risks cannot be mitigated sufficiently, it is expected that dependant operations could be conducted, but this would result in lower capacity and/or less operational flexibility. The current ICAO separation for allowing independent approaches with no mitigations is 1525m.The existing runways are <1525m at c1450m and the proposed runway separation is 1035m from the existing northern runway. The proposer must demonstrate that the design meets the requirements of ICAO Document 9643 The Manual on Simultaneous Parallel or Near Parallel Instrument Runways (SOIR) for all possible modes of operation, in particular given the separation and stagger of the new northern runways. Appropriate mitigations will need to be provided. The existing ATC Tower currently infringes Obstacle Limitation Surfaces at Heathrow. This was accepted by the CAA based on the existing operational modes and an assessment of the likely number of missed approaches. The proposal changes the character of the airport operation. This would therefore require a new safety assessment to be undertaken by the promoter. There is a risk that this may not justify an EASA derogation, and could result in the need for alternative tower arrangements or limitations on certain modes of operation for example ‘deep-landings’. ILS localiser interference is a potential safety risk of in-line runways. The proposal now includes two additional localisers in between the northern runways. These will need to be frangible from impact in both directions (currently ILS localisers are designed to be frangible in one direction). They will also need to be positioned so that they are not damaged by jet-blast. Approach lighting begins 900m before the threshold and for occasions when the second section of the northern runway is used for landing, the lighting will encroach onto the prior landing runway. Approach lighting would therefore need to be inset into the surface of the pavement area and co-ordinated with other equipment that may need to be placed within the RESA e.g. ILS localisers and near field monitors. This may be achievable, although if not this may restrict some of the respite modes proposed such as early morning ‘deep landings’. The design of the in-line runways, if operating independently, will mean that an aircraft waiting to depart would be within the PSZ of the arrival runway. This may not be consistent with the DfT’s policy of minimising the number of people congregating within higher risk areas.

Ref.	Criteria	Yes / No / TBC	Comments
1.2	Can aircraft movements to and from the new runway(s) be accommodated without the need for crossing of other runways – at any stage as traffic capacity builds towards maximum capacity?	Yes	The scheme provides new infrastructure for aircraft in between the existing runways and therefore there would be no need to cross runways over and above that associated with Terminal 4 / Cargo areas.

Ref.	Criteria	Yes / No / TBC	Comments
2	**Air Traffic Control**		
2.1	Can the method of operation be delivered using established safety standards, requirements and criteria (ICAO/EASA/CAA)?	No	The proposal is likely to require new procedures and mitigations to ensure safety of the ATC operation. Due to the intensive and complex nature of the current Heathrow operation, the development of an additional runway will require a complete review and update of the entire operation. This could provide an opportunity to exploit safety enhancements that may be now available with an expanded infrastructure and increased resilience. In normal operations RAF Northolt is likely to have a form of dependency from an ATC perspective, although further work is required to understand the impacts fully. The promoter is suggesting up to 5 different modes of operation a day which has the potential to increase risk of human error. The proposal will need to include methods of interlocking the ILS and lighting to ensure that pilots land on the correct section of the northern runways. A human factors assessment should include this possibility. In-line runways introduce additional work and risk for Missed Approach Procedures where compliance is not always possible or could contribute to human error (A recent example of non compliance was an Etihad aircraft at Manchester August 2013). The in-line runway layout would require a fairly immediate turn on go-around and may have an impact on RAF Northolt (and vice versa). An Analysis of vertical and lateral distances between aircraft conducting a missed approach against aircraft departing from the upwind runway extension will need to be developed by the promoter. This needs to consider normal and abnormal operations; identify the dependencies that such distances are based on; consider the effects of non compliances; identify potential mitigations that could be applied. The analysis also needs to be supported by human factors assessment for the flight deck and Air Traffic Control to assess the operational impact of the proposed procedures. Combined, these activities should enable the promoter to develop a safety argument supporting the proposed concept of operation. If the Missed Approach Procedure cannot be adequately resolved then the two northern runways are likely to require dependent operations. For example departing aircraft may need to be held until an arriving aircraft has touched down and is under safe braking control. This is likely to reduce the capacity of the two northern runways (or reduce respite opportunity).This will require more detailed modelling to be undertaken to determine the precise impacts. The interaction of new SIDs and Missed Approach Procedures (MAPs) with existing/revised procedures will need to be examined in detail to determine whether proposals are viable. Additionally, the impact to RAF Northolt arrival and departure procedures, including RAF Northolt MAPs needs to be considered and procedures adequately managed.

Ref.	Criteria	Yes / No / TBC	Comments
2.2	Can the proposal be developed as an evolution of the current ATC operation?	No	The proposal is likely to require significant new procedures and mitigations to ensure safety of the ATC operation. The complexity is likely to increase if the northern runways and RAF Northolt have a form of dependency. There will also need to be safeguards to ensure that the introduction of additional localisers does not increase the potential for human error.
3	**Airspace**		
3.1	Can the proposal be delivered without significant effect on adjacent aerodromes and/ or adjacent airspace structures, which would require procedures and processes to be developed to ensure safety was maintained?	No	SIDs would need to be redesigned to avoid conflicts associated with having two runways providing departures and in the case of westerlies, the northern runway being further west. The result would be that SIDs would be pushed further to the west to avoid conflicts. This is likely to require changes at White Waltham and Denham aerodromes. The design may introduce the requirement for dependency with RAF Northolt, which could further reduce capacity at either or both airports. The impact on existing RAF Northolt procedures would need to be determined (as per 2.1). It is not possible to comment on the impact (if any) on London City Operations due to the lack of detailed design at this stage. This would have to be determined in due course with more detailed analysis by NATS and discussion with the proposer. There is no indication of how Heathrow arrival procedures would be integrated with London City operations. Given existing restrictions applied to London City SIDs following 'Level Bust' incidents in 2010, London City SIDs are initially capped at 3000ft on departure. However, NATS and London City are developing enhancements to London City SIDs for introduction with Lamp Phase 1 which are expected to change departure vertical profiles. This will need to be co-ordinated. The Inner Core TMA / LAMP would need to be redesigned with new procedures and knock on effects to other airports. This could take 5-7 years (LAMP Phases 1 & 2 are expected to take 5 and 9 years respectively).
3.2	Can the proposal be delivered in the surrounding airspace in accordance with Future Airspace Strategy principle to 'enhance safety by reducing controller and pilot workload and designing out risk factors'?	TBC	In addition to the potential complexity of dependency and go-around risks, there will also need to be safeguards to ensure that the introduction of additional localisers does not increase the potential for human error.

Ref.	Criteria	Yes / No / TBC	Comments
4	**Safety Management**		
4.1	Has the aerodrome design proposal and method of operation explicitly taken account of and addressed the following aviation safety threats:		
4.1a	Runway incursion?	Yes	In-line runways have the potential to cause confusion, however this can be overcome by placing warning lights and signage. Runway crossings should not increase as a result of the design.
4.1b	Runway excursion?	Yes	The potential RESA zone of upto 530m (two normal 240m RESAs plus 50m ILS zone) provided is more than adequate compared to current standards of 240m as long as equipment placed within it is frangible from impacts in both directions.
4.1c	Airborne conflict?	No	In-line runways introduce additional work and risk for Missed Approach Procedures where compliance is not always possible or could contribute to human error (a recent example of non compliance was an Etihad aircraft at Manchester August 2013). The in-line runway layout would require a fairly immediate turn on go-around and may have an impact on RAF Northolt (and vice versa). At present the published procedure at Heathrow is to continue straight ahead until reaching a specified altitude (>1000ft) and making the required turn, although this can be amended by tactical ATC instructions. Where radio communications are lost the aircraft are required to continue ahead for 10nm. The promoter is suggesting a fairly immediate turn to avoid potential impacts with departing aircraft. This will need to comply with SOIR rather than any existing operating procedures. An Analysis of vertical and lateral distances between aircraft conducting a missed approach against aircraft departing from the upwind runway extension will need to be developed, along with a human factors assessment for the flight deck and Air Traffic Control to assess the operational impacts of the procedures. Mitigation could involve holding departing aircraft at the beginning of the departure section of the northern runway until it's clear that landing traffic will not go-around. This would reduce capacity and/or respite opportunity. Missed Approach Procedures would also need to be co-ordinated with RAF Northolt to avoid any conflicts. The time separation available for this may be lower as the Heathrow runway is likely to require sharper turns to the north than a conventional runway configuration. See section 3.1 regarding London City operations.
4.1d	Ground handling?	Yes	Ground handling regulations and standards are not envisaged to be impacted by scheme design at this stage. This should be considered further in later stages.

Ref.	Criteria	Yes / No / TBC	Comments
4.1e	Obstacles?	TBC	The proposer demonstrates that aircraft holding on the northern departure runway would not infringe the balked landing surface. It may also be necessary to consider further the climb gradient associated with missed approaches from the landing portion of the runway in terms of the physical obstructions introduced by large aircraft waiting at the departure end of the extended runway. The impact of the existing ATC tower will need to be assessed. The tower would be close to the Approach surface of 27Rext. This is considered to be a more critical surface. The potential impact on obstacle limitation surfaces further from the airport has not been presented at this stage. The proposer will need to ensure that obstacles are identified and then potential hazards either removed or mitigated.
4.2	Has the proposed design and methods of operation been considered as part of the Safety Management System for the current operation?	TBC	Note that the proposer is not the current Heathrow operator. The specific safety issues under consideration by Heathrow Hub will need to be considered in the context of the whole operation in due course.
4.3	Can the proposed concept be progressed without the need for significant safety analysis of the concept to prove that it can be delivered safely without subsequent safety mitigations restricting traffic capacity and flow even further than already assumed?	No	Analysis of vertical and lateral distances between aircraft conducting a missed approach against aircraft departing from the upwind runway extension will need to be developed by the promoter, along with a human factors assessment. There is a risk that movement rates and/or respite opportunity would be lower than the expected. There is a potential dependency with RAF Northolt which could reduce capacity further at either or both airports. The infringement of the existing tower, ILS and lighting co-ordination and human factors may also have implications for some of the respite options, in particular ‘deep landings’.