Safety and Airspace Regulation Group

Report of the CAA's Post Implementation Review of the London Airspace Management Programme (LAMP) Phase 1A Module B Airspace Change Proposal – London City Airport RNAV-1 Replications

CAP 1692 B

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Executive Summary

1. The CAA's airspace change process is a seven-stage mechanism that is set out in detail in CAP 725. Under this process in February 2015, NATS submitted an Airspace Change Proposal (ACP) titled the London Airspace Management Programme (LAMP) Phase 1A proposal to the Civil Aviation Authority (CAA), to propose changes to airspace in the south-east of England including proposals to change a number of arrival and departure procedures at a number of aerodromes. LAMP Phase 1A was a major airspace change designed to deliver modifications to airspace arrangements affecting a broad swathe of south-east England from Stansted to the Isle of Wight in order to provide, primarily, capacity and efficiency benefits. There are five individual elements (referred to as Modules) of the LAMP Phase 1A proposal.

2. Module B was sponsored by London City Airport (LCA) and proposed replacing conventional departure and arrival procedures at LCA with RNAV-1 departures and arrivals (known as SIDs and STARs respectively) based on a variation of modern performance-based navigation technology known as RNAV-1.[1]

3. Module B proposed RNAV-1 routes up to 4000ft AMSL that match the conventional routes as closely as possible; that is RNAV-1 routes of the low altitude portions of all LCA conventional SIDs, and the introduction of RNAV-1 arrival transition procedures for the LCA radar vectored arrival flight paths to intercept the Instrument Approach Procedures (IAP) for both Runway (Rwy) 09 and Rwy 27. It was also proposed that a portion of the Runway 09 procedure would be used by traffic inbound to Biggin Hill.

[1] Performance-based navigation (of which RNAV-1 is a type) is satellite aviation guidance; in comparison to ground-based navigation aids (such as those used by conventional SIDs) performance based navigational technology will allow aircraft to fly much more accurate and flexible tracks. Satellite guidance will also allow the UK's complicated and busy airspace to be redesigned, increasing capacity and efficiency while maintaining or enhancing safety performance. A route structure optimised for satellite guidance with aircraft flying a pre-programmed trajectory will also reduce the need for tactical intervention by air traffic controllers to instruct pilots to change direction, bringing down the cost of air traffic control, and optimise the climb and departure profiles of aircraft (which is the most expeditious routeing of aircraft so far as airlines are concerned, and which also burns the least fuel and overall causes the least noise.

4. Stage 7 of this process is a Post Implementation Review (PIR) that normally begins one year after implementation of the change.

5. The sponsor provided PIR data to the CAA in June 2017; on 18 October 2017, the CAA commenced the PIR of the impact of its decision and the implemented change. The content and outcome of this review process by the CAA is discussed in detail in this report including its annexes.

6. On 2 January 2018, the CAA introduced a new process for making a decision whether or not to approve proposals to change airspace design (CAP1616). However, as this ACP was fully implemented prior to the introduction of that document, and the PIR data received by the CAA prior to its introduction, this review has been undertaken in accordance with CAP725 and the Department for Transport's Guidance to the Civil Aviation Authority on Environmental Objectives Relating to the Exercise of its Air Navigation Functions (2014).

7. During the review process, the CAA considered data provided by LCA. As a result, the CAA has reached the following conclusions:

Operational Conclusions

8. The PBN SID routes and the radar vectored arrival patterns have been successfully implemented from an operational viewpoint and the aims and objectives of the proposal have been achieved.

Complaints conclusion

9. We have analysed the enquiries/complaints received by the Change Sponsor, NATS and the CAA as part of this Review. As a result of our analysis, we have concluded that the themes associated with a significant proportion of the total received are consistent with the traffic patterns we were expecting and observed when carrying out our aircraft track analysis.

Environmental conclusions

10. The noise impacts, as defined by the L_{eq} contours, are consistent with the impact anticipated in the airspace change proposal. On that basis, we consider that there has been no increase in the number of people

significantly affected by noise as a direct result of the airspace change. As anticipated, there has been a net reduction in the number of people overflown, whilst there is also a proportion of the population that are being overflown more often. We also identified three situations where traffic pattern deviates from what was forecast, however in each case we have concluded that the impacts are consistent with the anticipated impacts.

11. This Module, in conjunction with Module C, has not achieved the reduction in annual CO_2 emissions that was expected. Instead these two Modules have resulted in an increase in CO_2 emissions.

Confirmation of LAMP Phase 1A Module B Implementation

12. In respect of Module B of LAMP Phase 1A the CAA confirms that no modification of the RNAV-1 arrival and departure designs are required by London City Airport except for:

1) Chart naming and associated data base coding changes to the ODLEG arrival procedures as described in paragraph 55.
2) A requirement for the CAA to implement the ICAO arrival chart naming convention for London City and Biggin Hill arrival procedures. This is to be discussed between the SARG IFP regulators and NATS with the action ratified to implement this requirement.
Note: this is an operational procedure naming issue and will not affect the position of any of the aircraft tracks over the ground.

In respect of the three situations where traffic pattern deviates from what was forecast, we recommend that the sponsor to investigate why there are some discrepancies. This concludes the CAA's airspace change process in respect of London City Airport's airspace change request dated 16 February 2015.

The PIR Report

13. This report, and its annexes and attachments, provide a summary of the information the CAA has reviewed and taken into account before reaching these conclusions. However, all the information the CAA has taken into account is published on our website/interim portal.

Scope and Background of the PIR

What is a Post Implementation Review

14. The CAA's approach to decision-making in relation to proposals to approve changes to airspace is explained in its Guidance on the Application of the Airspace Change Process, CAP 725. This detailed Guidance provides that the seventh and last stage of the process is a review of the implementation of the decision, particularly from an operational perspective, known as a Post Implementation Review (PIR).

15. The Guidance states that the purpose of a PIR is to determine whether the anticipated impacts and benefits in the original proposal and published decision are as expected, and where there are differences, what steps (if any) are required to be taken.

16. If the impacts are not as predicted, the CAA will require the change sponsor to investigate why, and consider possible mitigations or modifications for impacts that vary from those which were anticipated to meet the terms of the original decision.

17. A PIR is therefore focused on the effects of a particular airspace change proposal. It is not a review of the decision on the airspace change proposal, and neither is it a re-run of the original decision process.

Background to our conclusions in this PIR Decision

18. On 13 October 2015, the CAA approved LAMP Phase 1A change proposals to change traffic patterns for Stansted and Luton SIDs, London City arrival and departure routes, route network changes for London City, Gatwick, Farnborough, Southampton and Bournemouth; these changes involved a variety of changes which included RNAV1 procedures for London City arrivals and departures and a number of new ATS routes providing connectivity to the route network in adjacent States' airspace. The changes for LCA were proposed as Module B which is the subject of this report. In our Decision document dated 22 December 2015, we

provided information and background to the change. We recommend readers of this report read that decision in conjunction with this document.

Conditions attached to the CAA's decision to approve the change

19. The following conditions were placed on the sponsor:

1	Thames Radar controller to ensure that traffic entering the ATPEV Hold does not enter the Shoeburyness Danger Areas to the north-east.
2	The TC South Radar controller will monitor the vertical profile of the Heathrow Rwy 09 DET SIDs and take appropriate action to achieve separation between the Heathrow DET SID and the London City Rwy 09 arrivals if the controller considers separation could be eroded.
3	The TC North Radar controller will monitor the vertical profile of the Heathrow Rwy 09 BPK SIDs and take appropriate action to achieve separation between the London City Rwy 27 SIDs if the controller considers separation could be eroded.
4	The TC North Radar controller will monitor the vertical profile of the Heathrow Rwy 09 BUZAD SIDs and take appropriate action to achieve separation between the London City Rwy 27 SIDs if the controller considers separation could be eroded.

20. In the PIR data provided, there were no incidents reported as Mandatory Occurrence Reports (MOR) relating to these conditional reporting requirements therefore we are satisfied that these conditions for monitoring the relevant flight paths have been met.

Relevant events since the change

21. Air transport movements are described at paragraph 67.

Data collected for the purpose of the PIR

Sources of Information

Change Sponsor

22. By letter of 20 May 2016, the CAA requested from the change sponsor the data sets/analysis attached at Annex A by 4 May 2017. This summary of evidence is also published on the CAA website. Due to the volume of data required, the collation process and sponsor review of the data prior to submission to the CAA, the data was actually provided to the CAA on 2 June 2017.

23. During the review process, the CAA considered:

- a commentary summary by the sponsor (PIR requirements B10, B14);
- track dispersion and density plots of arriving and departing aircraft (PIR requirements B10, B14);
- track plots for go-arounds in strong wind conditions;
- altitude track dispersion plots in 1000ft intervals for departures; (PIR requirements B14);
- details of complaints received; (PIR requirements B15);
- details on procedure usage (PIR requirements B8, B9, B10);
- LAeq16hrs contour impact assessment.

24. We have noted that the change sponsor provided all of the data requested.

Operators and Airlines

25. The CAA received some early feedback from some operators on issues with the naming of arrival procedures and associated issues with the loading of flight procedures into the aircraft FMS. This was quickly addressed and resolved – the detail is covered later in the operational issues section of this report.

Air Navigation Service Provider

26. NATS is the air navigation service provider (ANSP) currently providing air traffic control services for arrivals and departures at the Airport. On 20 May 2016, the CAA confirmed with NATS the PIR data submission requirements to enable the PIR to be analysed. This request was published on the CAA's website and the response is included at Annex A and on the CAA website together with all the data provided.

27. Regarding the Annex A requirements, NATS provided evidence to satisfy all the PIR requirements. Some database coding issues had already been brought to the attention of the CAA during the first year of operations (as alluded to above). Specific aspects are considered in more detail later in the report.

Other data we have considered

28. The CAA, change sponsor, and NATS have all received feedback on the change from groups and residents much of which was directly related to the issues that the CAA required to be considered under the terms, scope and objective of this PIR. Groups and residents local to LCA have raised complaints on aircraft noise, overflight and concentration of flight paths with the airport and the CAA.

29. Complaints to the CAA were received and analysed – see paragraphs 85-89 for the details provided and our analysis of complaints.

30. A total of four petitions were raised by local communities following the implementation of this airspace change proposal, one of which was submitted directly to the CAA by Waltham Forest & Redbridge Green Party on behalf of residents affected by the concentration of flightpaths from LCA over selected communities across London. The other three were submitted directly to LCA and despite numerous requests for them to be, they were not actually forwarded on to the CAA. Whilst this means the raw data has not been seen, the locations/areas responsible for generating these petitions is known by the CAA and therefore they have still been considered as part of our analysis - see paragraph 87.

Objectives and Anticipated Impacts

The original proposal and its objectives

31. As explained in the change proposal, the objective of these changes is to introduce RNAV routes "to match the existing conventional routes as closely as possible" i.e. RNAV Standard Instrument Departures (SIDs) and arrival transitions which match as far as possible the conventional SIDs and concentration of radar vectored arrival flight paths.

32. A further justification for the London City procedures was that they would enable connectivity with the RNAV route structure as proposed in the NATS London Airspace Management Programme (LAMP) Phase 1 Module C airspace change proposal which NATS submitted to the CAA with the proposal. End to end RNAV1 connectivity between the en-route network and the arrivals & departure routes would enable the ATC network to operate more efficiently. NATS forecast environmental benefits which would be achieved by enabling departures to climb higher earlier, and repositioning higher level arrival routes over the Thames Estuary. As a result, the combined LAMP proposal would both reduce the CO_2 impact of each flight, and reduce the noise impact by reducing the time aircraft spend at 3,000-4,000ft over parts of East London, Kent and Essex. These benefits could not be realised without the proposal to introduce RNAV routes for the low-level conventional routes for London City Airport.

Anticipated Impacts

33. As Module B largely reflected the conventional procedures below 4000ft AMSL, but also the SID profiles as far as Clacton, Brookmans Park and Compton above 4000ft, with no anticipated changes to track mileage or vertical profile, there was little expected impact upon either fuel burn or CO_2 emissions. However, the proposal made it clear that this Module was an "enabler" for the changes in Module C, which did have an expected lower fuel burn and therefore coincident lower CO_2 emissions, and the combined impacts that arose from all of the LAMP Phase 1A Modules would therefore benefit operators. A summary of the impacts on CO_2 emissions from the LAMP Phase 1A Modules is at Appendix 1 to the Environmental Assessment Section 5.1.

34. Whilst anticipating that the CO_2 impact of this Module would be minimal, the CO_2 assessment of this Module was combined with that of Module C in the original proposal. The anticipated combined CO_2 reduction for Modules B and C was estimated to be with the range of 10,100-20,200 tonnes in 2016. However, as discussed in the CAA's Environmental Assessment, overall, the LAMP Phase 1A package of proposals was anticipated by NATS to provide an estimated 34,900 tonnes of CO_2 savings in 2016. Fuel savings were predicated on a number of factors and were calculated for a series of scenarios for 2016 and 2020 timelines. Taking a more conservative assessment, for the purpose of making this decision we concluded that we anticipated that the LAMP Phase 1A changes overall, (as enabled by Module B) would deliver a reduction of approximately 17,400 tonnes of CO_2 in 2016 and 20,800 tonnes in 2020.

35. We anticipated that there would be no effects on biodiversity.

36. We anticipated there would be no effect on local air quality, or on Areas of Outstanding Natural Beauty and National Parks.

37. There were unlikely to be any adverse tranquillity or visual intrusion impacts as a direct result of these changes.

38. We assessed the anticipated impact of noise emissions on the changes proposed. When doing so we had regard to the altitude-based priorities as given to the CAA by the Secretary of State in the 2014 Guidance to CAA on Environmental Objectives (set out in Annex A to the **CAA Decision: Part applicable to each LAMP Phase 1A Modules A – E**).

39. We concluded that we did not anticipate there would be a significant impact on noise emissions (within the meaning of Paragraph 9 of the Secretary of State's 2001 Directions to the CAA). See the incorporated **CAA Decision: Part applicable to each LAMP Phase 1A Modules A – E**, Annex A for an explanation of the CAA's policy in this regard. As set out in the CAA Environmental Assessment this is because the proposed changes to both departure routes and arrival routes will have no anticipated impact upon the airport's L_{eq} noise contours.[2]

[2] Noise contours are used to represent on a map the location of places affected by different volumes of noise.

40. Although we did not anticipate a significant noise impact as a result of these changes, we did consider that there was likely to be some change in noise dispersion. Experience of implementation of RNAV-1 departures at other airports led us to conclude that departing aircraft from London City after the first turn would more accurately fly the nominal track of the RNAV-1 route and would, consequently, produce a more concentrated track dispersion over the ground than aircraft flying the existing conventional departures. However, because of the type of RNAV design criteria used for the proposed London City departures (specifically because of the use of a 'fly-over' waypoint for the first turn), there was the likelihood of greater concentration than is currently the case because of the characteristics of the SID design. We stated that this may be slightly different to the track of the black dots shown in the consultation diagrams, but that this could only be confirmed after the procedures were actually flown under a representative set of operating conditions. Therefore, for the reasons set out below we anticipated track dispersion was likely to be very similar to the dispersion resulting from existing conventional SIDs around the first turn, but once aircraft had completed these turns, thereafter, the anticipated impact was that aircraft would be more concentrated along the nominal track of the SID as the aircraft fly east, compared with the conventional SID designs.

41. The new RNAV-1 designs for SIDs at London City were based around the use of a fly-over waypoint (as opposed to fly-by) for the first turn followed by a DF (direct-to-fix) path terminator to the next waypoint. This means that aircraft will initiate the first turn at the same point as they do in the conventional procedures.[1] However, we anticipated there would continue to be some dispersion around the first turn which would vary by aircraft type due to their differing operating speeds and because the aircraft are still accelerating at this point in their flight path. This affects the radius of the turn and may be exacerbated by wind direction and speed under certain circumstances. After the first turn has been completed, there would then be a more concentrated swathe of departures compared with the conventional SIDs. However, because at the point of change to the new procedures, approximately 30% of the aircraft types currently using London City would be unable to fly RNAV-1 SIDs, there would still be some aircraft flying the current conventional profile as this remained as a published alternative. As a result, we anticipated that there may have been some

[1] A fly-over waypoint is used by database coders when they provide informal RNAV-1 'coded overlays' of the conventional SID designs. There is, therefore, less likelihood of experiencing track dispersion around the initial turns, and consequently, the CAA believes that the designs for the SIDs at London City will provide a better SID replication than the design used for the recent Gatwick Route 4 RNAV-1 SID design.

variance from the track patterns shown in the consultation document diagrams for the departures, but the impact would not become totally apparent until all aircraft were flying RNAV-1 departures (on implementation, there was no anticipated date for this to occur). See paragraph 6 of PART APPLICABLE TO EACH LAMP PHASE 1A MODULES A – E for further detail.

42. Regarding arrival tracks, we anticipated that the consultation diagrams were a fair representation of the track dispersion that was likely to result from the implementation of the changes proposed in this Module. See paragraph 6 of PART APPLICABLE TO EACH LAMP PHASE 1A MODULES A – E for further detail.

43. We therefore considered that some residents should experience a reduction in noise impacts because they would have fewer flights overhead as a result of redistribution arising from concentration. However, some residents already under the nominal tracks of the conventional SIDs the subject of this proposal, were likely to experience more overflight and more noise as a result of this concentration. In our view, this impact was not significant in terms of the Secretary of State's policy and guidance to the CAA set out above.

44. Having carefully considered this information we concluded that overall, the proposals in Module B contributed to and enabled the environmental benefits anticipated from the package of proposals in LAMP Phase 1A. We acknowledged that this was achieved as a consequence of the anticipated concentration and associated noise impact described above.

CAA Assessment

Operational Assessment

45. The CAA examined the track data plots presented by the sponsor and reviewed the evidence provided by the sponsor with regard to the set of PIR reporting requirements as highlighted at Annex A. We completed a detailed analysis of all the new procedures flown and compiled a report which is at Annex B. In the track data analysis at Annex B, the SARG IFP regulator recorded whether the procedures were being flown correctly by the operators, and if not, particular issues were highlighted. We also took account of feedback from operators and engagement with database coding houses as illustrated earlier in paragraphs 53 and 55. The following is a summary of the CAA's conclusions.

Safety

46. From the evidence supplied in Annex A (the evidence provided in accordance the PIR requirements), there were no Mandatory Occurrence Reports (MOR) raised by NATS in relation to the particular scenarios where we sought feedback given the nature of some of the design characteristics used for the departure and arrival procedures. We therefore conclude that the procedure designs have been successful in this context.

47. As NATS reported in their Anticipated Impacts and Benefits statement, as a result of the implementation of LAMP Phase 1A, the controller workload in the London Terminal Control ("TC") Thames sector has been greatly reduced as a result of the new systemised airspace design with much less tactical control at low levels overland within a congested area close to the airport. This has resulted in an improvement in safety risk within the Swanwick TC environment and with the TC Thames sector. The reduction in complexity has therefore had a positive safety impact. Whilst this is evident across the regions affected by change in Modules B and C (the network changes), the particular benefits within this Module are associated with the reduced controller workload in managing the Runway 09 arrivals towards the base leg turn as aircraft approach Streatham, and subsequent turn at Lambeth Bridge towards final approach, and the systemised EKNIV SID departure route which is designed to reduced radar vectoring and controller workload enabling departures to the south to be climbed above all the arriving traffic, a factor which was previously tactically managed by

controllers before the change. The CAA recognises that the design has been successful in this regard, and that flight safety has been improved with the changes implemented in this Module.

48. Under PIR requirement B14, NATS was advised to report on any inadvertent penetration of the Southend controlled airspace by traffic arriving into or departing from London City which resulted in an MOR being raised. There were no occurrences reported under the MOR reporting system.

49. Prior to LAMP 1A designs, following an incident in 2010, departures to the south east are technically capped by the SID design to climb not above 3000ft. Therefore, there is a long-standing procedure for all departures which requires ATC to climb aircraft above 3000ft as soon as they are clear of other traffic. During the last year, whilst not specifically reported to the CAA, we became aware of a number of situations when aircraft on departure routeing to the east/south east have not been climbed soon enough to remain inside controlled airspace.

50. For LAMP 1A post implementation operations, given the requirement for ATC to climb departures above the arrivals, there was always a necessity to give the climb to departures early enough in order to establish vertical separation prior to the cross-over of both departing and arriving flightpaths. Since implementation, whilst it became apparent that some aircraft have inadvertently left controlled airspace for a short period until climb instructions have been issued by ATC, we became aware of a number of 'in house' procedures which NATS are using to alleviate this situation. At the time of compiling this report, there has been a reduction in such occurrences. Although not attributable to the new airspace design, as the situation existed prior to implementation, the CAA will nevertheless continue to monitor developments.

51. The evidence provided under PIR requirement B8/9/10 forecast RNAV usage at the time of the ACP submission at 70%. However, the actual usage over the first year rose to 92.6%, and to 95.9% in the last quarter of the annual period (4 Nov 16-3 Feb 17). The increased RNAV utilisation is an additional benefit as there is less radar vectoring for non-RNAV 1 aircraft, and hence reduced controller workload; consequently, this is a contributory factor to an improvement in flight safety for both flight deck crews and air traffic controllers.

Operational Feedback

Flyability.

52. Under PIR requirement B1, we asked NATS to provide details of any issues with flyability of SIDs and arrival transitions. There were no flyability issues noted within the flightpaths covered by the Module B proposal. We did however note that NATS illustrated the impact of strong south westerly winds on the Rwy 27 BPK SID at the turn after Woodford during Storm Imogen in February 2016 (see PDF Ref B36-B14). The strong winds did cause some ballooning at the Woodford turn which could be expected in these extreme wind conditions. In normal wind conditions, no flyability issues were noted. We therefore accepted in these extreme conditions that this was not an issue of the procedure - it merely demonstrated the impact that extreme strong winds can have. We therefore conclude that all the procedures have been flown to a satisfactory standard. However, we have a number of observations to make regarding the actual track dispersion achieved and some comments on charting which are detailed below.

Arrival Procedure Identification in Aircraft FMS.

53. Although the arrival procedures were being flown by the operators as intended, it was brought to our attention that the initial introduction of the procedure caused confusion for some operators. This was where some operators were unable to select the STAR and arrival transition procedures as cleared by ATC. This meant that ATC had to provide radar vectors until the various procedures had been recoded/renamed which took some time before all were corrected. The issue was highlighted by NATS under PIR Requirement B12 evidence (see Annex A). As part of the PIR, we have determined that the “Transition Arrival” charts will need to be renamed as “Approach transition” by the procedure sponsor. Action will be initiated by the CAA Instrument Flight Procedures (IFP) Airspace Regulator to address this technicality.

Note: whilst this mainly affects the arrival procedures under the jurisdiction of Module C, this is included here for reference as the arrival procedures cover changes proposed in both Modules B and C.

54. After the introduction of these procedures in 2016, a subsequent requirement as defined in the EASA Reg (EU) 2017/373 requires the UK to comply with the ICAO STAR naming convention. The current UK naming convention for STARs and arrivals is currently predicated on the last waypoint of the procedure, whereas the ICAO naming convention is predicated on the first waypoint of the procedure. This difference means

that all London City STARs/Arrivals will need to be renamed in due course; however, we would highlight that this is a procedure naming issue and will not affect any of the aircraft tracks over the ground. Therefore, to comply with this requirement, it is now recommended that London City STARs and Arrival transitions be re-named once co-ordination between the CAA and NATS has been initiated and appropriate action is agreed to address the issue.

Runway 09 Arrival Procedure via ODLEG.

55. The terminating leg of segment 2 where aircraft are on the 'base leg' of the runway 09 arrival procedure, has a fix to manual termination (FM) path terminator seen in the AIP published coding tables. During the PIR analysis, we determined through engagement with database coding houses that due to FMS coding constraints, many coding providers changed the coding from an FM to a Course to Fix (CF) path terminator. This CF is a course of 049° to the intermediate fix on the ILS. Therefore, when the aircraft reaches ODLEG it takes up a course of 049°M to intercept the ILS localiser as cleared by ATC earlier on the base leg. As the current standard practice by ATC is to clear pilots to establish on the ILS localiser before reaching ODLEG, this change of path terminator has had no impact on the track flown after passing ODLEG.

56. The only impact is that should an aircraft experience an RCF the procedure is now coded as a closed procedure terminating at the instrument approach procedure intermediate fix instead of continuing on a heading of 049°. As long as NATS are content with this and are able to manage an RCF situation, this is acceptable.

Note: For the non-technical stakeholder, this effectively means the procedure has performed as expected.

57. This effectively means that database houses have coded up a procedure which is different to that published in the UK AIP. As the published RNAV procedure should reflect what is published in the State AIP, this conflict has to be resolved. To resolve the conflict between the UK AIP chart coding tables and navigation databases, the CAA requires NATS to:

- Confirm that a closed transition is acceptable and that this presents no issues regarding Radio Communication Failure (RCF) implications. If this is acceptable, NATS will need to engage with an Approved Procedure Designer (APD) to amend the existing

procedure design files, and then submit the changes via an APD to the CAA for approval by the CAA IFP section of SARG for implementation in the UK AIP.

Note: this change to the published UK AIP database coding table will not result in any changes to track over the ground.

Air Navigation Service provision

58. There has been adequate resource for service provision to arrival and departures for the elements of the LAMP 1A design in Module B – the requirements were relatively speaking, unchanged, compared with the situation prior to the airspace change.

Utilisation and Track Keeping

59. The CAA carried out an in-depth analysis of the traffic patterns for selected periods during 4 seasonal months throughout the first year of operation. The analysis report is detailed in Annex B. The traffic samples are included on the CAA website. To understand the impacts, interested parties should read the guidance in Annex B before reading the track analysis and associating the commens with the relevant diagrams.

60. We found that:

1) There was a minor anomaly with the CLN1H Rwy 09 SID chart and coding table such that a course was missing from LCE01 to LCE02. This has been addressed and an amendment to the chart has been authorised.
2) Procedures were being flown correctly by the operators.
3) The track keeping was broadly as expected, however, there are some differences as discussed below.
4) Direct routeings to waypoints were obvious on the track plots when traffic conditions permitted shorter routeings to be provided – this would either have been radar vectoring (potentially for the very small number of non-RNAV-1 equipped aircraft) or instructions to route to a particular waypoint to save track mileage and provide a more expeditious routeing; for example, for the Runway 09 arrival direct routeings to OSVEV are very noticeable.
5) The turn after ODLEG (Streatham) onto final approach to Runway 09 appears to be working well, thus reducing controller and pilot workload.

61. We also determined that there were three situations when tracks over the ground appeared different to those predicted (see paragraphs 62-64).

62. CLN1H Rwy 09 SID. In segment 3 the tracking displacement of RNAV tracks from LCE02-05 was north of the where the concentrated traffic pattern was expected.

63. EKNIV1H Rwy 09 SID. In segment 3 the tracking displacement of RNAV tracks from LCE02-05 was slightly south of where the concentrated traffic pattern was expected.

64. BPK1A Rwy 27 SID. In segment 2 the concentration swathe has slightly widened when compared with the traffic sample in 2013 before the change.

65. In all three cases after investigation and analysis we determined that the impact was such that the noise impacts would not be deemed to be significant. Further detail may be found at Annex B.

Traffic

66. Given that the new LAMP1A departure and arrival procedures covered within Module B were introduced in areas of controlled airspace which were unchanged, there has been no impact on other airspace users. The traffic patterns observed are acceptably close to that forecast by the sponsor and therefore, we would conclude that operational impacts have been as expected. For operators flying into LCA, the RNAV-1 procedures have produced benefits by reducing both controller and flight deck workload as a result of less radar vectoring compared with the situation prior to the change.

Note: Certain operations (mainly those to and from the north and the few flights that fly in and out on westerly routeings from and to Ireland / USA) have experienced extra track mileage and flight times – this is a result of the changes in Module C and is covered in the Module C report.

67. The CAA examined the traffic statistics during the period from 2012 to 2017. Annual traffic figures are shown in Table 1.

Table 1 - Comparison of annual traffic figures with traffic forecast from the airspace change proposal

	Actual						Forecast (2012+20%)
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2016**
Total traffic*	64,300	68,100	70,100	79,300	80,400	76,600	77,200

* Air Transport Movements, taken from CAA data. Rounded to the nearest 100.

The traffic forecast that was provided in the original airspace change proposal for 2016 was 2012 volume +20%. Using 2012 traffic volumes as the baseline, this equals a forecast of 77,200 movements for 2016. The actual traffic volume for 2016 was approx. 80,400. This is 4.1% greater than the forecast for 2016, and represents growth of 25% since 2012; this shows that traffic growth has exceeded the sponsor's forecast, although we note that the figures for 2017 appear to be closer to what was forecast for 2016.

68. We also note that the RNAV 1 equipage compliance has significantly increased from that originally forecast and is now above 90% of all aircraft movements.

Environmental Assessment

69. The sponsor provided its analysis of the environmental impacts (see Annex A of this report for a list of information provided) for the airspace change post implementation review. The CAA has assessed that data and the details of that assessment are set out below.

70. It should be noted that at the time of the consultation and decision on this Module, the CAA's PBN SID Replication Policy was current and therefore its reduced requirements were applied to this Module.

Noise – Leq Contours

71. The airport's L_{eq} noise contours were not expected to change as a result of the airspace change because any changes to arrival and departure routes would only occur well beyond the 57 L_{eq} dBA contours for London City Airport. NATS has presented a case and evidence for why this has indeed

been the case following implementation (see reference document B-Env1). NATS state that the radar track data density pattern diagrams provided for the four periods in 2016, when compared to the 2013 57dB LAeq 16h contours (slide 3 of the reference), indicate that there has been no noticeable changes to the 57dB LAeq 16 hrs contour post implementation. This supports the expectation that the airspace change does not have an impact on the Leq noise contours and therefore does not have a significant noise impact. By examination of these diagrams we support this conclusion.

72. On this basis, we conclude that the airspace change has not resulted in an unexpected increase in people significantly affected by noise, as defined in our original decision.

Overflights

Summary of "overflight" impacts, as presented in the PIR data from the sponsor:

73. The details in Table 2 and accompanying text should be read in conjunction with the further information at Annex C of this report. Population counts in the table have been rounded to the nearest 100, and therefore differences will be due to rounding.

Note: In Table 2 we refer to CAP 1498. CAP 1498 is a guidance document that describes a standardised method for assessing overflights. This document was developed in conjunction with the Department for Transport, to respond to community feedback on the fact that stakeholders situated outside the noise contour that represents the onset of significant community annoyance can be adversely affected by passing aircraft. It details a standardised metric for describing overflights."

Table 2 – Summary of overflights (persons overflown)

Modules B & C – London City	Pre-implementation (2013)	Post-implementation (2016)	Increase / decrease
Arrivals			
Direct overflight - Ground to below 4,000ft	881,000	331,000	-550,000
Direct overflight - 4,000ft to below 7,000ft	404,900	72,100	-332,800
Direct overflight - Ground to below 7,000ft	1,285,900	403,100	-882,800
"CAP1498 swathe"	2,439,700	1,231,300	-1,208,400
Departures			
Direct overflight - Ground to below 4,000ft	672,900	416,300	-256,600
Direct overflight - 4,000ft to below 7,000ft	184,800	115,100	-69,700
Direct overflight - Ground to below 7,000ft	857,700	531,400	-326,300
"CAP1498 swathe"	1,447,200	1,317,100	-130,200

Note: The Arrivals and Departures population counts cannot be combined to show a total because some of the geographic areas are common to both Arrivals and Departures, especially for the pre-implementation traffic patterns.

74. NATS has not used the CAP1498 "overflight" methodology to produce a set of contours which would have given a clearer picture the proportion of the population that are being overflown more often as a result of the airspace change.

75. So in the case of Modules B & C, a proxy for gauging the population being overflown more often is the headcount for those within the direct overflight totals (the shaded cells in the table above).

76. Therefore, whilst it is apparent that using the simplified CAP1498 swathe shows that there has been a reduction in the population overflown below 7,000ft, the shaded cells in the table show that there is a portion of the population that is likely to be experiencing an increase in being overflown as a direct result of this airspace change, regardless of the increase in traffic volumes that has occurred despite the airspace change.

Arrivals - Up to 4000ft:

77. The reduction in direct overflight in this altitude band is partly as a result of greater concentration, but also due to a change in traffic pattern that has reduced the number of arriving aircraft over North Kent.

Arrivals - From 4000ft to 7000ft:

78. 76. The reduction in overflight in this altitude band is as a result of a distinct change in traffic pattern resulting from the introduction of Point Merge. This has reduced the number of aircraft arriving over Hertfordshire, North London, East Essex and North Kent in this altitude band. The one location that appears to be overflown more often as a result of change in traffic pattern (other than as a result of concentration) is the Hoo Peninsula/Isle of Grain.

Departures – Up to 4000ft:

79. The reduction in overflight in this altitude band is primarily as a result of increased concentration rather than as a change in general shape of the traffic pattern.

Departures – From 4000ft to 7000ft:

80. The reduction in overflight in this altitude band is primarily as a result of a change in the shape of the traffic pattern. There are much fewer flights heading east across South Essex, coupled with an apparent improved climb profile meaning that aircraft tracks are generally shorter (and therefore overflying a smaller geographic area below 7000ft). In the original consultation and proposal, the sponsor indicated that because aircraft could be tactically vectored from 4000ft, they did not anticipate any change in traffic patterns above that altitude. In our consideration of the impacts, we noted that our experience of previous SID "replications" for other airspace changes when PBN SIDs are introduced suggested that concentration also occurs above the height at which tactical vectoring is possible. This was our expectation at the time of the decision, and the above assessment of the overflight analysis supports that expectation for departures between 4000ft-7000ft.

CO_2 Emissions

81. Further detail of the PIR assessment of the change in fuel burn and CO_2 emissions can be found in Annex D of this report which summarises the impacts across all of the LAMP Phase 1A Modules. The assessment of CO_2 emission that supported the original airspace change proposal and which the CAA took account of in making its decision was a combined assessment that reflected the totality of the changes related to London City Airport (i.e. Modules B and C). In the same way, the CO_2 assessment for the PIR has also combined these two Modules. That said, the expectation was that the majority if not all of the change in CO_2 emissions would relate to Module C because that was the Module that reflected the large changes

to the arrival routes. By comparison Module B was intended to be a "replication" of the existing departure and arrival routes, and therefore was not expected to have any notable change in CO_2 emissions.

82. In the original ACP, the fuel burn and CO_2 estimates for London City routes reflected the sponsor's expectations of an increase in track mileage generally for arrivals, but also balanced this against expected savings in both holding time and improved vertical profiles for arriving aircraft. The result was that fuel savings and CO_2 reductions were forecast for London City flights.

83. The PIR assessment shows that Modules B and C have not achieved a CO_2 reduction in line with the estimated change in emissions that was proposed and considered when the CAA made its decision to approve the airspace change. On the contrary, the emissions assessment indicates that rather than deliver an anticipated reduction in CO_2 emission, these two Modules have resulted in an increase in emissions. This is due to the change in the arrival routes not delivering the expected benefit rather than a result of the changes made to the departure routes.

Environmental Conclusion

84. The CAA's conclusion in this PIR is that the environmental impacts consequential on the implementation of the airspace changes are as expected other than the CO_2 emissions impact noted above and are consistent with the impacts we took into consideration in making our original decision.

Community Stakeholder observations

85. As part of the data collection process, the Change Sponsor was required to accept, process and collate noise enquiries/complaints and feedback relating to the implementation of this airspace change. Within their PIR data submission, the Change Sponsor included details in relation to a total of 175 enquiries/complaints which they have determined as falling within scope of this Review. The Change Sponsor also advised the CAA that they received four petitions following the implementation of this airspace change proposal; one was submitted directly to the CAA and the other three were not forwarded on by LCA. All of this data has been reviewed and assessed by the CAA for the purpose of this PIR.

86. The 175 enquiries/complaints that the Change Sponsor has determined fall within scope of this Review were generated by 141 individuals/organisations, all of which were located within the boundaries of 14 different London Boroughs; the Change Sponsor requires individuals/organisations to provide a full postal address when registering an enquiry/complaint and summary address information (partial postcode and confirmation of relevant London Borough) was included in their PIR data submission. The Change Sponsor used this information to produce an indicative heat map, which included an overlay showing complaint/enquiry locations (by London Borough). This map clearly shows that the 175 enquiries/complaints were generated by individuals/organisations who reside within London Boroughs that fall directly under the centrelines associated with some of the instrument flight procedure that were implemented following the regulatory approval of this airspace change proposal. The main themes identified when analysing these enquiries/complaints concerned the concentration of traffic patterns and the general burden of aircraft noise/overflight, the need to introduce respite routes and the unfairness of the regulatory decision to approve the implementation of the procedures associated with this airspace change proposal.

87. With regards to the four petitions referenced above, two were from Waltham Forest and Redbridge Green (355 and 676 signatories) and two were from Lewisham (70 and 91 signatories). Whilst the CAA received a copy of one of the Waltham Forest & Redbridge Green petitions, the other three were submitted directly to LCA and despite requests for them to be, they were not actually forwarded on to the CAA. Whilst this means the raw data has not been seen, the locations/areas responsible for generating these petitions is known and therefore they have still been considered as part of our analysis. The CAA notes that Waltham and Redbridge are London Boroughs that fall directly under the departure routes associated with this airspace change, whilst Lewisham is a London Borough that falls directly under the arrival routes associated with this airspace change proposal.

88. A comparison of complainants' locations in relation to London City's traffic patterns both before and after the implementation of the change has been completed, with the main conclusion being that there have been no unanticipated impacts – please refer to Annex E (Complaints Analysis) for more information.

89. In addition to the feedback noted and considered above, the CAA has also analysed the correspondence which it received directly from stakeholders following the implementation of this airspace change.

90. During this time, the CAA received a total of 63 enquiries/complaints which specifically relate to London City airport and aircraft activity associated with it. Of the total received, 12 fell outside of the scope of this review as they focussed solely on the correctness or otherwise of our original regulatory decision, sought clarification on the requirements of the airspace change process and/or concerned un-related aircraft activity. As this correspondence did not specifically concern the impact of aircraft activity following the implementation of this airspace change, it was not considered for the purposes of the PIR conclusions.

91. Of the remaining 51 enquiries/complaints, 33 were received directly from individuals whilst 18 were received from elected representatives (16) and representative organisations (2).

92. Focussing initially on the 33 enquiries/complaints the CAA received from individuals, 31 provided the full or initial part of their postcode, 1 provided a general location for their residence (i.e. town/village name) and 1 did not specify any address details in their submission. We have used the information provided to plot 32 locations during our analysis and we note that all of the locations plotted fall directly under or within close proximity (2-mile radius) of the instrument flight procedure centrelines associated with this airspace change proposal. Several common themes were identified when reviewing the content of these enquiries/complaints, with much of the correspondence received by the CAA highlighting that there had been a noticeable change/increase in the amount of aircraft noise experienced at their property since the implementation of the change. Other common themes concerned a change in aircraft activity/patterns and the concentration of aircraft tracks. Whilst it is important to acknowledge that a number of individuals challenged the adequacy of the consultation associated with this airspace change proposal in their correspondence, the primary objective of this Review is to assess the success of this airspace arrangement and its progress since implementation in order to identify any operational issues that may have arisen.

93. Similar themes were identified when reviewing the 18 enquiries/complaints that were received from elected representatives and representative organisations. The CAA has analysed the location of the various

constituencies and areas of interest and notes that they all fall directly under or within close proximity (2-mile radius) of the instrument flight procedure centrelines associated with this airspace change proposal.

94. To summarise, we have analysed the enquiries/complaints received by the Change Sponsor and the CAA as part of this Review. As a result of our analysis, we have concluded that the themes associated with a significant proportion of the total received are consistent with the traffic patterns we were expecting and observed when carrying out our aircraft track analysis and do not give rise to any unforeseen impacts of the proposal.

Ministry of Defence Operations

95. Operations by the Ministry of Defence were not affected by the proposals in Module B.

Conclusion

Operational Conclusions

96. No MORs relating to procedure designs and flyability were attributed to any scenarios where we specifically as requested feedback. We therefore conclude that the procedure designs have been successful in this context.

97. Early issues with the naming of the arrival procedures which were loaded onto some operator's (but not all operators) aircraft flight management systems were resolved once the issues had been investigated. This was a database coding issue with procedure naming conventions and not associated with the actual designs themselves. The SARG IFP regulators have noted these issues and will ensure that future designs are named appropriately.

98. ATC complexity has been reduced by the introduction of RNAV1 procedures which has reduced ATC workload, which in turn reduces flight deck workload and RT transmissions between ATC and flight crews due to the more systemised nature of operations which has meant less radar vectoring by controllers. This has been a positive impact on flight safety. The benefits of the RNAV Design have been realised by more operators than perhaps first thought as RNAV 1 equipage rates have risen from an estimated 70% on implementation to almost 96% at the end of the first year of operations.

99. The EKNIV SIDs have seen an improved climb performance for departures flying to the southeast and south, although the benefits of these procedures are more associated with Module C rather than with Module B, although both modules are related in this aspect.

100. In the main track keeping on all procedures has been as expected, and the Runway 09 arrival procedure has not presented any issues on the base leg turn onto final approach. However, a change to data base coding for the Runway 09 ODLEG arrival procedure is to be progressed by the sponsor in conjunction with their APD as outlined in paragraph 57 to reflect how the procedures have been coded by the database houses.

101. With the exception of three instances highlighted in this report the traffic pattern anticipated and as shown in consultation has been realised.

102. The change proposal has delivered the operational impacts and benefits which were anticipated in consultation and have been successfully implemented from an operational viewpoint.

Environmental conclusions

103. The noise impacts, as defined by the L_{eq} contours, are consistent with the impact anticipated in the airspace change proposal. On that basis, we consider that there has been no increase in the number of people significantly affected by noise as a direct result of the airspace change.

104. As anticipated, there has been a net reduction in the number of people overflown, whilst there is also a proportion of the population that are being overflown more often.

105. This Module, in conjunction with Module C, has not achieved the reduction in annual CO_2 emissions that was expected. Instead these two Modules have resulted in an increase in CO_2 emissions.

106. With the exception of three instances highlighted in this report the traffic pattern anticipated and as shown in consultation has been realised

Overall Conclusion and Confirmation of LAMP 1A Implementation.

107. In respect of Module B of LAMP Phase 1A the CAA confirms that the operational aims and objectives have been achieved. No modification of the RNAV-1 arrival and departure designs are required by London City Airport except for the chart change and database coding change modification as discussed in paragraphs 55-57. The CAA's airspace change process in respect of London City Airport's airspace change request dated 16 February 2015 has now concluded.

108. Notwithstanding our overall conclusion, in view of the three differences of actual track dispersal from what was predicted as shown in consultation diagrams relating to:

1) Runway 09 CLN Departures, Segment 3 where the traffic pattern runs north of the predicted concentration pattern as shown in consultation;
2) Runway 09 DVR/EKNIV Departures, Segment 3 where the traffic pattern runs south of the predicted concentration pattern as shown in consultation;
3) Runway 27 BPK/CLN/EKNIV Departures, Segment 2 where the traffic pattern of departures is slightly wider than expected,

In each case we have concluded that the impacts are consistent with the anticipated impacts, however we recommend that the sponsor examine why this has occurred and to propose further action, if any.

Note on plain language

109. The CAA has attempted to write this report as clearly as possible. Our approach has been to include all the relevant technical material but also to provide a summary and of the conclusions the CAA has reached in reliance on it in as understandable a way as possible. Nevertheless, when summarising a technical subject there is always a risk that explaining it in more accessible terms can alter the meaning. For that reason, the definitive version of our assessment and conclusions are in the attached technical reports.

Annexes

Annex A. LAMP Phase 1A PIR data provision Requirements - evidence provided.

Annex B. London City Airport Arrival and departure Track Analysis Assessment.

Annex C. General commentary on the sponsor's assessment of populations overflown.

Annex D. CO_2 Emissions Summary.

Annex E. Complaints Analysis.

Annex A - LAMP Phase 1A PIR data provision Requirements - evidence provided

Data for the PIR review is to be submitted to the CAA by [agreed date in 2017] unless stated otherwise in the remarks column where specific actions are required to be completed in accordance with the CAA Decision Documents dated 22 December 2015 as amended.
The following Notes relate to data provision regarding the format of submission material and responsibilities of the appropriate LAMP sponsors.
In the Table below, the last column indicates responsibility for the appropriate LAMP sponsor to provide data as appropriate; in some circumstances, this responsibility is to be shared as agreed between sponsors.
Note 1: NATS, London City Airport Ltd and London Stansted Airport Ltd are to collaborate to produce a joint PIR to match the collaborative ACP. References to 'LAMP Sponsors' in the remarks column refer to the collective.
Note 2: MOR analysis: A number of the remarks below relate to MOR analysis. NATS is to monitor MORs generated within the region and highlight any significant issues that require further investigations to the case officer as they arise. A complete MOR summary for the year post implementation is to be provided with the PIR in May 2017. It is noted that overloads are reported as a subset of MORs.
Note 3: Density and track plot maps: NATS is to aim to produce directly comparable maps across the whole LAMP 1A region. However, given that NATS is upgrading their track processing technology, it is understood that this may mean data presentation tools change from those used in the consultation. The CAA recognises that this in turn may make it impossible to produce new maps that are directly comparable to the consultation diagrams. If this occurs NATS is to produce fresh maps using the new technology with the new data and the historic consultation data; this is to allow comparison of:

- The difference the between the old and new tools (i.e. compare consultation material with same data in new tool).

- The difference between the old and new data (i.e. comparing the consultation data and new data using the new tool).

If any of the sponsors find they are unable to produce directly comparable maps, they must advise the CAA at the earliest opportunity with a view to agreeing the best alternative presentation of data in advance of the PIR target deliverable date in May 2017.
Whilst airports have additional data that is not compatible with the NATS system, for example track plots distinguishing between RNAV and non RNAV arrivals, these should also be provided where relevant.
Where consultation and ACP material showed plots highlighting flights over AONBs, this is to be repeated for the PIR plots.
The Lmax data provided with consultation plots is to be reviewed and any difference highlighted.
Note 4: Sponsors are to review the assumptions of the CO2 analyses and update the analyses accordingly.
Note 5: Sponsors are to review all the ACP claims and report on whether the statements can be supported by observation post implementation.

Source Material	Data Required	Remarks	Responsibility	Evidence
Decision Documents				
CAP 1366 (Decision Document)	Not specified here; see Individual Modules, and ENV requirement under bridging Module			
General ENV Requirement for track dispersion plot diagrams	The general requirement for all Modules is that any diagrams provided as part of the PIR must be directly comparable with equivalent diagrams provided as part of the consultation and/or the proposal. There should be no changes to style, format, scale, colour-coding etc.	See note 3	NATS and airports	
Bridging Module 1	Updated CO_2 analysis using the same principles as the assessment undertaken as part of the Bridging Module. Assumptions to be updated based upon actual post-implementation data (e.g. the proportion of traffic that is tactically vectored, runway usage, flight numbers etc). Analysis to be broken down by Module, to reflect individually all five Modules submitted.	See note 4	NATS	See NATS reports: Bridge-Anticipated Impacts and Benefits Summary Bridge-Fuel-CO2-Analysis Bridge-Population-Overview-Analysis For MORs regarding overloads, see Bridge-Safety-Confidential-MORs
Module A Decision Document STANSTED SID SWITCH	Provide any details of occurrences of traffic using (U)M84 resulting in inadvertent penetration of D138A, together with action taken to prevent any further occurrence. NIL returns required.	See note 2	NATS	No MORs were attributed to this scenario
Module A Operational A1	Provide details of any sector overload associated with the Stansted DET SID switch resulting in an MOR.	See note 2	NATS	No MORs were attributed to this scenario
A2	Provide details of any release difficulties to adjacent ACCs with traffic routeing through KONAN.	See note 2	NATS	See Bridging Module filename: Bridge-Safety-CONFIDENTIAL-MORs-LAMP-Related Specifically, report numbers 112535 & 113762
A3	Provide details of the number of flights using Stansted Rwy 22 and Rwy 04 CLN and DET SIDs for the period 4 Feb 15 – 3 Feb 16 and post change for period of 4 Feb 16 - 3 Feb 17. The number of flights post change should illustrate	To be provided from STAL records of departures	STAL for runway records	STAL has supplied their reports, see zip file A3-A4-A5-EnvA1_STAL-Reports KONAN data was supplied to STAL by NATS CPW and was also incorporated into evidence filename:

Source Material	Data Required	Remarks	Responsibility	Evidence
	those flights specifically routeing eastbound after CLN on the original SID routeing, and those routeing via (U)M84 to KONAN.			A-Env2-Env4 Commentary
A4	Provide details of number of flights using the DET SID at night from 2300L-0600L for the periods in No 3 above.	To be provided from STAL records of departures	STAL for runway records NATS for flight plan data	STAL has supplied their reports, see zip file A3-A4-A5-EnvA1_STAL-Reports
A5	The sponsor should keep local reaction to the airspace change below 7000ft under review, and complete an annual summary of issues arising. Sponsors are requested to advise the CAA Airspace Regulation Consultation Regulator with an initial summary of any feedback by 30 June 2016.	STAL is to provide a summary of stakeholder reaction.	STAL	STAL has supplied their reports, see zip file A3-A4-A5-EnvA1_STAL-Reports NATS evidence supplied under Bridge-Comms-Complaints
Module A ENV A1	Sponsor to provide sufficient data to confirm that there have been no changes to Leq noise contours as a result of the airspace change, or alternatively to illustrate any changes to the contours. The sponsor may provide post-implementation contours for direct compassion with pre-implementation contours, or provide sufficient evidence that support any rationale that Leq contours are unchanged and do not need to be produced. Such evidence is likely to include a comparison of lateral and vertical aircraft tracks (both pre- and post-implementation).	If a rationale for not producing Leq contours cannot be provided and accepted by the CAA, then the comparison can be based on 2016 Leq contours – subject to other factors not related to the ACP being taken into account (e.g. traffic growth).	STAL	STAL has supplied their reports, see zip file A3-A4-A5-EnvA1_STAL-Reports
ENV A2	In addition to the requested operational track diagrams, the sponsor is to re-perform any noise assessment that was reflected in the consultation or proposal documents, to reflect post-implementation data. This includes any swathes, altitude bands, anticipated noise levels and frequency of flights that were used to portray the expected noise impact.	See Note 3.	NATS and airports are to review diagrams and assess/ provide what is required	Track plots complete, matching those in the main consultation doc (including consultation areas and AONB) See evidence folder A-Env2-Plots And filename A-Env2-Env4 Commentary

Source Material	Data Required	Remarks	Responsibility	Evidence
ENV A3	Sponsor to provide an assessment of the impact upon CO_2 emissions as a result of the airspace change, using the same methodology as the consultation and proposals, but updated as required using actual post-implementation data (e.g. to replace or update any assumptions used, to use actual track profiles and actual track mileages. The emissions assessment must be consistent with the pattern of traffic reflected in any associated track diagrams provided for the PIR.	See note 4.	NATS & Airport	See Bridging Module files: Bridge-Fuel-CO2-Analysis Bridge-Population-Overview-Analysis
ENV A4	Sponsor to provide sufficient data/rationale to support any claimed environmental impacts (positive, negative or neutral) made in consultation or proposal documents (e.g. Local Air Quality, tranquillity, visual intrusion etc.)	See note 5.	NATS and the airport are to review and assess what is required	Track plots from A-Env2 will be that evidence See filename A-Env2-Env4 Commentary
Module B Decision Document LONDON CITY SID Replic Arr Trans Replic	1. Requirement N/A here - detailed in Module C			
	2. Provide any details of occurrences when RNAV 1 traffic deviates from the RNAV1 flight path of the London City traffic downwind / base leg for Rwy 09 using the ODLEG arrival transition procedure resulting in an MOR to such an extent that controller intervention is required to maintain separation with the Heathrow Detling SIDs. NIL returns required.	See note 2	NATS	No MORs were attributed to this scenario
	3. Provide any details of occurrences when RNAV1 traffic deviates from the RNAV1 flight path of the London City Rwy 27 RNAV SIDs resulting in an MOR to such an extent that controller intervention is required to maintain separation with	See note 2	NATS	No MORs were attributed to this scenario

Source Material	Data Required	Remarks	Responsibility	Evidence
	the Heathrow Rwy 09 BPK SIDs. NIL returns required.			
	4. Provide any details of occurrences when RNAV1 traffic deviates from the RNAV1 flightpath of the London City Rwy 27 RNAV SIDs resulting in an MOR to such an extent that controller intervention is required to maintain separation with the Heathrow Rwy 09 BUZAD SIDs. NIL returns required.	See note 2	NATS	No MORs were attributed to this scenario
Module B Operational B1	Provide any details of any issues with flyability of all SIDs and Arrival Transitions. (Provide dates of any occurrences and appropriate details and how issues have been resolved).	See note 2	NATS	None noted. See track plot packages B10 and B14 for examples of the impact of strong SW wind (Storm Imogen, 7-8 Feb 2016).
B2	Provide any details of EKNIV SIDs not being able to reach Min Stack Level by SODVU resulting in an MOR.	See note 2	NATS	No MORs were attributed to this scenario
B3	Provide details of any issues where the IFP naming and/or coding had an impact on the flyability of all SIDs.	See note 2	NATS	None noted
B4	Provide any details of issues associated with vectoring of non-RNAV 1 departures resulting in an MOR.	See note 2	NATS	No MORs were attributed to this scenario
B5	Provide any details of issues associated with vectoring of Rwy 09 non-RNAV 1 arrivals when turning aircraft onto base leg / final approach at TODBI resulting in an MOR.	See note 2	NATS	No MORs were attributed to this scenario
B6	Provide details of any issues with aircraft not being able to establish on the Rwy 09 ILS following the turn at ODLEG resulting in an MOR.	See note 2	NATS	No MORs were attributed to this scenario
B7	Provide any details of any inadvertent penetration of the London Heathrow CTR by traffic using the ODLEG arrival transition which fail to take the turn at TODBI resulting in an MOR and what subsequent action was taken.	See note 2	NATS	No MORs were attributed to this scenario
B8	Advise of RNAV 1 usage: 4 Feb 16, 4 May 16, 4 Aug 16, 4 Nov 16, 4 Feb 17	LAMP Sponsors are to provide quarterly updates as in Col 2.	LCAL	See evidence filename: B8 B9 B10 Data, Commentary

Source Material	Data Required	Remarks	Responsibility	Evidence
B9	The % of RNAV 1 / non-RNAV1 using each SID.	This is to be provided by analysing airport records of SID allocation.	LCAL	See evidence filename: B8 B9 B10 Data, Commentary
B10	The % of RNAV1 aircraft using the RNAV arrival transitions.	Flight plan data is to be analysed to identify flights filing on the transitions. NB: Track dispersion plots will need to show non-RNAV flights as well as RNAV	NATS for flight plan data	See evidence filenames: B8 B9 B10 Data, Commentary B10 B14 Commentary See folder of track plots: B10 Arrival transitions
B11	Any issues of RNAV1 traffic using the BPK/CPT SIDs not making the turn at LCN05 resulting in an MOR.	See note 2	NATS	No MORs were attributed to this scenario
B12	Details of any database coding issues and action taken to resolve.	See note 2	NATS	Coding issues arose on implementation that were not discovered during the live checks completed as per the CAA requirement to be carried out during the 10 days before the change. One airline discovered that the LAMP RNAV transitions had been linked to the STARs, but that their FMS could not cope with a “STAR followed by STAR”. The operator worked with the Coding Houses to rectify this and the problem was resolved in the first few weeks – the issue was raised immediately with the IFP team at CAA. The subject was raised through the LOCP (Lead Operator and Carrier Panel) meetings and its technical sub-group (attended by LAMP Case Officer) to highlight the required lessons learned for all parties. There was an instance of a coding house deciding to impose its own naming code for RNAV transitions to Biggin Hill, renaming the LAVNO and ODLEG transitions as JACKO and GODLU. This was flagged up in the live checking and coding houses advised accordingly to correct their charts. Again, the IFP team at CAA were advised of this. Following resolution of these issues during the first few weeks of implementation, there has been no recurrence of any associated problems.

Source Material	Data Required	Remarks	Responsibility	Evidence
B13	Any issues of inadvertent penetration of Southend CAS by traffic arriving into EGLC or departing from EGLC resulting in an MOR.	See note 2	NATS	No MORs were attributed to this scenario
B14	Monthly track dispersion plots of all London City conventional SIDs before the change are required for each SID, together with the new RNAV SIDs showing altitudes in 1000ft level bands on both conventional and RNAV track dispersion diagrams post change to illustrate monthly analysis carried out by London City Airport to determine whether the impacts on traffic patterns arising from the change have been as predicted as shown in consultation, both from an operational and environmental perspective. In particular, track keeping around the first turns should be monitored on a monthly basis to determine if the impacts are as portrayed in consultation. The track dispersion plots must be comparable with the diagrams shown in the consultation document to enable a direct like-for-like comparison. There must be explanation to illustrate when/where radar vectoring has occurred to enable stakeholders to understand any deviation away from the nominal track of the SID design that may be a result of radar vectoring as and where this occurs. Track dispersion diagrams must illustrate the Rwy in use, SID designator and the number of aircraft in the relevant traffic sample to enable a like-for-like comparison between the conventional SIDs and RNAV SIDs.	When providing RNAV track dispersion diagrams to illustrate RNAV impacts, please add suitable comments on diagrams to explain differentiation between the impacts of RNAV track dispersion and radar vectoring. Any track plots showing deviations away from the nominal track need to be explained, whether it is a result of 'direct to' instructions by ATC or tactical vectoring. Also, any unusual deviations away from the expected track arising from the effects of high winds, or otherwise, also need to be explained. If there are unusually high wind days, it is helpful from a flyability point of view to be able to show separately, impacts on these days. Action: LCAL		See evidence filename: B10 B14 Commentary See folder of track plots: B14 SIDs

Source Material	Data Required	Remarks	Responsibility	Evidence
	Details of the above monthly stats must be submitted to the CAA in the PIR data after 1 year of implementation. However, an initial first month snapshot is requested to provide an early indication of flight paths flown. Any changes in radar vectoring practices should be explained. Track dispersion data plots should be provided on separate diagrams to illustrate pre- airspace change track dispersion, and post airspace change track dispersion to illustrate both RNAV1 and non-RNAV1 traffic. (This is to enable explanation of differences between traffic patterns after the change).			
B15	The sponsor should keep local reaction to the airspace change below 7000ft under review, and complete an annual summary of issues arising. Sponsors are requested to advise the CAA Airspace Regulation Consultation regulator with an initial summary of any feedback by 30 June 2016.	LAMP sponsors are to provide a summary of stakeholder reaction.	LCAL and NATS as appropriate	See LCAL-supplied evidence items, filenames: B15 LAMP Localised Complaints B15 Final Complaints Submission NATS evidence supplied under Bridge-Comms-Complaints
B16	Provide details of any level busts associated with the RNAV SID replications.	See note 2	NATS MM	No MORs were attributed to this scenario
Module B ENV B1	Sponsor to provide sufficient data to confirm that there have been no changes to Leq noise contours as a result of the airspace change, or alternatively to illustrate any changes to the contours. The sponsor may provide post-implementation contours for direct compassion with pre-impleme-ntation contours, or provide sufficient evidence that support any rationale that Leq contours are unchanged and do not need to	If not producing Leqs state why.	LCAL to provide Leq contours or appropriate rationale if otherwise	See evidence filename: B-Env1-Leq Argument is that flights do not change path noticeably within the extent of the contour, therefore there would be no change to the contour itself due to the implementation of the RNAV1 flight procedures.

Source Material	Data Required	Remarks	Responsibility	Evidence
	be produced. Such evidence is likely to include a comparison of lateral and vertical aircraft tracks (both pre- and post-implementation).			
ENV B2	In addition to the requested operational track diagrams, the sponsor to re-perform any noise assessment that was reflected in the consultation or proposal documents, to reflect post-implementation data. This includes any swathes, altitude bands, anticipated noise levels and frequency of flights that were used to portray the expected noise impact.	See note 3.	NATS and airport	Track plot data supplied for B10 & B14 will be that evidence. See evidence filenames: B10 B14 Commentary
ENV B3	Sponsor to provide an assessment of the impact upon CO_2 emissions as a result of the airspace change, using the same methodology as the consultation and proposals, but updated as required using actual post-implementation data (e.g. to replace or update any assumptions used, to use actual track profiles and actual track mileages. The emissions assessment must be consistent with the pattern of traffic reflected in any associated track diagrams provided for the PIR.	See note 4.	NATS and airport	See Bridging Module files: Bridge-Fuel-CO2-Analysis Bridge-Population-Overview-Analysis
ENV B4	Sponsor to provide sufficient data/rationale to support any claimed environmental impacts (positive, negative or neutral) made in consultation or proposal documents (e.g. Local Air Quality, tranquillity, visual intrusion etc.)	See note 5.	NATS and airport	Track plot data supplied for B10 and B14 will be that evidence. See evidence filenames: B10 B14 Commentary
Module C Decision Document LONDON CITY PM	1. Provide any details of occurrences of traffic using the GEGMU and GODLU STARs resulting in inadvertent penetration of D037 resulting in an MOR, together with action taken to prevent any further occurrence. NIL returns required.	See note 2	NATS	No MORs were attributed to this scenario

Source Material	Data Required	Remarks	Responsibility	Evidence
	2. See note 2. Provide any details of occurrences of traffic using the GODLU Hold resulting in inadvertent penetration of the Paris FIR, together with action taken to prevent any further occurrence resulting in an MOR. NIL returns required.	See note 2	NATS	No MORs were attributed to this scenario
	3. See note 2. Provide any details of occurrences of traffic using the ROPMU Hold leaving controlled airspace resulting in an MOR, together with action taken to prevent any further occurrence. NIL returns required.	See note 2	NATS	No MORs were attributed to this scenario
	4. See note 2. Provide any details of occurrences of traffic in the ATPEV hold inadvertently entering the Shoeburyness Danger Areas resulting in an MOR, together with action taken to prevent any further occurrence. NIL returns required.	See note 2	NATS	No MORs were attributed to this scenario
	5. See note 2. Provide any details of occurrences of traffic using the OKVAP Hold resulting in inadvertent penetration of the Paris FIR resulting in an MOR, together with action taken to prevent any further occurrence. NIL returns required.	See note 2	NATS	No MORs were attributed to this scenario
	6. See note 2. Provide details of any flyability issues with aircraft using the arrival transition procedures between: JACKO-NONVA NONVA-BABKU ERKEK-OKVAP And the STAR between NEVIL-OSPOL.	See note 2	NATS	None known (see also B12)
	7. Review the climb and descent profiles of traffic utilisation in the lower limits of controlled airspace in the areas of controlled airspace identified in Module C Regulatory Requirement Serial 7 as discussed with NATS on 21 May 2015.	**Action by 31 August 2016.** This date is required to enable the CAA to review	NATS	Closed in August 2016

Source Material	Data Required	Remarks	Responsibility	Evidence
	NATS is to determine which areas of controlled airspace could be raised as a result of non-usage by GAT, and provide appropriate draft AIP changes for the areas concerned. NATS is also to advise the CAA of any the options identified for potential raising of controlled airspace which are not feasible and provide the appropriate rationale.	and approve any proposals in order to meet the ICAO Southern England 1:500,000 chart due for publication on 2 March 2017. Note: the AIS deadline for chart amendments is 31 October 2016.		
	8. In conjunction with No 7 above, NATS is to determine whether the lower limits of the LTMA may be raised in LTMA Sectors 3 and 8 as follows: -- LTMA Sector 3 (3500-FL195) situated south of the Southend CTA 7 and, -- The revised LTMA Sector 8 from the north coast of Kent to the boundary of the LTMA Sector 21/N859 eastern extremity taking due consideration of the new southern arrival segment of the London City arrival transition procedure.	**Action by 31 August 2016** This date is required to enable the CAA to review and approve any proposals in order to meet the ICAO Southern England 1:500,000 chart due for publication on 2 March 2017. Notes: 1. The AIS deadline for chart amendments is 31 October 2016. 2. In conjunction with Module E	NATS	Closed in August 2016
Module C Operational C1	Provide any details of EKNIV SIDs not being able to reach MSL by SODVU.	See note 2	NATS	None noted. No MORs were attributed to this scenario
C2	Listed in Mod B.	Env Req		See Mod B
C3	Listed in Mod B.	See note 2	NATS	See Mod B
C4	Listed in Mod B.	See note 2	NATS	See Mod B
C5	Listed in Mod B.	See note 2	NATS	See Mod B

Source Material	Data Required	Remarks	Responsibility	Evidence
C6	Provide a summary of any unauthorised incursions into the new controlled airspace resulting in an MOR.	See note 2	NATS	None noted - No MORs were attributed to this scenario
C7	Provide details of any unusual holding patterns flown at the TIMBA RNAV hold. From an airline operational perspective, is the TIMBA RNAV hold being flown manually or via the FMS coding? Provide details of any issues which have impacted the FMS selection and/or flyability of the hold resulting in an MOR.	See note 2	NATS	None noted - No MORs were attributed to this scenario
C8	Provide details on any issues with the revised delegated ATS between LTC and Paris ACC in La Manche East Low.	See note 2	NATS	None noted - No MORs were attributed to this scenario
C9	Provide details of any issues with use of (U)L10 and the interface with Reims ACC.	See note 2	NATS	None noted - No MORs were attributed to this scenario
C10	Provide any details of excessive workload in vectoring non-RNAV 1 arrivals from either JACKO or GODLU inbound London City and Biggin Hill resulting in an MOR. (Nil returns required).	See note 2	NATS	None noted - No MORs were attributed to this scenario
C11	Provide track dispersion plot data of traffic in 1000ft level bands routeing from JACKO and GODLU to the LAVNO for Rwy 27 and ODLEG for Rwy 09 to illustrate the lowest levels flown.	See Note 3.	NATS and airports	See evidence filename: C11 Env-C1 Env-C2-Env-C4 Commentary See track plots folder: C11-PointMerge
C12	Provide details of any inadvertent entry into the Shoeburyness Danger Areas by traffic using the arrival transitions resulting in an MOR together with any subsequent action taken.	See note 2	NATS MM	No MORs were attributed to this scenario
C13	Provide details of the number of PAT alerts.	Determine with NATS how event data is gathered and processed, then confirm.	NATS to investigate available data	No PAT alerts resulted in safety incidents. See evidence filename: C13 PAT Alerts
C14	Details of any database coding issues that impacted ATC clearance delivery and/or operator selection of IFP and action taken to resolve.	See note 2	NATS MM	See item B12
C15	Are the Clearance Limit Points being monitored by ATC? Report any issues of where adherence of	See note 2	NATS MM	Clearance limit points are monitored by ATC. No MORs were attributed to this scenario

Source Material	Data Required	Remarks	Responsibility	Evidence
	the clearance limit points on the STARs has not occurred resulting in an MOR.			
C16	The sponsor should keep local reaction to the airspace change below 7000ft under review, and complete an annual summary of issues arising. Sponsors are requested to advise the CAA Airspace Regulation Consultation Regulator with an initial summary of any feedback by 30 June 2016.	Early snapshot to consultation regulator by 30 April 2016.	NATS	NATS evidence supplied under Bridge-Comms-Complaints
C17	Provide any details of occurrences of traffic failing to make the OSPOL waypoint when using the GODLU 1F and GEGMU 1G STARs due to the previous segment length resulting in an MOR. NIL returns required.	See note 2	NATS	No MORs were attributed to this scenario
C18	Provide any details of occurrences of traffic failing to make the AVANT waypoint when using the GEGMU 1N STAR due to the previous segment length resulting in an MOR. NIL returns required.	See note 2	NATS	No MORs were attributed to this scenario
C19	Provide any details of occurrences of traffic failing to make the OKVAP waypoint when using the GEGMU 1F STAR due to the previous segment length resulting in an MOR. NIL returns required.	See note 2	NATS	No MORs were attributed to this scenario
C20	Provide any details of occurrences of traffic failing to make the ABTUM waypoint when using the TIMBA 1J/1K STARs due to the previous segment length resulting in an MOR. NIL returns required.	See note 2	NATS	No MORs were attributed to this scenario
C21	Provide any details of occurrences of traffic failing to make the OSPOL waypoint when using the TIMBA 2G STAR due to the previous segment length resulting in an MOR. NIL returns required.	See note 2	NATS	No MORs were attributed to this scenario

Source Material	Data Required	Remarks	Responsibility	Evidence
C22	Provide any details of occurrences of traffic failing to make the EVEXU waypoint when using the SAM 2D STAR due to the previous segment length resulting in an MOR. NIL returns required.	See note 2	NATS	No MORs were attributed to this scenario
Module C ENV C1	In addition to the requested operational track diagrams, the sponsor to re-perform any noise assessment that was reflected in the consultation or proposal documents, to reflect post-implementation data. This includes any swathes, altitude bands, anticipated noise levels and frequency of flights that were used to portray the expected noise impact.	See note 3.	NATS & Airports	See evidence filename: C11 Env-C1 Env-C2-Env-C4 Commentary
ENV C2	Data regarding post-implementation traffic patterns over AONBs and National Parks to be provided, in order to support anticipated impacts set out in the consultation or proposal. Notably the following AONBs - Dedham Vale, Suffolk Coast & Heath, Kent Downs and High Weald.	See note 3.	NATS	See evidence filename: C-Env2-LC-AONB-Comparison-ArrsDeps
ENV C3	Sponsor to provide an assessment of the impact upon CO_2 emissions as a result of the airspace change, using the same methodology as the consultation and proposals, but updated as required using actual post-implementation data (e.g. to replace or update any assumptions used, to use actual track profiles and actual track mileages. The emissions assessment must be consistent with the pattern of traffic reflected in any associated track diagrams provided for the PIR.	See note 4.	NATS	See Bridging Module
ENV C4	Sponsor to provide sufficient data/rationale to support any claimed environmental impacts (positive, negative or neutral) made in consultation or proposal documents (e.g. Local Air Quality, tranquillity, visual intrusion etc.)	See note 5.	NATS	See evidence filename: C11 Env-C1 Env-C2-Env-C4 Commentary

Module D Decision Document **Luton/Northolt**	1. As per Module A 1.			
Module D Operational D1	Provide details of any sector overload associated with the Luton & Northolt DET SID switch resulting in an MOR.	See note 2	NATS	No issues noted – no MORs were specifically attributed to Luton/Northolt, for overload info see evidence filename Bridge-Safety-CONFIDENTIAL-MORs-LAMP-Related
D2	Provide the number of occasions when D138 is active above 13,000ft necessitating a re-route from M85 onto (U)M84 from 4 Feb 16-3 Feb 17.	NATS is to provide details of D138 activation but it is recognised that NATS may not be able to identify re-routes as a consequence; – NATS to investigate what is possible and provide detail as appropriate.	NATS	See evidence filename: D2-data-D138-use
D3	Provide number of flights regarding continued use of the DET SID for positioning flights or for traffic routeing via L10 to RINTI.	NATS is to produce a flight plan analysis.	NATS	See evidence filename: D3-data-D-Env2-D-Env3-commentary
Module D ENV D1	In addition to the requested operational track diagrams, the sponsor to re-perform any noise assessment that was reflected in the proposal documents, to reflect post-implementation data. This includes any swathes, altitude bands, anticipated noise levels and frequency of flights that were used to portray the expected noise impact.	See note 3.	NATS	Change occurred well along the track of the SIDs, generally FL100+, therefore no change to noise impacts below 7,000ft. This applies to both pre- and post-implementation.
ENV D2	Provide illustrations of vertical and lateral profiles that demonstrate traffic patterns between BPK and DET for departures from both Luton and Northolt. These should portray traffic patterns for comparative and representative periods, and should show a comparison between pre-implementation and post-implementation. Average tracks should be derived for both lateral	See note 3 and 4.	NATS	See evidence filename: D3-data-D-Env2-D-Env3-commentary See Bridging Module files: Bridge-Fuel-CO2-Analysis

	and vertical profiles and then used to model the fuel burn and CO_2 emissions, and then extrapolated to estimate an annual figure for the respective fleets at each airport.			
ENV D3	Provide data as evidence of the proportion of flights that benefit from the new routeing, i.e. the proportion of flights that achieve a profile that crosses above the Heathrow arrivals, both pre-implementation and post-implementation.	See note 3 and 4, this is to be achieved through the track plots analysis	NATS	Approx 32% of Luton DVR-bound deps moved from “below FL100” to “above FL150” which is above the majority of the Heathrow arrival flow in that area. See evidence filename: D3-data-D-Env2-D-Env3-commentary
ENV D4	Sponsor to provide an assessment of the impact upon CO_2 emissions as a result of the airspace change, using the same methodology as the proposals, but updated as required using actual post-implementation data (e.g. to replace or update any assumptions used, to use actual track profiles and actual track mileages. The emissions assessment must be consistent with the pattern of traffic reflected in any associated track diagrams provided for the PIR.	See note 4.	NATS	See Bridging Module files: Bridge-Fuel-CO2-Analysis
ENV D5	Sponsor to provide sufficient data/rationale to support any claimed environmental impacts (positive, negative or neutral) made in consultation or proposal documents (e.g. Local Air Quality, tranquillity, visual intrusion etc.)	See note 5.	NATS	None claimed

Module E Decision Document **Portsmouth CTAs, Southampton/ Bournemouth/ Farnborough arrivals.**	1. Provide any details of occurrences of traffic using the RUDMO Hold resulting in inadvertent penetration of D037 resulting in an MOR, together with action taken to prevent any further occurrence. NIL returns required.	See note 2	NATS	No issues noted – no MORs were attributed to this scenario
	As per Module C. 2. Review the climb and descent profiles of traffic utilisation in the lower limits of controlled airspace in the areas of controlled airspace identified in Module C Regulatory Requirement Serial 7 as discussed with NATS on 21 May 2015. NATS is to determine which areas of controlled airspace could be raised as a result of non usage by GAT, and provide appropriate draft AIP changes for the areas concerned. NATS is also to advise the CAA of any the options identified for potential raising of controlled airspace which are not feasible and provide the appropriate rationale.	**Action by 31 August 2016** This date is required to enable the CAA to review and approve any proposals in order to meet the ICAO Southern England 1:500,000 chart due for publication on 2 March 2017. Note: the AIS deadline for chart amendments is 31 October 2016.	NATS	Closed in August 2016
	As per Module C. 3. In conjunction with No 7 above, NATS is to determine whether the lower limits of the LTMA may be raised in LTMA Sectors 3 and 8 as follows: -- LTMA Sector 3 (3500-FL195) situated south of the Southend CTA 7 and, -- The revised LTMA Sector 8 from the north coast of Kent to the boundary of the LTMA Sector 21/N859 eastern extremity taking due consideration of the new southern arrival segment of the London City arrival transition procedure.	**Action by 31 August 2016** This date is required to enable the CAA to review and approve any proposals in order to meet the ICAO Southern England 1:500,000 chart due for publication on 2 March 2017. Notes: 1. The AIS deadline for chart amendments is 31 October 2016.	NATS	Closed in August 2016

		2. In conjunction with Module E		
	4. NATS is to investigate re-classification of the new Portsmouth CTAs 1 and 2 from Class A to Class C. Notwithstanding details provided to the CAA during the Case Study concerning reasons why NATS could not manage Class C operations immediately on implementation, NATS is to determine if these areas could be Class C rather than Class A as proposed. If a reversion to Class C is possible, NATS is to provide the CAA with a proposal to revert the Portsmouth CTAs to Class C airspace for implementation on 2 March 2017 meeting the appropriate AIRAC deadline for the AIP and ICAO 1:500,000 chart cycle (31 October 2017).	**Action by 31 August 2016** This date is required to enable the CAA to review and approve any proposals in order to meet the ICAO Southern England 1:500,000 chart due for publication on 2 March 2017. Note: the AIS deadline for chart amendments is 31 October 2016.	NATS	Closed in August 2016
	5. Provide a record of any instances where segregated VFR operations have been agreed in accordance with the Module E Regulatory Requirement No 5 together with any issues arising and what action was taken to resolve the issue.		NATS	None recorded

Module E Operational E1	Provide track dispersion plot data of traffic in 1000ft level bands routeing through the Portsmouth CTA 1 & 2 to illustrate the lowest levels flown for traffic inbound to Farnborough, and inbound to Bournemouth and Southampton as far as the IAF for the runway in use. Track dispersion plots for flights before the change and flights after the change should demonstrate the new flight paths flown to enable comparison with diagrams shown in consultation. Compare with Consultation Document Fig D 5 and D 6 (both pre change) and Figs D8 and D 9 (both post change) Data must be provided to illustrate a direct like-for-like traffic density for the changes below 7000ft before and after the change.	See note 3.	NATS	See evidence folder of track plots: E1-TrackPlots See evidence filename: E1-EnvE1-3-4-Track-Plot-Commentary
E2	Details of any database coding issues and action taken to resolve.	See note 2	NATS	None noted. No MORs were attributed to this scenario.
Module E ENV E1	In addition to the requested operational track diagrams, the sponsor to re-perform any noise assessment that was reflected in the consultation or proposal documents, to reflect post-implementation data. This includes any swathes, altitude bands, anticipated noise levels and frequency of flights that were used to portray the expected noise impact.	See note 3.	NATS	See evidence filename: E1-EnvE1-3-4-Track-Plot-Commentary
ENV E2	Sponsor to provide an assessment of the impact upon CO_2 emissions as a result of the airspace change, using the same methodology as the consultation and proposals, but updated as required using actual post-implementation data (e.g. to replace or update any assumptions used, to use actual track profiles and actual track mileages. The emissions assessment must be consistent with the pattern of traffic reflected in any associated track diagrams provided for the PIR.	See note 4.	NATS	See Bridging Module files: Bridge-Fuel-CO2-Analysis

ENV E3	Sponsor to provide sufficient data/rationale to support any claimed environmental impacts (positive, negative or neutral) made in consultation or proposal documents (e.g. Local Air Quality, tranquillity, visual intrusion etc.)	See note 5.	NATS	See evidence filename: E1-EnvE1-3-4-Track-Plot-Commentary
ENV E4	Data regarding post-implementation traffic patterns over AONBs and National Parks to be provided, in order to support anticipated impacts set out in the consultation or proposal, notably the Isle of Wight AONB.	See note 3.	NATS	See evidence filename: E1-EnvE1-3-4-Track-Plot-Commentary

Annex B - London City Airport Arrival and Departure Track Analysis Assessment

INTRODUCTION

1. To enable the CAA to conduct the PIR analysis, the sponsor provided traffic pattern plots for the traffic sample shown in consultation (a five-day period from 3 – 7 June 2013) and traffic samples throughout the first year of operation; these were various five-day periods during February, May, August and November of 2016. The traffic sample dates are shown below at paragraph 16.

2. NATS has provided a brief commentary to explain on how to review the documents. A summary of impacts for both arrivals and departures is shown at pages 2 and 3 respectively. It is recommended that readers first read the London City Airport (LCA) Consultation document, then the NATS commentary before reading this CAA analysis of the data provided. The following CAA analysis should then be read in conjunction with viewing the relevant diagrams provided via links in the analysis Tables 1 and 2.

3. The CAA believes that these traffic patterns are consistent with the traffic patterns throughout the year as it covers all four seasons; therefore, for the purposes of this analysis, for arrivals, the February 2016 example is representative of the full samples; for departures, we have analysed the samples relating to February 2016 and then compared that sample with the remaining 3 samples taken through 2016. It should be noted that during February 2016, Storm Imogen created some very strong winds from the southwest. Impacts of this are also shown in the analysis.

4. In this assessment, we refer to a number of diagrams supplied by NATS on behalf of London City Airport. These are:

Arrival procedures:

- Density key diagram.
- Track density plots from arrivals from 4000ft to touchdown for each runway.
- A track ‘whisker plot’ to show the impact of strong winds resulting in Runway 27 ‘go-arounds’

Departure procedures:

- Track Density diagrams for Runway 09 and Runway 27.
- Altitude bands in 1000ft intervals for Runway 09 and Runway 27 departures.
- Altitude bands from departure to 7000ft and 20,000ft for Runway 09 and Runway 27 departures.
- Track analysis in the Romford area.
- Strong winds affecting the Runway 27 Brookmans Park SID at the Woodford turn.

ABBREVIATIONS/TERMINOLOGY

5. In this analysis, we refer to a number of technical aspects relating to the design of the arrival and departure procedures; to aid understanding, we have attempted to explain these terms in a non- technical manner:

DER Departure End of Runway (normally the end of the physical length of the runway).

NM Nautical mile.

WP (FO = flyover) Waypoint (flyover means that the aircraft will fly over the position of the waypoint before turning to intercept the next segment of the procedure).

WP (FB = flyby) Waypoint (flyby means that the aircraft will anticipate the turn before the waypoint to allow tangential interception of the next segment of the procedure).

Path Terminator Is a set of defined codes, each of which defines a specific type of flight path and a specific type of termination of that flight path. Examples of these in the LCY Arrival and Departure Instrument Flight Procedures (IFPs) are course to fix (CF) and track to fix (TF).

6. The coding that is used within the Flight Management System (FMS) to capture the defined path and which is stored in the navigation data base is reflected through an Industry standard called ARINC Specification 424. The current version is ARINC 424-20, although earlier versions are still employed in many navigation data bases with varying functional capability. RNAV 1 defines a subset of functional blocks termed as 'Path Terminators' for use in the design of instrument flight procedures. In this way, all RNAV 1 qualified aircraft are capable of executing leg transitions and maintain tracks consistent with ARINC 424 path terminators. The required path terminators for RNAV 1 are:

    - Initial Fix (IF)
    - Track to Fix (TF)

- Course to Fix (CF)
- Course from a Fix to an Altitude (FA)
- Direct to a Fix (DF)
- Manual Termination (FM)

7. Although RNAV 1 defines the above Path Terminators, only a subset has been used in the designs for the London City RNAV 1 SIDs. Those used are described as follows:

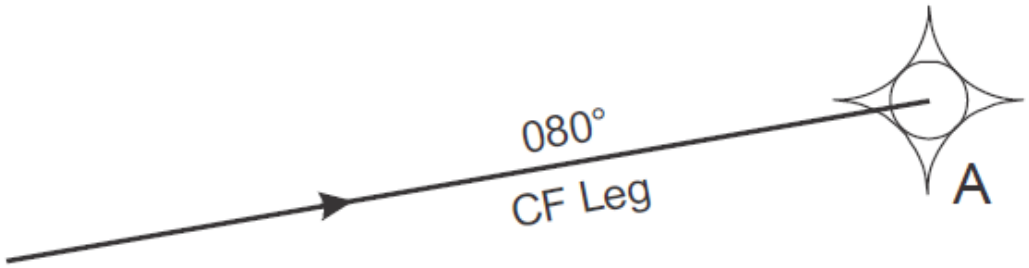
Track to Fix (TF)

A TF leg is defined as a geodesic path between two fixes (waypoints). It is the preferred leg type in RNAV Terminal Procedures that are not using ground based navaid references. The TF defines a great circle track over the ground between two known database fixes. The first fix is either the previous leg termination or an initial fix leg.

Track to Fix (TF) Leg

Path: Geodesic Path between A and B with Termination at Fix B

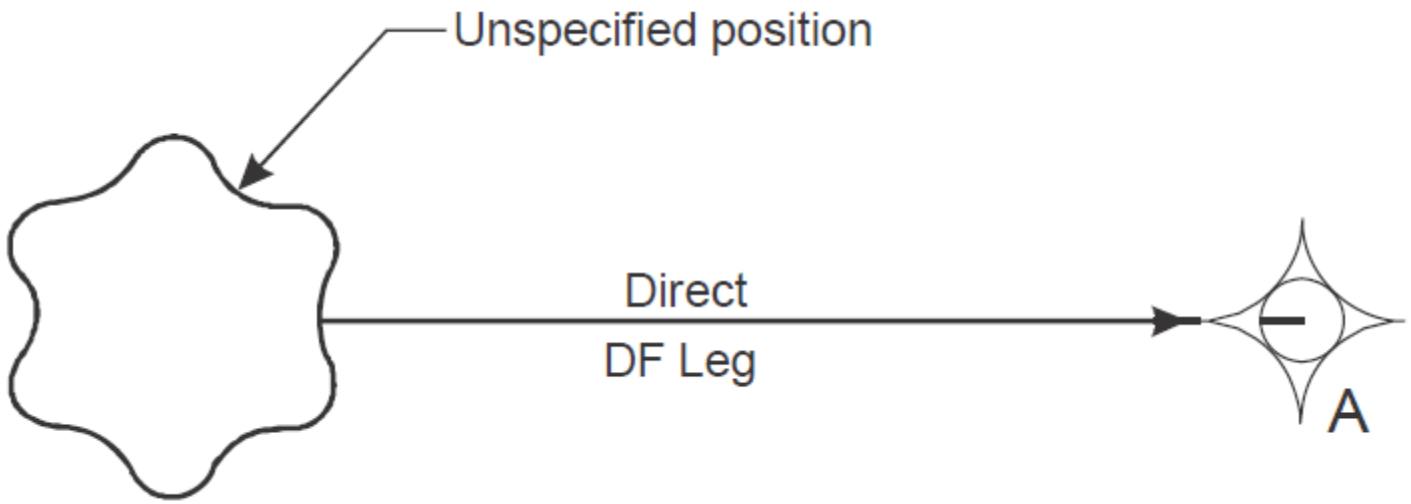
Course To Fix (CF) A CF leg is defined as a geodesic path that terminates at a fix with a specified course at that fix. The inbound course at the termination fix and the fix are provided by the navigation database.



Course to Fix (CF) Leg

Direct to a Fix (DF)

A DF leg defines an unspecified track starting from an undefined position to a defined fix. It is used to define a route segment from an unspecified position on the aircraft's present track to a specified fix or waypoint. A DF path terminator does not provide a predictable, repeatable flight path therefore it is effective in dispersing the flight tracks over the widest area. When a DF is used it ensures that the shortest track distance is flown from the unspecified position to the fix or waypoint.

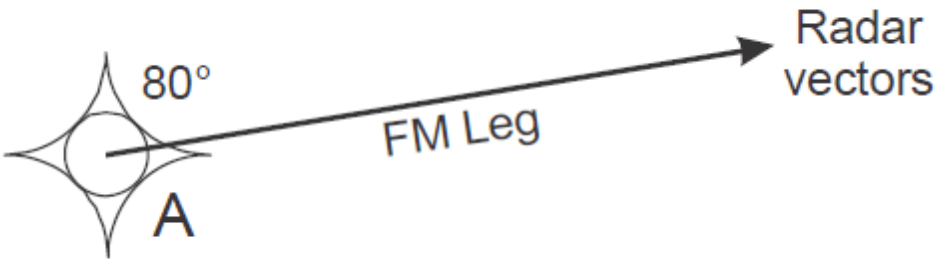


Direct to Fix (DF) Leg

Manual Termination

Course from a fix to a manual termination (FM)

An FM path terminator is used when a route segment is terminated for radar vectors. The aircraft continues on the prescribed heading until intervention by the pilot.



Course from a Fix to a Manual Termination (FM) Leg

Track Dispersion. Is where the flights tracks over the ground of a procedure are varied due to the use of path terminator, differing aircraft types, operator standard operating procedures (SOPs) and wind conditions as examples. Track dispersion tends to spread the noise over a wider area.

Track Concentration. Is where the tracks over the ground are concentrated on predictable flight tracks. Concentration of tracks can allow for noise sensitive areas to be avoided but it is not always possible to avoid all populated areas.

SID Nominal Track (NT).

The nominal track is the intended track to be flown when adhering to the speeds as shown on the procedure chart used by flight crews. The adherence to this published nominal track will vary in accordance with how the procedure has been designed to achieve either dispersion or concentration of flight tracks and external factors effecting aircraft ground speed e.g. wind conditions.

ILS

ILS is the abbreviation for the Instrument Landing System, which is the most commonly used precision approach aid in the world. It is known as a precision aid as it offers electronic guidance in both height in relation to the ideal approach path and also in azimuth in relation to the final approach track of the runway.

Airport / SID Designator: London City

Departures:	Runway 27:	BPK 1A, CPT 1A, CLN 1A, EKNIV 1A	Runway 09:	BPK 1H, CPT 1H, CLN 1H, EKNIV 1H
Arrivals:	Runway 27:	LAVNO 1J, LAVNO 1G	Runway 09:	ODLEG 1J, ODLEG1G

GUIDE TO INTERPRETING TRACK DISPERSION AND DENSITY DIAGRAMS

8. Attached to this document (via Links) are the track dispersion and density plots which have been provided by NATS on behalf of London City Airport (LCA). These are similar to and include diagrams which are identical to those shown in the LCA consultation document except that the technical production methodology has been upgraded, so there is a different colour tint to the diagrams in PIR data. The before and after track diagrams are therefore located in the same PDF documents which should facilitate ease of comparison for interested parties. To fully understand this review, readers will have to view the track dispersion diagrams which are associated with the descriptions of track dispersion, track density and altitude band diagrams.

9. The explanations of track distribution are described using references to locations shown on the diagrams to help to describe impacts of the RNAV 1 arrival and departure procedures. The departures include both RNAV1 replications of conventional SIDs and the new EKNIV SIDs for departures heading via EKNIV (approximately 5NM north of Detling) towards Lydd and points beyond to the south and west, and via EKNIV towards Dover for onward journeys to Europe.

10. The Adobe PDF diagrams may be expanded using the plus or minus function in the Adobe toolset to see more detail of the mapping, and by use of the down or up arrows, it is possible to see the immediate difference between the track over the ground flown by aircraft before the change compared with track over the ground flown following the change.

TRACK DISPERSION DIAGRAMS

11. Track dispersion diagrams portray each aircraft track on a map, based on radar data. Tracks are overlaid upon each other, such that if many tracks are overlaid on top of each other, individual tracks may no longer be visible. They are useful for illustrating the dispersion of the traffic pattern, but are not as useful for determining the density/concentration of tracks.

TRACK DENSITY DIAGRAMS

12. Track density diagrams portray the concentration of flight tracks using a colour code to indicate differing concentrations of flight tracks. They are sometimes referred to as “heat plot” diagrams. Whilst they can be used to illustrate traffic dispersion, they are most useful for illustrating if traffic is concentrated along a route or over a geographic location. Depending on the key used for portraying track concentration, individual tracks towards the outer limits of the dispersion may not be visible on the diagram.

TRAFFIC SAMPLES AND DIAGRAM INTERPRETATION

13. The traffic samples used for the PIR analysis reflect the sample portrayed in the consultation document in June 2013, followed by four samples during 2016 – February, May, August and November all of which are five day plots. Of note was Storm Imogen during February 2016 which had some impacts on operations during the period of 7-8 February, resulting in strong winds of 30kts with gusts of 45kts from the southwest. A separate slide illustrates the impact which resulted in a number of ‘go-arounds’ for arrival traffic when the crew has discontinued the approach to Runway 27 due to the effects of the wind on the final approach. This is described in the Runway 27 analysis at Table 2.

14. We have not completed a separate analysis for Biggin Hill traffic as this traffic follows the London City runway 09 arrival procedure as far as OSVEV, then joins the Runway 20 ILS approach at Biggin Hill.

15. In the NATS commentary pack (Link: **B02**), at page 4, NATS describe the nature of radar vectoring traffic off the SID procedure. For these flights, **including tactical shortcuts over Romford, c**ontrollers state that flights using the SIDs follow them well, unless tactically instructed. Off-SID flights are generally manually vectored due to conflictions with Southend or Biggin Hill traffic, or are non-RNAV1 and either following the pre-implementation SIDs or being manually vectored. See file B14-Whisker-Multi-Romford Link **B35-B14**: Pre-implementation, a band of flights was tactically routed across central Romford. Post-implementation, there was a c.80% reduction in the number of flights tactically routed across the same area. We have not conducted a separate analysis however, the reduction in overflight of Romford has been noted.

16. The traffic sample periods are:

Month, Year, Runway dir	Num Deps	Num Arrs	Specific Dates
Jun 2013 E	681	687	03-07 Jun
Jun 2013 W	672	669	24-28 Jun
Feb 2016 E	442	439	12-13+26-28 Feb
Feb 2016 W	633	650	07-11 Feb
May 2016 E	619	604	10-14 May
May 2016 W	634	637	17-21 May
Aug 2016 E	595	584	15-18+27 Aug
Aug 2016 W	590	593	09-13 Aug
Nov 2016 E	664	663	23-25+27-28 Nov
Nov 2016 W	633	633	15-19 Nov

17. Each diagram portrays a coloured density plot. The key to the density plots should be read before viewing the diagrams to enable readers to understand the varying traffic conditions. Link: **B01**

CONCLUSIONS FROM TRACK ANALYSIS

18. In broad terms, the traffic patterns (in terms of lateral and vertical profile, and dispersion and concentration) are as expected and therefore are consistent with the impacts anticipated by the CAA. The specific detail of our review on each arrival and departure route are reflected in the Tables 1 and 2 in this report.

19. However, we have identified three instances within the departure route segments where the traffic patterns following the implementation of the airspace change are not entirely as expected. These are outlined in detail below. In each case we have concluded that the impacts are consistent with the anticipated impacts.

(1) Runway 09 CLN Departures, Segment 3

The main concentration of the 2016 traffic diverges northwards of the anticipated concentration of traffic from the vicinity of Eastbrookend Country Park. From that location, the northerly concentration (which represents the aircraft flying CLN SID) continues north-eastwards, but

also continues to be situated north of where the concentration was expected (based upon the illustration of the forecast shaded dots on the diagrams). The degree of difference in this positioning will not result in a significant difference in noise impact between what was anticipated and what has been achieved.

Based upon the colour key for the density of the traffic pattern, the red/orange colour indicates that there are between 10-20 aircraft per day on average on this route.

It is also worth noting that the post-implementation concentrated traffic pattern for the CLN departures in this segment of the CLN SID is above locations that were already overflown before the airspace change, but to a lesser extent.

The whisker plots for both 2013 and 2016 indicate that the traffic at that location is between 2000ft-5000ft, and most typically 3000ft-4000ft. The location is beyond the airport's 57 Leq dBA contour, so any noise impacts would not be deemed to be significant.

In addition, based on the elevation angle of 48.5^{o} advocated in the CAA's Definition of Overflight (CAP 1498), the general heights of aircraft beyond Eastbrookend Country Park and an approximate lateral distance of 1km between the anticipated concentration and the actual CLN concentration, the fact that Segment 3 concentration is not exactly where is was anticipated will not have a significantly different impact than what was expected. Namely, in terms “overflight”, a location beneath the anticipated concentrated traffic pattern and a location beneath the actual 2016 concentrated traffic pattern would be considered equally “overflown”.

However, the population located to the north of the 2016 concentrated traffic (i.e. towards Romford) may perceive to be overflown more often than if the forecast concentred traffic pattern had been achieved.

On balance, we can conclude that the impacts are consistent with the anticipated impacts.

(2) Runway 09 DVR/EKNIV Departures, Segment 3

The main concentration of the 2016 traffic is slightly south (approximately 500m) of the anticipated concentration of traffic from the vicinity of Eastbrookend Country Park. From that location, the southerly concentration (which represents the EKNIV SID) continues north-eastwards, but also continues to be situated south of where the concentration was expected (based upon the illustration of the forecast black dots on the diagrams). The degree of difference in this positioning is unlikely to result in a notable difference in noise impact. In terms of noise impact, this will mean that some people beneath the 2016 concentration in that location are likely to be directly overflown more than anticipated, but it will also mean that the location to the north (i.e. where the black dots were located) is directly overflown less often than anticipated.

The whisker plots for both 2013 and 2016 indicate that the traffic at that location is between 2000ft-5000ft, and most typically 3000ft-4000ft. The location is beyond the airport's 57 Leq dBA contour, so any noise impacts would not be deemed to be significant. In addition, based on the elevation angle of 48.5^{o} advocated in the CAA's definition of Overflight (CAP 1498), the general heights of aircraft beyond Eastbrookend Country Park and an approximate lateral distance of 500m between the anticipated concentration and the actual CLN concentration, the fact that Segment 3 concentration is not exactly where is was anticipated is unlikely to have a discernible impact. On that basis, we can conclude that the impacts are consistent with the anticipated impacts.

(3) Runway 27 BPK/CLN/EKNIV Departures, Segment 2

The concentrated swathe of traffic (represented by the purple colour on the density plots) has slightly widened (by approximately 350-500m) in the 2016 traffic samples when compared with the 2013 sample. In our Decision Document (Para 63) we stated that there was a likelihood of greater concentration after the first turn than was previously the case and that the effects may be slightly different to the black dots shown in consultation diagrams but that this could only be confirmed after the procedures were flown. We also anticipated that track dispersion around the first turn would be very similar to that experienced from aircraft flying the conventional SIDs, and thereafter, aircraft would be more concentrated along the nominal track of the SID,

The black dots were used by the sponsor to illustrate the expected degree of concentration that would result for the airspace change.

The general reduction in the dispersion of the tracks in this segment (as anticipated from the consultation) means that, as anticipated, fewer residents are being directly overflown by these departures. The concentrated swathe in 2016, (i.e. the purple colour density band) whilst becoming slightly wider than anticipated, is nonetheless still consistent with the expected outcome of the change (i.e. a general greater concentration of traffic centred on the shaded dots) and is unlikely to result in a noise impact that is significantly different from expectations.

We would note that the traffic samples also include aircraft still flying the conventional SIDs and we believe that this may also explain why there is perhaps a slightly wider ‘bulge’ in the concentrated pattern

The whisker plots for both 2013 and 2016 indicate that the traffic at that location is between 1000ft-4000ft, and most typically 2000ft-3000ft. The segment is beyond the airport's 57 Leq dBA contour, so any noise impacts would not be deemed to be significant.

GUIDE TO OUR ASSESSMENT OF THE LONDON CITY RNAV ARRIVAL PROCEDURES

21. In Table 1, we are showing our assessment of the new RNAV arrival procedures.

- Column 1 shows the **CAA Web Link** to the relevant diagram, the document title and the name of the AIP chart arrival procedure.

- Column 2 describes the relevant segment of the arrival procedure, with an approximate geographical description together with the RNAV waypoints.

- Column 3 shows the design path terminator used in the design.

- Column 4 describes the traffic pattern before the change and the forecast traffic pattern (in blue) and whether dispersion or concentration was expected.

- Column 5 is a qualitative description of the traffic pattern and track-keeping of the new arrival procedure and a comparison with radar vectoring before the change.

- Column 6 describes a vertical profile comparison of the new arrival procedure (traffic pattern) and comparison with radar vectoring before the change.

- Column 7 indicates whether the expected track-keeping has been achieved.

- Column 8 indicates whether the arrival procedure is being flown correctly by operators and whether the design is acceptable.

22. The PIR analysis team has compared the impact of the new arrival procedures below 4000ft amsl with the traffic patterns achieved with radar vectoring before the change using the four traffic samples of 2016. In Table 1, we indicate the characteristics of the RNAV track dispersion as a result of the RNAV designs and whether the anticipated impact has been realised.

23. For analysis purposes, we have divided the analysis of the track dispersion of the RNAV arrival procedures into segments. We are using approximate locations which are visible on the map to aid readers understand our analysis.

Runway 09 segments:

- Segment 1 (upwind/downwind) is from a position southeast of Dartford to Streatham, i.e. the downwind track which enables aircraft to be descended to 2000ft amsl, reduce speed to allow the turn on to the base leg segment prior to establishing on final approach.

- Segment 2 (base leg) is from Streatham to Tower Bridge which encompasses the turn from the westbound downwind track onto the final approach track the turn from the downwind track onto the base leg and the turn onto the final approach track.

- Segment 3 (final approach) is from Tower Bridge to touchdown and is included for reference only as this segment / phase covers the instrument approach procedures (the ILS approach) which is unchanged.

Runway 27 segments:

- Segment 1 is described as the area to the north of the extended runway centreline extending from the London Gateway Port on the River Thames to touchdown

- Segment 2 is described as the area to the south of the extended runway centreline extending from the London Gateway Port on the River Thames to touchdown

- Segment 3 (straight in-final approach) is the runway centreline from the London Gateway Port on the River Thames to touchdown and covers the instrument approach procedures (the ILS approach) which is unchanged.

Table 1- CAA Track Analysis of the London City Arrival Procedures

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of arrival procedure & Waypoints** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change** **And in Blue Text:** **Forecast Track Keeping Performance (Dispersion or Concentration) - these comments are a description of what the sponsor expected the traffic pattern to be).** **(4)**	**Qualitative description of the track-keeping of the new RNAV arrival procedure (traffic pattern) & comparison with radar vectoring.** **(5)**	**Vertical Profile Description – comparison of new RNAV procedure compared with radar vectoring** **(6)**	**Track-keeping Achieved?** **(7)**	**Arrival procedure flown correctly by operators. If no provide details Is the technical design acceptable (Yes/No)** **(8)**
B05 **B10 E Arr 40-00** **Runway 09 arrivals** **ODLEG 1G 1J AD 2-EGLC-7-14 AIP Chart** **C03** **C04** **C05** **C06** **C07**	**Segment 1** **Upwind/downwind** **OSVEV- LCS01-LCS02-TODBI** From a position southeast of Dartford - Intersection of the A 2 and the B255 (east of J2 of the M25) to Streatham	**TF**	**Slide 1: Rwy 09 Sample 3-7 Jun 2013** Prior to the change, before entering vicinity of LCA as shown in these diagrams, for Runway 09 arrivals, aircraft were radar vectored by ATC from different directions – from the north of the aerodrome and from many directions ranging clockwise all the way round to the south. The majority of aircraft from the north were vectored over Romford, past Dagenham and then turned downwind right hand in the vicinity of Erith. When traffic conditions permitted, some aircraft (but not many) were vectored left hand downwind passing overhead Wanstead and Walthamstow, before being turned onto a base leg in the vicinity of Finsbury Park and then on to final approach for landing. Aircraft from the northeast, east, and south east were vectored towards the vicinity of Dartford. Some aircraft are vectored from the south and do not join the downwind track until passing the Chislehurst area. The normal track for aircraft to proceed downwind to the west of LCA (which	**Slide 2: Rwy 09 Sample 12-13 & 26-28 Feb 2016** With the introduction of the point merge arrival procedure, aircraft vectoring practice has noticeably changed, as aircraft are now predominately following the RNAV arrival transition prior to entering the traffic pattern at 4000ft and below as shown on this diagram. The majority of aircraft are established on the arrival flightpath by Dartford. There is a more evident concentration in traffic as aircraft fly downwind past Dartford, Sidcup, Catford and Dulwich Village which is illustrated by the much-reduced purple band which follows the shaded dots. There are a number of aircraft which appear displaced from this narrower band (the lighter grey coloured tracks). These will most certainly be aircraft being radar vectored by ATC (or non-RNAV1 equipped aircraft) or potentially those aircraft which have been given more direct routeings by ATC when light traffic conditions prevail, or it could also be due to weather avoidance manoeuvres. The yellow/orange coloured band either side of the main concentration could still be associated with aircraft	The design is such that aircraft should reach 3000ft by OSVEV, and 2000ft by passing south of LCA to ensure separation from Heathrow traffic, and therefore there is no noticeable change in altitude with arriving traffic. Aircraft are reaching OSVEV in the 5-4000ft band, 4-3000ft band 3-2000ft band. They are all reaching 2000ft by midway betweenLCS01 and LCS02.	**Yes.** **The traffic pattern is as expected.** The objective of the design has been achieved.	**Yes** For clarification: While this procedure is being flown by the operators as intended, the initial introduction of the procedure caused confusion to operators due to the coding of the procedures in various aircraft navigation databases. This issue was rectified by ensuring the procedures

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of arrival procedure & Waypoints** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change** **And in Blue Text:** **Forecast Track Keeping Performance (Dispersion or Concentration) - these comments are a description of what the sponsor expected the traffic pattern to be).** **(4)**	**Qualitative description of the track-keeping of the new RNAV arrival procedure (traffic pattern) & comparison with radar vectoring.** **(5)**	**Vertical Profile Description – comparison of new RNAV procedure compared with radar vectoring** **(6)**	**Track-keeping Achieved?** **(7)**	**Arrival procedure flown correctly by operators. If no provide details Is the technical design acceptable (Yes/No)** **(8)**
			enables aircraft to position onto a base leg before commencing the final approach to land), becomes an established widespread traffic pattern as aircraft cross the M25 Junction 2, and this traffic pattern extends across a band of approximately 3-4 km from Dartford -Sidcup-Catford-Dulwich Village, after which aircraft are vectored onto a base leg by ATC. There is a more concentrated, approximately 2KM wide band in the centre of this swathe which is where the predominate traffic flow exists. To illustrate the impacts of the change proposal and the introduction of the RNAV approach procedure, the sponsor forecast that most aircraft would be concentrated along the line of shaded dots (equivalent to the black dots in the consultation diagrams). The dots extend from the A2 east of Junction 2 of the M25 as far as Lambeth.	following the approach arrival procedure as this displacement is within navigation tolerances, or it could be a result of vectoring by ATC. There are a very small number of aircraft flying the left hand downwind pattern, or the previously radar vectored pattern from the north which is a noticeable change to the arrival flow prior to the change. This has therefore reduced overflight by arriving traffic over a large number of communities to the north, north east, east and south east of LCA in the area shown in these diagrams. The traffic pattern shown on this segment is representative of the forecast traffic pattern shown in consultation, and it is also what we would expect to see from the design.			were treated as an "Approach transition" for FMS coding purposes. As part of the PIR the "Transition Arrival" charts will need to be renamed as "Approach transition" by the procedure sponsor.
	Segment 2 **Base leg** **TODBI-ODLEG** From Streatham to Tower Bridge	**TF & FM (after turn at ODLEG)**	**Slide 1: Rwy 09 Sample 3-7 Jun 2013** After Dulwich Village, aircraft follow radar vectoring by ATC over Brixton, and then ATC turn the aircraft onto the final approach track to intercept the ILS for the approach to land. There is a wide traffic pattern extending approximately 3-4KM from east to west with the main concentration in a swathe of approximately 1.5KM wide as aircraft pass over Lambeth. At approximately Lambeth Bridge, ATC turn	**CLN Rwy 09 Segment 3 in Column 7, we stated the displacement**	All aircraft must be at 2000ft before passing south of LCA which is well before commencing the turn onto base leg.	**Yes.** **The traffic pattern is as expected.** The objective of the design	**Yes** The terminating leg of segment 2 has a fix to

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of arrival procedure & Waypoints** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change** **And in Blue Text:** **Forecast Track Keeping Performance (Dispersion or Concentration) - these comments are a description of what the sponsor expected the traffic pattern to be).** **(4)**	**Qualitative description of the track-keeping of the new RNAV arrival procedure (traffic pattern) & comparison with radar vectoring.** **(5)**	**Vertical Profile Description – comparison of new RNAV procedure compared with radar vectoring** **(6)**	**Track-keeping Achieved?** **(7)**	**Arrival procedure flown correctly by operators. If no provide details Is the technical design acceptable (Yes/No)** **(8)**
			aircraft onto final approach which is when the aircraft will intercept the ILS final approach track. As aircraft complete this turn, a wide spread pattern around the turn is evident, but this becomes more concentrated as aircraft converge onto the runway centreline with the majority of aircraft being established on final approach (the ILS procedure) by Tower Bridge. To illustrate the impacts of the change proposal and the introduction of the RNAV approach procedure, the sponsor forecast that aircraft would be concentrated along the line of shaded dots (equivalent to the black dots in the consultation diagrams) which continue from Dulwich village to the white dot at Lambeth. After Lambeth, it was forecast that there would be some variation in the traffic pattern as aircraft turn onto final approach but it would be similar to that experienced before the change.		There is therefore no change to vertical profiles on this segment.	has been achieved.	manual termination (FM) path terminator seen in the AIP published coding tables. Due to FMS coding constraints, many coding providers changed the coding from an FM to a CF path terminator. This CF is a course of 049° to the intermediate fix on the ILS. Therefore, when the aircraft reaches ODLEG it takes up a course of 049°M to intercept the ILS localiser as cleared by ATC earlier on the base leg.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of arrival procedure & Waypoints** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change** **And in Blue Text:** **Forecast Track Keeping Performance (Dispersion or Concentration) - these comments are a description of what the sponsor expected the traffic pattern to be).** **(4)**	**Qualitative description of the track-keeping of the new RNAV arrival procedure (traffic pattern) & comparison with radar vectoring.** **(5)**	**Vertical Profile Description – comparison of new RNAV procedure compared with radar vectoring** **(6)**	**Track-keeping Achieved?** **(7)**	**Arrival procedure flown correctly by operators. If no provide details Is the technical design acceptable (Yes/No)** **(8)**
							As the current standard practice by ATC is to clear pilots to establish on the ILS localiser before reaching ODLEG, this change of path terminator has had no impact on the track flown after passing ODLEG.
AIP Chart AD 2 EGLC 8-1	**Segment 3** **Final approach** From Tower Bridge to touchdown	**N/A**	**Slide 1: Rwy 09 Sample 3-7 Jun 2013** After passing Tower Bridge, aircraft fly a concentrated approach track along the centreline before landing. This is where aviation stakeholders would refer to as being 'established on the ILS', that is to say that the aircraft will follow the track guidance and signals transmitted by ground based instrument landing system which guide the aircraft to a point on the approach where the pilots become visual with the runway and continue visually to touchdown.	**Slide 2: Rwy 09 Sample 12-13 & 26-28 Feb 2016** After passing Tower Bridge, aircraft fly a concentrated approach track along the final approach track before landing. There is no noticeable change after Tower Bridge. This is because aircraft are flying the ILS approach procedure which is unchanged.	No change.	**No change.** **As expected.** The objective of the design has been achieved.	**Yes** Comments on the FM are placed in segment 2 above.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of arrival procedure & Waypoints** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change** **And in Blue Text:** **Forecast Track Keeping Performance (Dispersion or Concentration) - these comments are a description of what the sponsor expected the traffic pattern to be).** **(4)**	**Qualitative description of the track-keeping of the new RNAV arrival procedure (traffic pattern) & comparison with radar vectoring.** **(5)**	**Vertical Profile Description – comparison of new RNAV procedure compared with radar vectoring** **(6)**	**Track-keeping Achieved?** **(7)**	**Arrival procedure flown correctly by operators. If no provide details Is the technical design acceptable (Yes/No)** **(8)**
			With the change proposal, there was no reference made to the arrival profile after Tower Bridge. However, the CAA can advise that the track and vertical profile of the arriving traffic should not have changed after passing Tower Bridge.				
B06 **B10 W Arr 40-00** **Runway 27 arrivals** **LAVNO 1G 1J AD 2-EGLC-7-13 AIP Chart** **C09 C10**	**Segment 1** The area to the north of the extended runway centreline		**Slide 1: Rwy 27 Sample 24-28 Jun 2013** Prior to the change, before entering vicinity of LCA as shown in these diagrams, for Runway 27 arrivals, aircraft were radar vectored by ATC to establish on the runway extended centreline from different directions – from the north of the aerodrome and from many directions ranging clockwise all the way round to the south. In this segment, from the north, some aircraft were vectored over the vicinity of Romford, Hornchurch and Upminster towards the extended runway centreline, but the majority of aircraft from the north were vectored to the east of Upminster then turned towards the runway centreline to commence the final approach to Runway 27. Some aircraft (e.g. the tracks just east of Dagenham), were taken through the centreline and delayed to the south before being vectored back to final approach. This was referred to in consultation as the 'washing machine' scenario due to the lack of appropriate holding patterns as a result of	**Slide 2: Rwy 27 Sample 7-11 Feb 2016** From the north, the majority of arrivals have been re-routed to the point merge arrival procedure which results in aircraft being established on the extended centreline well out in the Thames Estuary towards the east. What is evident is that some aircraft have been given radar vectoring to establish on the extended runway centreline between Mucking Marshes as far west as Aveley, which is no change to what occurred before the airspace change; however these numbers of arrivals are minimal, but they will include any aircraft which have had to execute a 'missed approach – these events did occur during this traffic sample and such aircraft are evident from being re-positioned to the north of LCA overflying Romford to be re-positioned to re-commence a further approach. The traffic pattern to the north of the runway centreline only involves a small	**See diagram C10.** From below 4000ft, there is a significant reduction in traffic because of the revised flight path. Most aircraft have reached 4000ft when they have passed by Southend to the south. Aircraft are in the 4-3000ft band between the Isle of Grain and LAVNO (Rainham/Aveley). Aircraft are in the 3-2000ft band	**Yes.** The objective of the design has been achieved.	**Yes** For clarification: While this procedure is being flown by the operators as intended, the initial introduction of the procedure caused confusion to operators due to the coding of the procedures in various aircraft navigation databases. This issue was rectified by ensuring

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of arrival procedure & Waypoints** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change** **And in Blue Text:** **Forecast Track Keeping Performance (Dispersion or Concentration) - these comments are a description of what the sponsor expected the traffic pattern to be).** **(4)**	**Qualitative description of the track-keeping of the new RNAV arrival procedure (traffic pattern) & comparison with radar vectoring.** **(5)**	**Vertical Profile Description – comparison of new RNAV procedure compared with radar vectoring** **(6)**	**Track-keeping Achieved?** **(7)**	**Arrival procedure flown correctly by operators. If no provide details Is the technical design acceptable (Yes/No)** **(8)**
			congested airspace limitations, hence the tactical nature of the delaying and sequencing of traffic inbound to LCA in a variety of different patterns. Aircraft from the northeast and east were vectored from the vicinity of Southend towards the vicinity of Corringham / Stanford-le-hope and turned onto the runway centreline to commence the final approach. To illustrate the impacts of the change proposal and the introduction of the RNAV approach procedure, the sponsor forecast that aircraft would be concentrated along the line of shaded dots (equivalent to the black dots in the consultation diagrams). The dots extend from Mucking Marshes on the edge of the River Thames along the runway approach centreline to touchdown. This is where aviation stakeholders would refer to as being 'established on the ILS' that is to say that the aircraft will follow the track guidance and signals transmitted by ground based instrument landing system which guide the aircraft to touchdown.	number of flights, but overall, the majority of arrivals have been re-distributed away from this area resulting in fewer people being overflown by LCA arrivals which would have been as low as 3000ft amsl. This re-distribution of arrivals is a direct result of the change proposal and is what was expected.	after LAVNO (Rainham/Aveley). Whilst aircraft are on the runway centreline, there is no noticeable difference in vertical profile. Those areas overflown by arrivals before the change and which continue to be overflown after the change should therefore not be experiencing any changes to vertical profiles.		the procedures were treated as an "Approach transition" for FMS coding purposes. As part of the PIR the "Transition Arrival" charts will need to be renamed as "Approach transition" by the procedure sponsor.
	Segment 2 The area to the south of the		**Slide 1: Rwy 27 Sample 24-28 Jun 2013** The predominate traffic pattern from the south east enters the area in the vicinity of Junction 1 of the M 2 and heads towards	**Slide 2: Rwy 27 Sample 7-11 Feb 2016** From the south of the runway extended centreline, the majority of arrivals have been re-routed to the point merge arrival	**As above.**	**Yes.**	**Yes**

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of arrival procedure & Waypoints** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change** **And in Blue Text:** **Forecast Track Keeping Performance (Dispersion or Concentration) - these comments are a description of what the sponsor expected the traffic pattern to be).** **(4)**	**Qualitative description of the track-keeping of the new RNAV arrival procedure (traffic pattern) & comparison with radar vectoring.** **(5)**	**Vertical Profile Description – comparison of new RNAV procedure compared with radar vectoring** **(6)**	**Track-keeping Achieved?** **(7)**	**Arrival procedure flown correctly by operators. If no provide details Is the technical design acceptable (Yes/No)** **(8)**
	extended runway centreline.		Gravesend, passing Tilbury, Grays and Little Thurrock and are then turned onto the runway centreline to commence the final approach. There is a wide distribution of the arriving traffic in this traffic pattern due to the tactical vectoring. To illustrate the impacts of the change proposal and the introduction of the RNAV approach procedure, the sponsor forecast that aircraft would be concentrated along the line of shaded dots (equivalent to the black dots in the consultation diagrams). The dots extend from Mucking Marshes on the edge of the River Thames along the runway approach centreline to touchdown. This is where aviation stakeholders would refer to as being 'established on the ILS' that is to say, that the aircraft will follow the track guidance and signals transmitted by ground based instrument landing system which guides the aircraft to touchdown.	procedure which results in aircraft being established on the extended centreline well out in the Thames Estuary towards the east. What is evident is that some aircraft have been given radar vectoring from the south east to establish on the extended runway centreline between Mucking Marshes as far west as Aveley, which is no change to what occurred before the change, however these numbers of arrivals are minimal, but they may include some non-RNAV1 equipped aircraft which are radar vectored, or even RNAV 1 arrivals which are given a direct routeing when traffic conditions permit The traffic pattern to the south of the runway centreline only involves a small number of flights, but overall, the majority of arrivals have been re-distributed away from this area resulting in fewer people being overflown by LCA arrivals which would have been as low as 3000ft amsl. This re-distribution of arrivals is a direct result of the change proposal and is what was expected.		The objective of the design has been achieved.	
AIP Chart AD 2	**Segment 3** **Final approach**		**Slide 1: Rwy 27 Sample 24-28 Jun 2013** Aircraft have been radar vectored onto the extended runway centreline from as far out as Mucking Marshes to as close in as	**Slide 2: Rwy 27 Sample 7-11 Feb 2016** The traffic pattern for this segment is where	**As above.**	**Yes.**	**Yes**

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of arrival procedure & Waypoints** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change** **And in Blue Text:** **Forecast Track Keeping Performance (Dispersion or Concentration) - these comments are a description of what the sponsor expected the traffic pattern to be).** **(4)**	**Qualitative description of the track-keeping of the new RNAV arrival procedure (traffic pattern) & comparison with radar vectoring.** **(5)**	**Vertical Profile Description – comparison of new RNAV procedure compared with radar vectoring** **(6)**	**Track-keeping Achieved?** **(7)**	**Arrival procedure flown correctly by operators. If no provide details Is the technical design acceptable (Yes/No)** **(8)**
EGLC 8-4	The runway centreline from the London Gateway Port on the River Thames to touchdown.		Aveley (close to the Junction 30 of the M25). The majority of arrivals establish on the ILS (i.e. the extended runway centreline) between Thurrock and Junction 30 of the M25, and hence west of Thurrock, aircraft are concentrated on the final approach track as they make their approach to land. This is where aviation stakeholders would refer to as being 'established on the ILS' that is to say that the aircraft will follow the track guidance and signals transmitted by ground based instrument landing system which guide the aircraft to touchdown. With the change proposal, there was no reference made to the arrival profile after Thurrock. However, the CAA can advise that the track and vertical profile of the arriving traffic should not have changed after passing Thurrock.	Aircraft are established on the RNAV approach transition procedure which is along the extended runway approach centreline enabling aircraft to become 'established on the ILS approach to runway 27. By virtue of flight along the runway centreline, aircraft fly a concentrated flight path. After passing London Gateway Port, aircraft fly a concentrated approach track along the centreline before landing. There is a slight change to the position aircraft enter this segment as the majority of arrivals are already established on the runway centreline by virtue of the RNAV Arrival transition being aligned on the runway centreline well out in the Thames estuary. After London Gateway Port aircraft continue to fly along the runway centreline on the ILS approach procedure which is unchanged.		The objective of the design has been achieved.	

GUIDE TO OUR ASSESSMENT OF THE LONDON CITY RNAV DEPARTURE PROCEDURES

SID TRACK PLOTS

24. In Table 2, we are showing our assessment of the revised RNAV SID.

- Column 1 shows the **CAA Web Link** to the relevant diagram, the document title and the name of the AIP chart departure procedure.

- Column 2 describes the relevant segment of the SID design, with an approximate geographical description, together with the RNAV waypoints.

- Column 3 shows the design path terminator used in the design.

- Column 4 describes the traffic pattern before the change and the forecast traffic pattern (in blue) and whether dispersion or concentration was expected.

- Column 5 is a qualitative description of the traffic pattern and track-keeping of the new RNAV1 SID and a comparison with the conventional SID before the change.

- Column 6 describes a vertical profile comparison of the new SID and comparison with the conventional SID before the change.

- Column 7 indicates whether the expected track-keeping has been achieved.

- Column 8 indicates whether the arrival procedure is being flown correctly by operators and whether the design is acceptable.

DEPARTURE PROCEDURES TRACK ANALYSIS

24. In the Table 2 below, for analysis purposes, we have divided the analysis of the track dispersion of the modified RNAV SID design into a number of segments; this is shown in Column 2 and varies depending on the SID design.

25. For some departures, some dispersion around the turns is evident after departure, after which a more concentrated traffic pattern develops. In consultation, the sponsor illustrated the potential impact of concentration by showing a black dotted line to show the area where the sponsor considered that traffic would be concentrated. In the traffic samples for the PIR, the sponsor has shown the same

positioning of the dots; however, to aid interpretation, the dot intensity has been reduced so mapping features are visible through the shaded dots.

26. In Table 2 Column 6, the comparison is the basis on which we decide whether or not the RNAV SID has met its objective.

Table 2 – CAA Track Analysis of the London City Departure Procedures

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
B07 B14 E SID BPK 00-40 **Rwy 09 BPK** **AIP Chart AD 2 EGLC 6-6** **B15** **B16**	**Segment 1** DER-WP 1 (Flyover) (**LCE01**) (Take-off – straight ahead) segment to WP1 – the dot on the eastern river bank of the Thames (at Gallions Reach)	Course to Fix (CF)	**Slide 1:** Rwy 09 Sample 3-7 Jun 2013- 681 Deps from Rwy 09 not all on this SID) Departures climb straight ahead to the A2041 at Thamesmead and then commence the turn towards Brookmans Park ((BPK). the traffic pattern is concentrated along the runway centreline towards the east. The sponsor predicted a similar concentration of departures portrayed by the shaded dots.	**Slide 2** - Feb 2016. No discernible difference. **Slide 3** - May 2016. No discernible difference. **Slide 4** - Aug 2016. No discernible difference. **Slide 5** - Nov 2016. No discernible difference.	No change	**Yes** Traffic pattern is as expected in all 4 samples. The objective of the design has been achieved.	**Yes** The SID as published in the AIP is being flown as expected.
Rwy 09 BPK (cont)	**Segment 2** WP1 to WP2	Direct to Fix (DF)	**Slide 1:** Rwy 09 Sample 3-7 Jun 2013- 681 Deps from Rwy 09 not all on this SID)	**Slide / Sample 2 - Feb 2016**.	No change	**All Samples:**	**Yes**

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
B15 B16	**LCE01** to **LCN03** WP1 is FO WP2 is FB Turn to the north from the riverbank at Thamesmead to Gants Hill (A12 round-about)		At Thamesmead, aircraft commence the turn towards Gants Hill and pass over the areas of Barking and Ilford. The traffic pattern is concentrated along the shaded dots although there is some dispersion (approximately one KM wide) spread across the turn and the northbound track all away along this segment. The diagram also shows other departures heading towards the northeast which are described in the Clacton and EKNIV SIDs analysis. The sponsor forecast that the traffic pattern would be concentrated	The main core of concentrated traffic is almost similar, although there is a slight displacement to the west and the concentration is less dense than before the change. The dispersion is also slightly further expanded to the east (by a further one km) following the initial turn. The forecast concentration is slightly further west than the sponsor portrayed in consultation. **Slide / Sample 3 - May 2016.** The main core of concentrated traffic is almost similar, although there is a slight displacement to the west and the concentration is less dense than before the change. The dispersion is also slightly further expanded to the east (more so than in Feb 16) (by a further 1 - 1.5 km) following the initial turn. The forecast concentration is slightly further west than the sponsor portrayed in consultation. **Slide / Sample 4 - Aug 2016.** The main core of concentrated traffic is almost similar, although there is a slight displacement to the west and the concentration is less dense than before the change. The dispersion is also		The concentrated traffic pattern is slightly further west than the sponsor forecasted, as indicated by the dots in the consultation diagrams, and generally appears <u>less</u> concentrated than the 2013 traffic sample. **CAA Comment:** The traffic pattern is resulting in a slight reduction in concentration, a slight displacement of reduced concentration to the west, and a wider band of dispersion to the east. The slight displacement of the concentrated flight path is consistent with the dots shown in consultation. The dispersion to the east is as expected	The SID as published in the AIP is being flown as expected. The flight tracks being slightly to the west of those being produced by a/c cleared for the conventional SID is possibility due to the use of difference path terminators and even slightly different WP placements used within the “coded overlays” of the conventional SID, compared to those being used in the RNAV SID design. The dispersion to the east was not portrayed by the sponsor but we believe that this is a result of the SID design with the placement of WP LCN03 and the data base coding where a path

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
				slightly further expanded to the east (similar to May 16) following the initial turn. The forecast concentration is slightly further west than the sponsor portrayed in consultation. **Slide / Sample 5 - Nov 2016.** The main core of concentrated traffic is almost similar, although there is a slight displacement to the west and the concentration is less dense than before the change. The dispersion is also slightly further expanded to the east (by a further 1 km) following the initial turn. The forecast concentration is slightly further west than the sponsor portrayed in consultation.		(we referred to this in paragraph 64 of the decision document). Traffic pattern is as expected in all 4 samples. The objective of the design has been achieved.	terminator of a Direct to Fix has been used to LCN03.
Rwy 09 BPK (cont) **B08** E SIDs 00-70	**Segment 3** WP2- WP3- **LCN03 - BPK** Both FB Gants Hill – Brookmans Park	Track to Fix (TF)	Slide 1 Sample 3-7 Jun 2013 Departures are heading from Gants Hill in a narrow concentrated band towards Brookmans Park , and continue thereafter to the north although radar vectoring is evident either side of the concentration. The expectation was that there would be no significant variation in	There is no discernible difference in the traffic patterns both in terms of concentration and radar vectoring. This applies to all four 2016 samples.	No discernible difference on vertical profile of departures.	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved.	**Yes** The SID as published in the AIP is being flown as expected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
			track positioning or concentration above 4000ft.				
B09 **B14 E SID CLN 00-40** **Rwy 09 CLN + EKNIV**	**Segment 1** DER-WP 1 (Flyover) (**LCE01**) (Take-off – straight ahead) segment to WP1 – the dot on the eastern rover bank of the Thames (at Gallions Reach)	Course to Fix (CF)	**Slide 1:** Rwy 09 Sample 3-7 Jun 2013- 681 Deps from Rwy 09 not all on this SID) Departures climb straight ahead to the A2041 at Thamesmead and then commence the turn towards Brookmans Park ((BPK). the traffic pattern is concentrated along the runway centreline towards the east. The sponsor predicted a similar concentration of departures portrayed by the shaded dots.	**SAME AS BPK SID** **Slide 2** - Feb 2016. No discernible difference. **Slide 3** - May 2016. No discernible difference. **Slide 4** - Aug 2016. No discernible difference. **Slide 5** - Nov 2016. No discernible difference.	No change.	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved.	**Yes** The SID as published in the AIP is being flown as expected.
Rwy 09 CLN + EKNIV (cont) **AIP Chart AD 2 EGLC 6-7 & 6-4**	**Segment 2** WP1 to WP2 **LCE01** to **LCE02** WP1 is FO WP2 is FB Turn to the north from the riverbank	Course to Fix (CF)	**Slide 1** Rwy 09 Sample 3-7 Jun 2013- 681 Deps from Rwy 09 not all on this SID) At the A2041 at Thamesmead, aircraft commence the turn towards Eastbrooke (north east of Dagenham) and pass over the vicinity of Dagenham before making a right turn towards Hornchurch as aircraft pass the A1112. The traffic	**Slide / Sample 2 - Feb 2016**. The main core of concentrated traffic pattern in Segment 2 is reduced in width as far as Dagenham up to the turn at the A1112 towards Hornchurch. At the A1112, the concentrated traffic pattern continues around the turn as aircraft pass the Eastbrookend Country Park and then takes up two distinct flight paths in Segment 3 – one towards	Aircraft have to reach 3000ft amsl by LCE02 (no change to vertical profile.	**Yes** **All Samples:** The concentrated traffic pattern is very close to that forecast in consultation as illustrated by the shaded dots, except for the dot on the	**Yes** The EKNIV SID as published in the AIP is being flown as expected. In the CLN 1H, there is a discrepancy between the chart

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
	at Thamesmead to the A1112 at Eastbrooke		pattern is concentrated along the shaded dots although there is some dispersion either side of the main core spread across the northeast bound track all away along this segment. Before the turn at the A1112, there is a distinct dispersed traffic pattern (yellow density) spread across the Beam Valley Country Park to the south of the main core, and a small number of departures head towards Romford on the north side of the main core track. At Hornchurch, traffic splits to route to either follow the Clacton SID to the northeast, or initially to the east to follow the Dover and Lydd SIDs towards the south via Detling where there is a noticeable '3 pronged' split in the traffic pattern – this is covered in Segment 3. The diagram also shows other departures over Barking heading towards the north which are described in the Brookmans Park SIDs analysis. The sponsor forecast that the traffic pattern would be concentrated along the dotted line throughout this segment.	Clacton, and one towards the east following the newly established EKNIV SID which takes aircraft towards Kent for onward flight to Europe via Dover or to other destinations via Lydd. After passing the A1112, there is some dispersion towards the north towards Rush Green but not to the extent that existed prior to the change (see segment 3). **Slide / Sample 3 - May 2016.** Almost identical to Sample 2, except for a slight increase in density at Dagenham and Dock railway station and at the turn at the A1112. **Slide / Sample 4 - Aug 2016.** Almost identical to Sample 3. **Slide / Sample 5 - Nov 2016.** Almost identical to Sample 3.		northern riverbank of the Thames. Therefore, taking into account the full extremity of this segment, the impact of the design is consistent with anticipated traffic pattern in that, there is a more concentrated traffic pattern than existed prior to the change. **CAA Comment:** Traffic pattern, in the main, as expected. The objective of the design has been achieved.	and coding tables between LCE01 and LCE02 with regard to which path terminator is used in the design. The chart would indicate that a DF was used whereas the coding table shows that a CF was used. This will need to be investigated and the inconsistency corrected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
			From the diagram, the CAA would take this to imply that aircraft would follow a narrower flight path over the railway station on the A1112 at Dagenham and turn towards Hornchurch, therefore the expectation being that the spread of the traffic pattern would be reduced in width across the departure track as aircraft head towards the north east, thus the dispersion at the turn towards the northeast/east occurring at Eastbrooke would be reduced as depicted by the dots.				
Rwy 09 CLN (cont)	**Segment 3** WP2- WP3- **LCE02 – LCE05** Both FB A1112 at Eastbrooke to the M25 west of Great Warley	Track to Fix (TF)	Up to LCE02 (where aircraft cross the A1112), departures flying the Clacton and EKNIV SIDs have followed the same departure track. After crossing the A1112 at Eastbrooke, traffic follows 3 small distinct concentrated flows during the turn to the west of Hornchurch before heading towards the northeast and east. This is where the concentrated traffic patterns split and two distinct departure flows occur after Hornchurch - traffic patterns split with aircraft routeing towards Clacton to the northeast routeing north of Upminster, or initially to the east over the vicinity of Upminster to follow the Dover and Lydd SIDs which	**Slide / Sample 2 - Feb 2016**. The traffic pattern forms 2 main cores of concentrated flight paths in Segment 3. After crossing the A1112 north of the Dagenham East railway station, there is a concentrated traffic pattern which heads to the north of Hornchurch which continues around the turn as aircraft pass the Eastbrookend Country Park; the northerly traffic pattern (the Clacton SID) routes over Emerson Park and then heads towards LCE05 (Great Warley), the southerly traffic pattern (the EKNIV SID) flies over Hornchurch towards Upminster, then eastbound. **Note: The pictures are the same as the EKNIV SIDs.**	No discernible difference	**All Samples:** In segment 3, east of the A1112, the concentrated traffic pattern of the Clacton SID (the northerly of the two traffic patterns) is further north to that forecast in consultation by the shaded dots between the A1112 and Great Warley (shown as far as Hornchurch). **CAA Comment:**	**Yes** The SID as published in the AIP is being flown as expected. But as the WPs have not been included in the plots it is not clear where LCE02 is located in relation to the flight tracks after Dagenham. It does seem strange that with the use of FB WPs that the tracks should be to the

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
			subsequently turn towards the south to route via Detling. The more dominant southerly of the 3 traffic patterns is concentrated along the shaded dots as aircraft turn towards the northeast and fly over Harrow Lodge Park towards Hornchurch and Upminster. The centre of the concentrated flight paths is evident over White Hart Lakes which then heads towards Hornchurch and beyond towards Great Warley. The third concentrated flight path passes over Barking and Dagenham College towards Rush Green, then passes to the north of Hornchurch and beyond towards Great Warley. After passing the A1306 to the southeast of Dagenham, there is also some dispersion of aircraft to the south of the '3 pronged' flight path – this is spread across the community of Hornchurch south of the railway line to Upminster. The diagram also shows other departures over Barking heading towards the north which are described in the Brookmans Park SIDs analysis. The sponsor forecast that the traffic pattern would be concentrated along	After passing the A1112, there is also some dispersion towards the north towards Rush Green but not to the extent that existed prior to the change where there was a more densely concentrated traffic pattern. There are some flights spread to the north and south of the main core of traffic, no doubt caused by radar vectoring by ATC. **Slide / Sample 3 - May 2016.** Almost identical to Sample 2, except for a more pronounced increase in density for the northerly traffic pattern (the Clacton SID. **Slide / Sample 4 - Aug 2016.** Almost identical to Sample 2 and 3. **Slide / Sample 5 - Nov 2016.** Almost identical to Sample 2, 3 and 4 but the traffic pattern of the Clacton SID is now more concentrated and the bulge towards Rush Green is no longer evident after the turn at LCE02 (the A1112).		The traffic pattern for this segment is not consistent with what was anticipated. The actual 2016 traffic pattern is up to 1km further north than was expected (as portrayed by the shaded dots in consultation /ACP. However, notwithstanding that the traffic pattern is not as anticipated, on balance we are satisfied that the impacts are nonetheless acceptable after taking account of: • The altitude of flights on this segment of the SID (typically 3000ft-4000ft); • the average number of flights on a daily basis	north of the shaded dots. It can be seen that the flight tracks have moved north from 2013, where it is demonstrated that the flight tracks were coincident with the dots. Having checked the original design files it can be seen that the conventional nominal track is slightly to the northern edge of the density plots. It would appear that the density plots are a true reflection of the "coded overlay "of the conventional SID but not the actual conventional SID. As the RNAV track is designed to match the conventional track it is not

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
			the dotted line from the Railway station on the A1112, passing overhead Harrow Lodge Park, Hornchurch then following the large arrow head heading passing north of Upminster towards Great Warley. From the diagram, the CAA would take this to imply that aircraft would follow a narrower flight path over the railway station on the A1112 at Dagenham and turn towards Hornchurch, therefore the expectation being that the spread of the traffic pattern would be reduced in width across the departure track as aircraft head towards the north east, thus the dispersion at the turn towards the northeast/east occurring at Eastbrooke would be reduced and the traffic pattern would become more concentrated as depicted by the shaded dots.			(between 10-20); • The distance between the anticipated concentration and the actual concentration (approx. 1km); • The fact that the locations beneath the 2016 concentration were already previously overflown by departing aircraft.	unexpected that the RNAV track is now slightly north of the density plots.
Rwy 09 CLN (cont) **B08** B14 E SIDs 00-70	**Segment 4** WP3- WP4- **LCE05-CLN** Both FB M25 west of Great Warley to Weeley Heath	Track to Fix (TF)	No clear pattern of concentration. Broad dispersion of tracks, suggesting majority of aircraft are tactically vectored. Swathe of traffic travelling north-eastwards in the direction of Chelmsford. Some tracks evident beyond Chelmsford. No change in dispersion or concentration expected, as no change anticipated to occurrence of tactical vectoring.	Broadly similar to 2013 for all the 2016 samples. Only discernible differences are moderately less dispersion and few aircraft tracks beyond Chelmsford.	There is no discernible difference.	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved.	**Yes** The SID as published in the AIP is being flown as expected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
B10 B14 E SID DVR 00-40 **Rwy 09** **EKNIV** + CLN **AIP Chart AD 2 EGLC 6-7 & 6-4**	**Segment 1** DER-WP 1 (Flyover) (**LCE01**) (Take-off – straight ahead) segment to WP1 – the dot on the eastern rover bank of the Thames (at Gallions Reach)	Course to Fix (CF)	**Slide 1:** Rwy 09 Sample 3-7 Jun 2013- 681 Deps from Rwy 09 not all on this SID) Departures climb straight ahead to the A2041 at Thamesmead and then commence the turn towards Brookmans Park ((BPK). the traffic pattern is concentrated along the runway centreline towards the east. The sponsor predicted a similar concentration of departures portrayed by the shaded dots.	**SAME AS BPK** **Slide / Sample 2** - Feb 2016. No discernible difference. **Slide / Sample 3** - May 2016. No discernible difference. **Slide / Sample 4** - Aug 2016. No discernible difference. **Slide / Sample 5** - Nov 2016. No discernible difference.	There is no discernible difference.	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved.	**Yes** The SID as published in the AIP is being flown as expected.
Rwy 09 **EKNIV** +CLN **(cont)**	**Segment 2** WP1 to WP2 **LCE01** to **LCE02** WP1 is FO WP2 is FB Turn to the north from the riverbank at Thamesmead to the A1112 at Eastbrooke	Course to Fix (CF)	**Slide 1:** Rwy 09 Sample 3-7 Jun 2013- 681 Deps from Rwy 09 not all on this SID) At the A2041 at Thamesmead, aircraft commence the turn towards Eastbrooke (north east of Dagenham) and pass over the vicinity of Dagenham before making a right turn towards Hornchurch as aircraft pass the A1112. The traffic pattern is concentrated along the shaded dots although there is some dispersion either side of the main core spread across the northeast bound track all away along this segment.	**Slide / Sample 2 - Feb 2016**. The main core of concentrated traffic pattern in Segment 2 is reduced in width as far as Dagenham up to the turn at the A1112 towards Hornchurch. At the A1112, the concentrated traffic pattern continues around the turn as aircraft pass the Eastbrookend Country Park and then takes up two distinct flight paths in Segment 3. – one towards Clacton, and one towards the east following the newly established EKNIV SID which takes aircraft towards Kent for onward flight to Europe via Dover or to other destinations via Lydd.	Aircraft have to reach 3000ft amsl by LCE02 (no change to vertical profile. No discernible difference	**Yes** **All Samples:** The concentrated traffic pattern is very close to that forecast in consultation, as illustrated by the shaded dots, except for the third dot on the southern riverbank of the Thames, and the fourth dot at Dagenham Dock Station.	**Yes** NB the dots are different to where they are for the CLN SID Yes, the SID as published in the AIP is being flown as expected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
			Before the turn at the A1112, there is a distinct dispersed traffic pattern (yellow density) spread across the Beam Valley Country Park to the south of the main core, and a small number of departures head towards Romford on the north side of the main core track (these will be the Clacton SIDs as the diagrams showing the CLN and EKNIV SIDs are the same). At Hornchurch, traffic splits to route to either follow the Clacton SID to the northeast, or initially to the east to follow the Dover and Lydd SIDs towards the south via Detling where there is a noticeable '3 pronged' split in the traffic pattern – this is covered in Segment 3. The diagram also shows other departures over Barking heading towards the north which are described in the Brookmans Park SIDs analysis. The sponsor forecast that the traffic pattern would be concentrated along the dotted line throughout this segment. From the diagram, the CAA would take this to imply that aircraft would follow a narrower flight path over the railway station on the A1112 at	After passing the A1112, there is some dispersion towards the north towards Rush Green (covered in the CLN SIDS analysis) but not to the extent that existed prior to the change (see segment 3). **Slide / Sample 3 - May 2016.** Almost identical to Sample 2, except for a slight increase in density at Dagenham and Dock railway station and at the turn at the A1112. **Slide / Sample 4 - Aug 2016.** Almost identical to Sample 3. **Slide / Sample 5 - Nov 2016.** Almost identical to Sample 3.		Therefore, taking into account the full extremity of this segment, the impact of the design is consistent with what was anticipated in the consultation in that, there is a more concentrated traffic pattern than existed prior to the change. **CAA Comment:** Traffic pattern, in the main, as expected. The objective of the design has been achieved.	

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change** **and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
			Dagenham and turn towards Hornchurch and Upminster, therefore the expectation being that the spread of the traffic pattern would be reduced in width across the departure track as aircraft head towards the north east, thus the dispersion at the turn towards the northeast/east occurring at Eastbrooke would be reduced as depicted by the dots.				
Rwy 09 EKNIV (cont)	**Segment 3** WP2- WP3- **LCE02 – LCE03** Both FB A1112 at Eastbrooke to Upminster	Track to Fix (TF)	Up to LCE02 (where aircraft cross the A1112), departures flying the Clacton and EKNIV SIDs have followed the same departure track. After crossing the A1112 at Eastbrooke, traffic follows 3 small distinct concentrated flows during the turn to the west of Hornchurch before heading towards the northeast and east. This is where the concentrated traffic patterns split and two distinct departure flows occur after Hornchurch - traffic patterns split with aircraft routeing towards Clacton to the northeast routeing north of Upminster, or initially to the east over the vicinity of Upminster to follow the Dover and Lydd SIDs which subsequently turn towards the south to route via Detling.	**Slide / Sample 2 - Feb 2016**. The traffic pattern forms 2 main cores of concentrated flight paths in Segment 3. After crossing the A1112 north of the Dagenham (East) railway station, there is a concentrated traffic pattern which heads to the north of Hornchurch which continues around the turn as aircraft pass the Eastbrookend Country Park; the northerly traffic pattern (the Clacton SID) routes over Emerson Park and then heads towards LCE05 (Great Warley); the southerly traffic pattern (the EKNIV SID) flies over Hornchurch towards Upminster, then eastbound. **Note: The density plots are the same as the EKNIV SIDs.** After passing the A1112, there is also some dispersion towards the north	Aircraft should be above 3000ft after LCE02. No discernible difference	**All Samples:** In segment 3, east of the A1112, the concentrated traffic pattern of the EKNIV SID (the southerly of the two traffic patterns is more or less as forecast up to the A125. To the east of the A125, the traffic pattern is further south to that portrayed in consultation by the shaded dots between the A125 and Upminster However, the main core of the EKNIV SIDs is in the centre of the 2013 area of	**Yes** The SID as published in the AIP is being flown as expected. The RNAV density plots appear to indicate that vectoring is taking place later (commences at the 3rd last dot) then can be seen on the conventional SID.

CAA Web Ref Proced-ure & AIP Chart Ref (1)	Segment / Stage / Phase of SID & Waypoint (2)	Path Terminator Employed (3)	Traffic pattern before the change and Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be]. (4)	Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID. (5)	Vertical Profile Description – comparison of new RNAV SID with conventional SID. (6)	Track-keeping Achieved? (7)	SID Flown Correctly by Operators If no provide details SID Technical Design Acceptable (Yes/No) (8)
			The more dominant southerly of the 3 traffic patterns is concentrated along the shaded dots as aircraft turn towards the northeast and fly over Harrow Lodge Park towards Hornchurch and Upminster. The centre of the concentrated flight paths is evident over White Hart Lakes which then heads towards Hornchurch and beyond towards Great Warley. The third concentrated flight path passes over Barking and Dagenham College towards Rush Green, then passes to the north of Hornchurch and beyond towards Great Warley. After passing the A1306 to the southeast of Dagenham, there is also some dispersion of aircraft to the south of the '3 pronged' flight path – this is spread across the community of Hornchurch south of the railway line to Upminster. The diagram also shows other departures over Barking heading towards the north which are described in the Brookmans Park SIDs analysis. The sponsor forecast that the traffic pattern would be concentrated along the dotted line from the Railway station on the A1112, passing overhead White Hart Lakes,	towards Rush Green but not to the extent that existed prior to the change where there was a more densely concentrated traffic pattern. There are some flights spread to the north and south of the main core of traffic, no doubt caused by radar vectoring by ATC. **Slide / Sample 3 - May 2016.** Almost identical to Sample 2, except for a more pronounced increase in density for the northerly traffic pattern (the Clacton SID. **Slide / Sample 4 - Aug 2016.** Almost identical to Sample 2 and 3. **Slide / Sample 5 - Nov 2016.** Almost identical to Sample 2, 3 and 4 but the traffic pattern of the Clacton SID is now more concentrated and the bulge showing the traffic heading towards Rush Green is no longer evident after the turn at LCE02 (the A1112).		dispersion for these departures, and as a result, a more concentrated band of traffic is evident on this segment. The traffic pattern is consistent with what was anticipated. **CAA Comment:** The objective of the design has been achieved. To the dot after Dagenham the flight tracks are more concentrated than in 2013. It appears that in 2013 perhaps there was more vectoring after Dagenham where the flight tracks become very dispersed. Whereas with the RNAV SIDs there are 2 defined tracks around the last 3 dots.	

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change** **and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
			Hornchurch then following the large arrow head heading passing over the north parts of Upminster towards Junction 29 of the M25. From the diagram, the CAA would take this to imply that aircraft would follow a narrower flight path over the railway station on the A1112 at Dagenham and turn towards Hornchurch, therefore the expectation being that the spread of the traffic pattern would be reduced in width across the departure track as aircraft head towards the north east, thus the dispersion at the turn towards the northeast/east occurring at Eastbrooke would be reduced and the traffic pattern would become more concentrated as depicted by the shaded dots.				
Rwy 09 EKNIV (cont) **B08**	**Segment 4** **LCE03-LCE06** **Upminster to Burstead Golf Course**		From Upminster (approx. location of LCE03), but also prior to reaching Upminster, there is a broad, dispersed swathe of tracks that travel eastwards across south Essex. Aircraft are further south than the waypoints for the new SID (LCE03, LCE06, SODVU).	**Slide / Sample 2 - Feb 2016**. Evidence of concentration of tracks directly between LCE03 and LCE06. Some evidence of tactical vectored aircraft to the south of this concentration heading towards Basildon, but much less dispersion than the 2013 sample. No aircraft over south Essex (i.e. the area over which the 2013 traffic pattern was positioned).	2013 sample shows traffic is typically between 3000ft-6000ft for this segment, whereas in 2016 traffic is typically 4000-7000ft.	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved.	**Yes** The SID as published in the AIP is being flown as expected.

CAA Web Ref Proced-ure & AIP Chart Ref (1)	**Segment / Stage / Phase of SID & Waypoint** (2)	**Path Terminator Employed** (3)	**Traffic pattern before the change and Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** (4)	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** (5)	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** (6)	**Track-keeping Achieved?** (7)	**SID Flown Correctly by Operators If no provide details SID Technical Design Acceptable (Yes/No)** (8)
B15 B16 B17 B18 B19 B20 B21 B22 B23 B24			The forecast traffic pattern (based upon LCY Design Feedback Report) anticipated that from 4000ft and above: • Traffic would achieve an earlier climb; • Aircraft would track further east before turning south; • That based upon the procedure; • design, traffic would generally avoid overflight of large towns such as Billericay, Wickford, Basildon and Rayleigh; • Aircraft would turn south (at SODVU) over Canvey Island but would typically be at 7000ft or above at that point; • Tactical vectoring would occur earlier than that location if aircraft had already achieved 7000ft.	Some evidence of aircraft being vectored directly from LCE03 towards SODVU, rather than via LCE06. Note: these could also be Non-RNAV1 departures being radar vectored by ATC. Generally, aircraft are being kept on the SID for this segment. **Slide / Sample 3 - May 2016.** Almost identical to Sample 2. **Slide / Sample 4 - Aug 2016.** Almost identical to Sample 2. **Slide / Sample 5 - Nov 2016.** Almost identical to Sample 2.	However, in Slide B 21 00-70-200 Slide 2, some aircraft are at in the 7000ft and above altitude band well before they reached 7000ft before the change so there is a significant improvement in the climb profile Evidence that aircraft are achieving an improved climb profile.		
Rwy 09 EKNIV (cont) **B08** **B15 B16 B17 B18**	**Segment 5** **LCE06-SODVU** **Burstead Golf Course to Rayleigh**		The broad swathe of traffic continues across south Essex, with evidence that most aircraft are being vectored south-eastwards when they are south abeam Basildon (though most aircraft are south of Basildon at this point rather than flying over it). Forecast Track Keeping as outlined in Segment 4 above.	**Slide / Sample 2 - Feb 2016**. Evidence of concentration of tracks directly between LCE06 and SODVU, but fewer aircraft than segment 4 as aircraft climb beyond 7000ft. LCE06. Some evidence of tactical vectored aircraft to the south of this concentration heading towards Basildon, but much less dispersion than the 2013 sample. No aircraft over south Essex	2013 sample shows traffic is typically between 3000ft-7000ft for this segment, whereas in 2016 traffic is typically 5000-7000ft, with most tracks disappearing	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved	**Yes** The SID as published in the AIP is being flown as expected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
B19 **B20** **B21** **B22** **B23** **B24**				(i.e. the area over which the 2013 traffic pattern was positioned). Note: these could also be Non-RNAV1 departures being radar vectored by ATC. Some evidence of a few aircraft below 7000ft being vectored directly from LCE03 towards SODVU, rather than via LCE06. Note: these could also be Non-RNAV1 departures being radar vectored by ATC. Generally, aircraft are being kept on the SID for this segment. **Slide / Sample 3 - May 2016.** Almost identical to Sample 2. **Slide / Sample 4 - Aug 2016.** Almost identical to Sample 2. **Slide / Sample 5 - Nov 2016.** Almost identical to Sample 2.	well before SODVU. However, in Slide B 21 00-70-200 Slide 2, some aircraft are at in the 7000ft and above altitude band well before they reached 7000ft before the change so there is a significant improvement in the climb profile Evidence that aircraft are achieving an improved climb profile.		
Rwy 09 EKNIV (cont) **B08** **B15**	**Segment 6** **SODVU-EKNIV** **Rayleigh to the River Medway Estuary**		Very wide swathe of dispersed tracks continues south-eastwards over Canvey Island. Forecast Track Keeping as outlined in Segment 4 above.	**Slide / Sample 2 - Feb 2016**. Almost no aircraft tracks beyond SODVU, which indicates that almost all aircraft have achieved 7000ft by this point. **Slide / Sample 3 - May 2016.**	2013 sample shows traffic is typically between 3000ft-7000ft for this segment with tracks beyond SODVU,	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved	**Yes** The SID as published in the AIP is being flown as expected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
B16 **B17** **B18** **B19** **B20** **B21** **B22** **B23** **B24**				Almost identical to Sample 2. **Slide / Sample 4 - Aug 2016.** Almost identical to Sample 2. **Slide / Sample 5 - Nov 2016.** Almost identical to Sample 2.	whereas in 2016 traffic almost all above 7000ft before SODVU, with a few tracks at 6000ft-7000ft. Evidence that aircraft are achieving an improved climb profile.		
RUNWAY 27 PROCEDURES							
B11 B14 W SID BPK 00-40 **Rwy 27 BPK** **AIP Chart AD 2 EGLC 6-5**	**Segment 1** DER-WP 1 (Flyover) (**LCW01**) (Take-off – straight ahead) segment to WP1 – the dot on the River Thames (Millennium Dome)	Course to Fix (CF)	**Slide 1:** Rwy 27 Sample 3-7 Jun 2013- 681 Deps from Rwy 27 not all on this SID) Departures climb straight ahead to the first turn which is north of the Millennium Dome (the third dot), after which, aircraft turn to the north towards Wanstead, then Brookmans Park (BPK). The traffic pattern is concentrated along the runway centreline towards the west.	**Slide /Sample 2** - Feb 2016. No discernible difference. **Slide / Sample 3**- May 2016. No discernible difference. **Slide /Sample 4** - Aug 2016. No discernible difference. **Slide /Sample 5** - Nov 2016. No discernible difference.	No discernible difference	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved.	**Yes** The SID as published in the AIP is being flown as expected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
			The sponsor predicted a similar concentration of departures portrayed by the shaded dots.				
Rwy 27 BPK (cont)	**Segment 2** WP1-WP2 LCW01-LCN01 WP1 is FO WP2 is FB Millennium Dome to Leyton	Direct to Fix (DF)	After commencing the turn at the Millennium Dome, aircraft head northbound towards Leyton. In the diagram, all Rwy 27 departures are shown which include those aircraft heading out to the northeast towards Clacton, and the departures which eventually turn to the south towards Kent. There is a noticeable concentrated traffic pattern evident from Poplar overhead to Bow and onwards to Leyton. There is also a less dense concentrated traffic pattern on the west side of the main flow of traffic – this flies over the A12 major bend at Hackney, then over Hackney marshes before it turns towards Wanstead. We asked NATS to explain what SID this traffic pattern was associated with. NATS advised that this particular traffic pattern was Swiss departures flying the Clacton SID.	**Slide /Sample 2** - Feb 2016. After the turn at the Millennium Dome there is a concentrated traffic pattern which becomes wider after Poplar and forms a spread of traffic which is also one Km wide as aircraft flypast Stratford towards Leyton. There are less dense bands of aircraft either side (the yellow streaks) and a few departures on both sides of the main core of departures. Unlike the conventional SIDs, the majority of departures now fly towards Leyton before turning to the north. The main core of concentrated traffic is spread across a wider area compared with the thinner main core and dispersion which is evident before the change. On the western side of the main core of traffic, the separate concentrated flow over Hackney marshes (the Swiss Clacton departures) is no longer evident. On the eastern side of the main core, overflight of West Ham and the Wanstead Flats is reduced.	No discernible difference.	**Yes.** The area where the sponsor forecast most aircraft would be concentrated along the shaded dots has seen the main core of departures flying through this segment of the departure and is relevant to all three SIDs. Even though the general spread of traffic has narrowed, the main core of concentration (the purple area in the density plots) appears to be wider than the equivalent concentrated pattern that was evident before the change (the 2013 sample). We had anticipated that the	**Yes** The SID as published in the AIP is being flown as expected. A DF path terminator is used after WP LCW01 and the flight tracks are as expected. A DF will produce tracks which depend on the a/c groundspeed and are the shortest distance to the next WP LCN01.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
			There is also a distinct traffic pattern on the eastern side of the main core of departures which is spread across from the Olympic Stadium towards West Ham which continues in a wide spread pattern towards Wanstead Flats. The sponsor forecast that most Brookmans Park departures would be concentrated along the shaded dots from Poplar to Leyton.	The aircraft outside the main core may be non-RNAV1 aircraft which are flying the conventional SID or, those aircraft which may have been vectored. (This can be compared with the 2013 sample where there is widespread departures over Wanstead Flats.) **Slide /Sample 3** - May 2016. Almost identical to Sample 2. **Slide /Sample 4** - Aug 2016. Almost identical to Samples 2 and 3. **Slide /Sample 5** - Nov 20 16. Almost identical to Samples 2, 3 and 4, but a more concentrated purple pattern is evident.		concentration would become narrower, i.e. the concentration was represented by the width of the shaded dots used to portray the expected traffic pattern. This unanticipated outcome is potentially a result of the choice of the flyover waypoint and the data base coding where a DF has been used on all 3 SIDs, so there is an element of dispersion evident in Slides/Samples 2-5. We would conclude that the traffic pattern is generally as expected from the design albeit with an element of dispersion occurring after the first turn at LCW01. The objective of the design has been achieved.	

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
Rwy 27 BPK (cont)	**Segment 3** WP2-WP4 LCN01-LCN05 WP2 is FB WP4 is FB Leyton to M11 Junction 4	Track to Fix (TF)	From Leyton departures aircraft follow a northeasterly track towards Wanstead then they commence a left turn towards Brookmans Park. There is a concentrated traffic pattern between Leyton and Wanstead which comprises the flow of all Runway 27 departures to the north, the northeast and east. This concentrated pattern splits into two separate traffic flows, with a northerly concentration if traffic flying over Wanstead towards the M11 Junction 4 after which the turn to the north is completed, and an easterly flow which heads towards the railway station at Barkingside. There is also a distinct traffic pattern on the eastern side of the main core of departures which is spread across from the Olympic Stadium towards West Ham which continues in a wide spread pattern towards Wanstead Flats. This is associated with the Clacton and Dover/Lydd SIDs. The sponsor forecast that most Brookmans Park departures would be concentrated along the shaded dots from Leyton to Junction 4 of the M11 at Woodford.	**Slide /Sample 2** - Feb 2016. From Leyton, departures are following a concentrated traffic pattern to J4 of the M11 before they turn towards the north. At Leytonstone, the traffic pattern splits with those aircraft flying the Clacton and EKNIV SIDs heading off towards Barkingside to the east. The aircraft outside the main core may be non-RNAV1 aircraft which are flying the conventional SID or, those aircraft which may have been vectored. (This can be compared with the 2013 sample where there is widespread departures over Wanstead Flats.) **Slide 3** - May 2016. A slightly wider band of yellow evident on the north side. **Slide 4** - Aug 2016. No discernible difference from Slide 2. **Slide 5** - Nov 2016. No discernible difference from Slides 2 and 4.	No discernible difference.	**Yes.** The concentrated traffic pattern is very close to that forecast in consultation, as illustrated by the shaded dots. The main core has shifted a very small distance to the north (approximately 200m) The objective of the design has been achieved.	**Yes** The SID as published in the AIP is being flown as expected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
Rwy 27 BPK (cont) **B36**	**Segment 4** WP4-WP5 LCN05-BPK WP4 is FB WP5 is FB M11 Junction 4 to Woodford Wells	Track to Fix (TF)	After the M11 Junction 4 the turn to the north is completed by Woodford Green railway station with aircraft heading northbound to Brookmans Park passing overhead Woodford Wells. There is a concentrated traffic pattern from J11 to Woodford Green railway station, then the pattern of traffic becomes slightly wider spread. The sponsor forecast that most Brookmans Park departures would be concentrated along the shaded dots from Junction 4 of the M11 at Woodford and after the turn would follow the track of the shaded arrowhead towards Brookmans Park.	**Slide /Sample 2** - Feb 2016. From Junction 4 of the M11, aircraft are mid-way through the turn to the north, and have almost completed the turn by Woodford Green railway station. Whilst the majority of departures are in a concentrated traffic pattern over Junction 4, traffic is spread across a slightly wider area than was the case with the conventional SID shown in Slide/Sample 1. **Slide /Sample 3** - May 2016. There is less dispersion towards the east compared with Slide 2. **Slide /Sample 4** - Aug 2016. There is less dispersion towards the east compared with Slide 3. **Slide /Sample 5** - Nov 2016. Similar to Slide 3.	No discernible difference.	**Yes** The moderate 'ballooning' (as it is sometimes referred to) after LCN05 could potentially be a result of aircraft having a tailwind component from the southwest resulting in additional groundspeed, and hence they will fly a wider radius of turn towards Brookmans Park. Evidence of this is shown on Slide pack **B36** The objective of the design has been achieved.	If the a/c groundspeeds are greater than 200Kts then it would be expected that some of the resultants flights tracks would balloon on the outside of the turn. From that 2016 density plots this is not demonstrated to be excessive.
Rwy 27 BPK (cont)	**Segment 4** **Above 4000ft** **As above**	Track to Fix (TF)	**As above**	As above	For both the 2013 and 2016 samples, traffic typically between 3000-7000ft.	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved.	The SID as published in the AIP is being flown as expected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
					No apparent changes in vertical profile.		
B12 B14 W SID CLN 00-40 **Rwy 27 CLN** **AIP Chart AD 2 EGLC 6-7**	**Segment 1** DER-WP 1 (Flyover) (**LCW01**) (Take-off – straight ahead) segment to WP1 – the dot on the River Thames (Millennium Dome)	Course to Fix (CF)	**Slide 1** Rwy 27 Sample 3-7 Jun 2013- 681 Deps from Rwy 27 not all on this SID) Departures climb straight ahead to the first turn which is north of the Millennium Dome (the second dot), after which, aircraft turn to the north towards Wanstead, then Collier Row/Harold Hill. The traffic pattern is concentrated along the runway centreline towards the west. The sponsor predicted a similar concentration of departures portrayed by the shaded dots.	**Slide /Sample 2** - Feb 2016. No discernible difference. **Slide / Sample 3** - May 2016. No discernible difference. **Slide / Sample 4** - Aug 2016. No discernible difference. **Slide /Sample 5** - Nov 2016. No discernible difference.	No discernible difference	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved.	**Yes** The SID as published in the AIP is being flown as expected.
Rwy 27 CLN (cont)	**Segment 2** WP1-WP2 LCW01-LCN02 WP1 is FO WP2 is FB Millennium Dome to Leytonstone	Direct to Fix (DF)	After commencing the turn at the Millennium Dome, aircraft head northbound towards Leytonstone (the railway station just off the A112). (This waypoint is just to the northeast of LCN01 which is used in the BPK design). In the diagram all Rwy 27 departures are shown which include those aircraft heading out to the north towards Brookmans Park, and the departures to the east which	**Slide / Sample 2** - Feb 2016. After the turn at the Millennium Dome there is a concentrated traffic pattern which becomes wider after Poplar and forms a spread of traffic which is also one Km wide as aircraft flypast Stratford towards Leytonstone. There are less dense bands of aircraft either side (the yellow streaks) and a few departures on both sides of the main core of departures.	No discernible difference	**Yes.** The area where the sponsor forecast most aircraft would be concentrated along the shaded dots has seen the main core of departures flying through this segment of the departure and is relevant to all three SIDs.	**Yes** The SID as published in the AIP is being flown as expected. A DF path terminator is used after WP LCW01 and the flight tracks are as expected. A DF will produce tracks which depend on

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
			eventually turn to the south towards Kent. There is a noticeable concentrated traffic pattern evident from Poplar overhead to Bow and onwards to Leyton. There is also a less dense concentrated traffic pattern on the west side of the main flow of traffic – this flies over the A12 major bend at Hackney, then over Hackney marshes before it turns towards Wanstead. We asked NATS to explain what SID this traffic pattern was associated with. NATS advised that this particular traffic pattern was Swiss departures flying the Clacton SID. There is also a distinct traffic pattern on the eastern side of the main core of departures which is spread across from the Olympic Stadium towards West Ham which continues in a wide spread pattern towards Wanstead Flats. The sponsor forecast that most Clacton departures would be concentrated along the shaded dots from Poplar to Leyton.	Unlike the conventional SIDs, the majority of departures now fly towards Leytonstone before turning to the north east. The main core of concentrated traffic is spread across a wider area compared with the thinner main core and dispersion which is evident before the change. On the western side of the main core of traffic, the separate concentrated flow over Hackney marshes (the Swiss Clacton departures) is no longer evident. On the eastern side of the main core, overflight of West Ham and the Wanstead Flats is reduced. The aircraft outside the main core may be non-RNAV1 aircraft which are flying the conventional SID or, those aircraft which may have been vectored. (This can be compared with the 2013 sample where there is widespread departures over Wanstead Flats.) Slide 3 - May 2016. Almost identical to Sample 2. Slide 4 - Aug 2016. Almost identical to Samples 2 and 3.		Even though the general spread of traffic has narrowed, the main core of concentration (the purple area in the density plots) appears to be wider than the equivalent concentrated pattern that was evident before the change (the 2013 sample). We had anticipated that the concentration would become narrower, i.e. the concentration was represented by the width of the shaded dots used to portray the expected traffic pattern. This unanticipated outcome is potentially a result of the choice of the flyover waypoint and the data base coding where a DF has been used on all 3 SIDs, so there is an element of dispersion evident in Slides/Samples 2-5.	the a/c groundspeed and are the shortest distance to the next WP LCN02.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
				Slide 5 - Nov 2016. Almost identical to Samples 2, 3 and 4, but a more concentrated purple pattern is evident.		We would conclude that the traffic pattern is generally as expected from the design albeit with an element of dispersion occurring after the first turn at LCW01. The objective of the design has been achieved.	
Rwy 27 CLN (cont)	**Segment 3** WP2-WP4 LCN02-LCE04 WP2 is FB WP4 is FB Leytonstone to Harold Hill	Track to Fix (TF)	From Leytonstone departures aircraft follow a northeasterly track in a turn towards Wanstead then they steady up on a north-easterly track towards Harold Hill. There is a concentrated traffic pattern between Leytonstone and Wanstead which comprises the flow of all Runway 27 departures to the north, the northeast and east. This concentrated pattern splits into two separate traffic flows, with a northerly concentration of traffic flying over Wanstead towards the M11 Junction 4 which are the Brookmans Park departures, and an easterly flow which heads towards Harold Hill.	**Slide /Sample 2** - Feb 2016. From Leytonstone, departures are following a concentrated traffic pattern to Harold Hill. After Leytonstone, the traffic pattern splits with those aircraft flying the Brookmans Park SID, and the Clacton track is common with the EKNIV SIDs until the golf course to the east of Rise Park when the Clacton SIDs takes a short right turn followed by a left turn towards Clacton (passing Brentwood to the south), and the EKNIV departures have a steady eastbound track towards Little Burstead, again passing south of Brentwood.	No discernible difference.	**Yes.** The area where the sponsor forecast most aircraft would be concentrated along the shaded dots has seen the main core of departures flying through this segment of the departure. As a result, there is a greater concentrated traffic pattern flying along the SID track from	**Yes** The SID as published in the AIP is being flown as expected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
			There is also a distinct traffic pattern on the southern side of the main core of departures which is spread across from the Olympic Stadium towards West Ham, Barking and Dagenham, although the main less dense spread is north of a line from Ilford to Hornchurch. This is probably associated with the Dover/Lydd SIDs. The sponsor forecast that most Clacton departures would be concentrated along the shaded dots from Leytonstone to Harold Hill.	The few aircraft outside the main core may be non-RNAV1 aircraft which are flying the conventional SID or those aircraft which may have been vectored. (This can be compared with the 2013 sample where there is widespread departures over Wanstead Flats.) As the majority of departures are now on a more concentrated traffic pattern following the RNAV SID towards Harold Hill, there is noticeably less traffic directly overflying Ilford and Romford Slide / Sample 3 - May 2016. Similar to Sample 2; however there is a yellow band over Romford, probably associated with the EKNIV SID. **Slide /Sample 4** - Aug 2016. Similar to Sample 3. **Slide / Sample 5** - Nov 2016. Similar to Sample 3.		Leytonstone to Harold Hill. There are fewer flights over Ilford and Romford. The objective of the design has been achieved.	
Rwy 27 CLN (cont)	**Segment 4** WP4-WP5 LCE04-LCE05 WP4 is FB WP5 is FB	Track to Fix (TF)	After Harold Hill, there is a turn to the right and departures follow a very short length concentrated traffic pattern to Great Warley after which they turn left direct towards Clacton passing south of Brentwood. There is some vectoring of departures towards the northeast	**Slide / Sample 2** - Feb 2016. From Harold Hill there is a split in the traffic pattern. The Clacton departures follow the southerly flow towards Great Warley before turning left flying to the south of Brentwood. The northerly flow is the EKNIV SID track towards Little Burstead (LCE06).	No discernible difference.	**Yes.** The area where the sponsor forecast most aircraft would be concentrated along the shaded dots has seen the main core of departures flying through this	**Yes** The SID as published in the AIP is being flown as expected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
	Harold Hill to Great Warley		both before, but in the main, after Harold Hill. There is also a widespread band of traffic south of the track from Harold Hill towards Great Warley which extends over Romford towards the east. This pattern may be more associated with the departures heading towards the south (Detling) for onwards flight to other destinations. The sponsor forecast that most Clacton departures would be concentrated along the shaded dots from Harold Hill to Great Warley. This is only a short distance of approximately 3NM with the new design.	The traffic pattern is similar to the concentrated pattern flown by the conventional SID. **Slide / Sample 3** - May 2016. Similar to Sample 2. **Slide /Sample 4** - Aug 2016. Similar to Sample 2. **Slide / Sample 5** - Nov 2016. Similar to Sample 2 but more concentrated.		segment of the departure. As a result, there is a similar concentrated traffic pattern flying along the SID track from Harold Hill to Great Warley. The objective of the design has been achieved.	
Rwy 27 CLN (cont) **B13** B14 W SID 00-70	Segment 5 WP4-WP5 Both FB LCE05-CLN Great Warley to Weeley Heath	Track to Fix (TF)	No clear pattern of concentration. Broad dispersion of tracks, suggesting majority of aircraft are tactically vectored. Swathe of traffic travelling north-eastwards in the direction of Chelmsford. Some tracks evident beyond Chelmsford. No change in dispersion or concentration expected, as no change anticipated to occurrence of tactical vectoring.	Broadly similar to 2013 for all the 2016 samples. Only discernible differences are moderately less dispersion and few aircraft tracks beyond Chelmsford.	There is no discernible difference.	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved.	**Yes** The SID as published in the AIP is being flown as expected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change** **and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
B14 B14 W SID DVR 00-40 **Rwy 27 EKNIV** **AIP Chart AD 2 EGLC 6-4**	**Segment 1** DER-WP 1 (Flyover) (**LCW01**) (Take-off – straight ahead) segment to WP1 – the dot on the River Thames (Millennium Dome)	Course to Fix (CF)	**Slide 1** Rwy 27 Sample 3-7 Jun 2013- 681 Deps from Rwy 27 not all on this SID) Departures climb straight ahead to the first turn which is north of the Millennium Dome (the second dot), after which, aircraft turn to the north towards Wanstead, then Collier Row/Harold Hill. The traffic pattern is concentrated along the runway centreline towards the west. The sponsor predicted a similar concentration of departures portrayed by the shaded dots.	**Slide / Sample 2** - Feb 2016. No discernible difference. **Slide / Sample 3** - May 2016. No discernible difference. **Slide / Sample 4** - Aug 2016. No discernible difference. **Slide / Sample 5** - Nov 2016. No discernible difference.	No discernible difference.	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved.	**Yes** The SID as published in the AIP is being flown as expected.
Rwy 27 EKNIV (cont)	**Segment 2** WP1-WP2 LCW01-LCN02 WP1 is FO WP2 is FB Millennium Dome to Leytonstone	Direct to Fix (DF)	After commencing the turn at the Millennium Dome, aircraft head northbound towards Leytonstone (the railway station just off the A112). (This waypoint is just to the northeast of LCN01 which is used in the BPK design). In the diagram all Rwy 27 departures are shown which include those aircraft heading out to the north towards Brookmans Park, and the departures to the north east which eventually route towards Clacton. There is a noticeable concentrated traffic pattern evident from Poplar	**Slide / Sample 2** - Feb 2016. After the turn at the Millennium Dome there is a concentrated traffic pattern which becomes wider after Poplar and forms a spread of traffic which is also one KM wide as aircraft flypast Stratford towards Leytonstone. There are less dense bands of aircraft either side (the yellow streaks) and a few departures on both sides of the main core of departures. Unlike the conventional SIDs, the majority of departures now fly towards Leytonstone before turning to the north east.	No discernible difference	**Yes.** The area where the sponsor forecast most aircraft would be concentrated along the shaded dots has seen the main core of departures flying through this segment of the departure and is relevant to all three SIDs. Even though the general spread of	**Yes** The SID as published in the AIP is being flown as expected. A DF path terminator is used after WP LCW01 and the flight tracks are as expected. A DF will produce tracks which depend on the a/c groundspeed and are the shortest

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
			overhead to Bow and onwards to Leyton. There is also a less dense concentrated traffic pattern on the west side of the main flow of traffic – this flies over the A12 major bend at Hackney, then over Hackney marshes before it turns towards Wanstead. We asked NATS to explain what SID this traffic pattern was associated with. NATS advised that this particular traffic pattern was Swiss departures flying the Clacton SID. There is also a distinct traffic pattern on the eastern side of the main core of departures which is spread across from the Olympic Stadium towards West Ham which continues in a wide spread pattern towards Wanstead Flats. The sponsor forecast that most EKNIV departures would be concentrated along the shaded dots from Poplar to Leyton.	The main core of concentrated traffic is spread across a wider area compared with the thinner main core and dispersion which is evident before the change. On the western side of the main core of traffic, the separate concentrated flow over Hackney marshes (the Swiss Clacton departures) is no longer evident. On the eastern side of the main core, overflight of West Ham and the Wanstead Flats is reduced. The aircraft outside the main core may be non-RNAV1 aircraft which are flying the conventional SID or, those aircraft which may have been vectored. (This can be compared with the 2013 sample where there is widespread departures over Wanstead Flats.) **Slide / Sample 3** - May 2016. Almost identical to Sample 2. **Slide / Sample 4** - Aug 2016. Almost identical to Samples 2 and 3. **Slide / Sample 5** - Nov 2016. Almost identical to Samples 2, 3 and 4, but a more concentrated purple pattern is evident.		traffic has narrowed, the main core of concentration (the purple area in the density plots) appears to be wider than the equivalent concentrated pattern that was evident before the change (the 2013 sample). We had anticipated that the concentration would become narrower, i.e. the concentration was represented by the width of the shaded dots used to portray the expected traffic pattern. This unanticipated outcome is potentially a result of the choice of the flyover waypoint and the data base coding where a DF has been used on all 3 SIDs, so there is an element of dispersion evident in Slides/Samples 2-5. We would conclude that the traffic	distance to the next WP LCN02.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
						pattern is generally as expected from the design albeit with an element of dispersion occurring after the first turn at LCW01. The objective of the design has been achieved.	
Rwy 27 EKNIV (cont)	**Segment 3** WP2-WP3 LCN02-LCN06 WP2 is FB WP4 is FB Leytonstone to Harold Hill	Track to Fix (TF)	From Leytonstone departures aircraft follow a northeasterly track in a turn towards Wanstead then they steady up on a north-easterly track towards Harold Hill. There is a concentrated traffic pattern between Leytonstone and Wanstead which comprises the flow of all Runway 27 departures to the north, the northeast and east. This concentrated pattern splits into two separate traffic flows, with a northerly concentration of traffic flying over Wanstead towards the M11 Junction 4 which are the Brookmans Park departures, and an easterly flow which heads towards Harold Hill. There is also a distinct traffic pattern on the southern side of the main core of departures which is spread across from the Olympic Stadium towards	**Slide / Sample 2** - Feb 2016. From Leytonstone, departures are following a concentrated traffic pattern towards Harold Hill. After Leytonstone, the traffic pattern splits with those aircraft flying the Brookmans Park SID, and the EKNIV track is common with the Clacton SIDs until the golf course to the east of Rise Park where the EKNIV departures have a small turn right and then have a steady eastbound track towards Little Burstead, passing south of Brentwood; the Clacton SIDs have a 30 degree right turn for a very short distance of approximately 3 NM followed by a left turn towards Clacton (passing Brentwood to the south). The few aircraft outside the main core may be non-RNAV1 aircraft which are	No discernible difference.	**Yes.** The area where the sponsor forecast most aircraft would be concentrated along the shaded dots has seen the main core of departures flying through this segment of the departure. As a result, there is a greater concentrated traffic pattern flying along the SID track from Leytonstone to Harold Hill.	**Yes** The SID as published in the AIP is being flown as expected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
			West Ham, Barking and Dagenham, although the main less dense spread is north of a line from Ilford to Hornchurch. This is probably associated with radar vectoring of departures on the Dover/Lydd SIDs. The sponsor forecast that most EKNIV departures would be concentrated along the shaded dots from Leytonstone to Harold Hill.	flying the conventional SID or those aircraft which may have been vectored. (This can be compared with the 2013 sample where there is widespread departures over Wanstead Flats.) As the majority of departures are now on a more concentrated traffic pattern following the RNAV SID towards Harold Hill, there is noticeably less traffic directly overflying Ilford and Romford **Slide / Sample 3** - May 2016. Similar to Sample 2; however there is a yellow band over Romford, probably associated with vectoring of traffic flying the EKNIV SID. **Slide /Sample 4** - Aug 2016. Similar to Sample 3. **Slide / Sample 5** - Nov 2016. Similar to Sample 3.		There are fewer flights over Ilford and Romford. The objective of the design has been achieved.	
Rwy 27 EKNIV (cont) **B13** **B30** **B31**	**Segment 4** **WP3-WP4** **LCN06-LCE06**		From Harold Hill (approx. location of LCN06), but also prior to reaching Harold Hill, there is a broad, dispersed swathe of tracks that travel eastwards across Hornchurch and south Essex. Aircraft are further south than the waypoints for the new SID (LCN06, LCE06, SODVU).	**Slide / Sample 2 - Feb 2016**. Evidence of concentration of tracks directly between LCN06 and LCE06. Some evidence of tactical vectored aircraft to the south of this concentration heading towards Basildon, but much less dispersion than the 2013 sample. No aircraft over south Essex (i.e. the area over which the 2013 traffic pattern was positioned).	2013 sample shows traffic is typically between 2000ft-6000ft for this segment, whereas in 2016 traffic is typically 3000-7000ft.	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved.	**Yes** The SID as published in the AIP is being flown as expected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
B32 **B33** **B34**			The forecast traffic pattern (based upon LCY Design Feedback Report) anticipated that from 4000ft and above: • Traffic would achieve an earlier climb; • Aircraft would track further east before turning south; • That based upon the procedure; • design, traffic would generally avoid overflight of large towns such as Billericay, Wickford, Basildon and Rayleigh; • Aircraft would turn south (at SODVU) over Canvey Island but would typically be at 7000ft or above at that point; • Tactical vectoring would occur earlier than that location if aircraft had already achieved 7000ft.	Note: These may be Non-RNAV 1 departures which are vectored by ATC. Some evidence of aircraft being vectored directly from LCN03 towards SODVU, rather than via LCE06. Note: These may be Non-RNAV 1 departures which are vectored by ATC. Generally, aircraft are being kept on the SID for this segment. **Slide / Sample 3 - May 2016.** Almost identical to Sample 2. **Slide / Sample 4 - Aug 2016.** Almost identical to Sample 2. **Slide / Sample 5 - Nov 2016.** Almost identical to Sample 2.	However, in Slide B 31-34 00-70-200 Slide 2, some aircraft are at in the 7000ft and above altitude band well before they reached 7000ft before the change so there is a significant improvement in the climb profile Evidence that aircraft are achieving an improved climb profile.		
Rwy 27 EKNIV (cont) **B13** **B30** **B31** **B32**	**Segment 5** **WP4-WP5** **LCE06-SODVU**		The broad swathe of traffic continues across south Essex, with evidence that most aircraft are being vectored south-eastwards when they are abeam Basildon (though most aircraft are south of Basildon at this point rather than flying over it). Forecast Track Keeping as outlined in Segment 4 above.	**Slide / Sample 2 - Feb 2016**. Evidence of concentration of tracks directly between LCE06 and SODVU, but fewer aircraft than segment 4 as aircraft climb beyond 7000ft. LCE06. Some evidence of tactical vectored aircraft to the south of this concentration heading towards Basildon, but much less dispersion than the 2013 sample. No aircraft over south Essex	2013 sample shows traffic is typically between 3000ft-7000ft for this segment, whereas in 2016 traffic is typically 4000-7000ft, with most tracks	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved	**Yes** The SID as published in the AIP is being flown as expected.

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
B33 B34				(i.e. the area over which the 2013 traffic pattern was positioned). Some evidence of a few aircraft below 7000ft being vectored directly from LCN03 towards SODVU, rather than via LCE06. Note: These may be Non-RNAV 1 departures which are vectored by ATC. Generally, aircraft are being kept on the SID for this segment. **Slide / Sample 3 - May 2016.** Almost identical to Sample 2. **Slide / Sample 4 - Aug 2016.** Almost identical to Sample 2. **Slide / Sample 5 - Nov 2016.** Almost identical to Sample 2.	disappearing well before SODVU. However, in Slide B 31-34 00-70-200 Slide 2, some aircraft are at in the 7000ft and above altitude band well before they reached 7000ft before the change so there is a significant improvement in the climb profile Evidence that aircraft are achieving an improved climb profile.		
Rwy 27 EKNIV (cont) **B13** **B30 B31**	**Segment 6** **WP5-WP6** **SODVU-EKNIV**		Very wide swathe of dispersed tracks continues south-eastwards over Canvey Island. Forecast Track Keeping as outlined in Segment 4 above.	**Slide / Sample 2 - Feb 2016**. Almost no aircraft tracks beyond SODVU, which indicates that almost all aircraft have achieved 7000ft by this point. **Slide / Sample 3 - May 2016.** Almost identical to Sample 2.	2013 sample shows traffic is typically between 4000ft-7000ft for this segment with tracks beyond SODVU, whereas in	**Yes** Traffic pattern as expected in all 4 samples. The objective of the design has been achieved	

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
B32 **B33** **B34**				**Slide / Sample 4 - Aug 2016.** Almost identical to Sample 2. **Slide / Sample 5 - Nov 2016.** Almost identical to Sample 2.	2016 traffic almost all above 7000ft before SODVU, with a few tracks at 6000ft-7000ft. However, in Slide B 31-34 00-70-200 Slide 2, some aircraft are at in the 7000ft and above altitude band well before they reached 7000ft before the change so there is a significant improvement in the climb profile Evidence that aircraft are achieving an improved climb profile.		
7 B10 Stronger Wind Go Around etc	**Missed Approach**		For completeness, diagrams illustrating the impact of a missed approached were provided by the sponsor to supplement the SID analysis and illustrate some variation	Slide 1 For information only.	N/A	N/A	N/A

CAA Web Ref **Proced-ure &** **AIP Chart Ref** **(1)**	**Segment / Stage / Phase of SID & Waypoint** **(2)**	**Path Terminator Employed** **(3)**	**Traffic pattern before the change** **and** **Forecast Track Keeping Performance (Dispersion or Concentration) [this is a description of what the sponsor expected the traffic pattern to be].** **(4)**	**Qualitative description of the track-keeping of the new RNAV SID (traffic pattern) & comparison with conventional SID.** **(5)**	**Vertical Profile Description – comparison of new RNAV SID with conventional SID.** **(6)**	**Track-keeping Achieved?** **(7)**	**SID Flown Correctly by Operators If no provide details** **SID Technical Design Acceptable (Yes/No)** **(8)**
Rwy 27 MAP			in flight paths for aircraft departing from Runway 27. In the event of a missed approach, aircraft climb straight ahead to 2000ft amsl and at approximately 5NM west of the aerodrome, they turn right to the NDB(L) LCY or as instructed by ATC for repositioning for a further approach, or to divert to another aerodrome as circumstances dictate. No diagrams were provided to illustrate the impacts of this procedure prior to the change, however, in light of the strong winds in February during the traffic sample, the sponsor provided a traffic sample of missed approaches (also known as 'go arounds') on 7 and 8 Feb 16 to illustrate the variety of traffic patterns flown.	This diagram shows a variety in tracks flown by aircraft which have executed a missed approach (go around) procedure. Aircraft are radar vectored by ATC for a further approach or diversion. The diagram illustrates that after turning right over Stratford, aircraft then typically fly over the vicinity of Romford and Hornchurch towards Basildon, and they are then turned back towards LCA to be sequenced with other arrival traffic As this is a tactical procedure controlled by ATC there are no restrictions on how ATC may position aircraft for further approaches.			

Annex C - “LAMP PIR Bridging Module Analysis – Changes to population overflown by Modules A, B and C” (Version 2)

NATS has prepared an assessment of population “overflown” in support of the PIR. This focuses on the population overflown below 7,000ft.

Commentary on the specific results for Modules A, B & C are contained within the body of each respective PIR Report from the CAA. The commentary below is general and highlights points regarding the methodology used by the sponsor.

NATS has used two approaches to assess the population overflown:

- The first is a simple boundary that closely encompasses the concentrated traffic pattern below 7,000ft and a count of the population within that boundary. As a measure, this could be taken to show the population that is directly overflown on a regular basis (which NATS has defined as more than five flights per day);

- The second is a simple approximation of the methodology set out in the CAA’s document CAP1498[3]. The precise approach that is outlined in that document as not been used; NATS has not produced “overflight” contours that would enable a better understanding of extent to which locations are overflown, nor have they used the widening swathe that represents aircraft as they climb or descend. Instead they have used a standard swathe of 1,079m for aircraft up to 4,000ft and a swathe of 1,888m for aircraft between 4,000ft and 7,000ft. Using this simplified methodology has the potential to not only over-estimate the area being “overflown” but also does not reflect the frequency of being overflown, i.e. the population count in these swathes does not differentiate between people overflown rarely and those overflown frequently.

This impact was not measured or portrayed by the sponsors as part of the consultation material or the formal submission of the LAMP modules; CAP1498 did not exist at the time of the original consultation and submission by the sponsor, or the decision by the CAA. These impacts are being measured and portrayed for the first time as part of the PIR. Therefore, if we use the impacts now being presented in the PIR, we need to be aware that this method for estimating and portraying “overflights” was not part of our consideration when approving the original Airspace Change Proposals.

[3] CAP1498: “Definition of overflight”, April 2017

Annex D - CO_2 Emissions Summary

Comparing forecast CO_2 impact from the original Airspace Change Proposal (ACP) documents with the Post-Implementation Review (PIR) outputs

	Forecast for 2016 (per original ACP)				PIR Results	
ACP Module	**Base case annual "enabled" fuel saving (tonnes)**	**Base case annual "actual" fuel saving (tonnes) – reduction of 21%**	**Convert to CO_2 @ 3.18 (tonnes)**	**Range for CO_2 annual saving per ACP - i.e. 50% as low case (tonnes)**	**NATS Report (A17035, V1.0) – fuel saving (tonnes)**	**Convert to CO_2 @ 3.18 (tonnes)**
Module A - Stansted	4,298	3,395	10,796	5,398 - 10,796	3,557	11,311
Module B – London City Replications	0[4]	0	0	0	0	0
Module C – London City Network (plus Gatwick & Southend)	LCY = 4,082 Gatwick (TIMBA STARs) & Southend = 3,959 **Total = 8,041**[4] (no separate figures for Biggin Hill)	6,352	20,199	10,099 - 20,199	LCY = -3,779 Gatwick = 178 Southend = - 81	-11,709
Module D – Luton & Northolt	1,815	1,434	4,560	2,280 - 4,560	Luton = 678 Northolt = -1	2,153
Module E – South Coast (Farnborough, Southampton, Bournemouth)	-265	-209	-665	-332 - -665	Farnborough = -89 Southampton = -48 Bournemouth = -8	-461
Total	**13,889**	**10,972**	**34,890**	**17,445 – 34,890**	**407**	**1,294**

Conclusion:

The key difference in impact between the ACP and the PIR (as shown in the table above) is for Modules B & C (i.e. the changes at London City airport). An overall fuel saving and CO_2 reduction was estimated at the time of the proposal – instead the PIR shows a significant increase in fuel and CO_2 , most notably for the arrivals. For the other modules (A, D & E) the changes in CO_2 impacts are broadly consistent with the estimated ranges that were considered when the CAA decision to approve was taken.

[4] The CO_2 impacts from London City that were reported in the Bridging ACP did not distinguish between those from the Replications (Module B) or the Network (Module C) and so the entire figure for London City was reflected in this table as being Module C.

Notes:

- It should be recognised that the original estimate submitted with the ACP, as with all such CO_2 estimates, has to make various assumptions when modelling the most likely changes to fuel burn and emissions. By their nature, they include a degree of uncertainty.
- The original ACP estimate (doc 44165/RPT/144, V1.2) did specifically adjust for tactical vectoring. (For example, read the statement made in the Introduction of that document about adjusting for tactical interventions in order to reflect "actual" flight trajectories. Equally the explanation of the adjustments made in Section 6 of that document to reflect "actual" fuel burn). However, what it did not do was make any assumptions about possible changes to the rate/proportion of tactical vectoring that would occur after implementation.
- The original CO_2 analysis for the ACP modelled two years, 2016 and 2020.
- Original ACP – the fuel burn and CO_2 estimates for London City routes did reflect the sponsor's expectations of an increase in track mileage generally, but also balanced this against expected savings in holding time and improved vertical profiles for arriving aircraft. The result was that fuel savings and CO_2 reductions were forecast for London City flights.
- The analysis excludes traffic from 4 Feb 2016 to 29 Feb 2016 because it was a period of "bedding-in" for the change. It includes traffic from 1 March 2016 to 3 Feb 2017. However, the number of movements for the full year has been used when calculating an annual total.
- The PIR assessment adjusts for fleet mix to ensure it is consistent, so that the changes in fuel burn and CO_2 are not a reflection of a change in relative proportions of aircraft types.
- The anticipated number of affected arrivals in the ACP for implementation year was 116,742. In the PIR analysis the number of arrivals is actually 122,129.
- The anticipated number of affected departures in the ACP for the implementation year was 56,839. In the PIR analysis the number of departures is actually 64,715.

Annex E – Complaints Analysis

CAA ANALYSIS OF COMPLAINT DATA FROM NON-AVIATION STAKEHOLDERS

Introduction.

1. This Annex is an analysis of complaint data submitted to London City Airport (LCA), NATS, and directly to the CAA. This report considers the location of the complaint, the altitude of aircraft as they overfly the complaint location and the impact of the change on that location. From complaints data received, we have analysed the impacts of the locations from where 10 or more complainants reside. By restricting our analysis to locations with 10 or more complainants, we have been proportionate in our considerations, prioritising those locations that appear to have generated the greatest response from communities.

2. LCA has analysed the complaint data by grouping it into London Boroughs; given the way in which the location data has been submitted to the CAA (partial postcodes), it has not been possible to be any more specific than London Boroughs when assessing the location of complainants. The full set of data relating to complaints to LCA, is published in London City Airport LAMP Submission **Ref B39-B15**.

3. Complaints raised directly to NATS and to the CAA were also reviewed and commented upon in Annex C.

What we did:

- We have reviewed the complaints analysis undertaken by LCA.
- For those London Boroughs with the most complainants (10 or more), we have compared the location of the Borough against the traffic patterns (as portrayed on radar track diagrams and density plots) of the departure and arrival procedures before and after the change. This approach ensured that our analysis was not only proportionate but that it adequately considered the feedback from the majority of complainants. See Note 1.
- In terms of the density plots, LCA provided one diagram pre-implementation (June 2013) and four diagrams post-implementation (Feb, May, Aug and Nov 2016) for each departure and arrival procedure. The patterns on the four post-implementation diagrams are very similar and therefore the Aug 2016 diagram was used when comparing the density of traffic before and after the change was implemented.
- We have reviewed the complaints submitted directly to NATS.
- We have reviewed the complaints submitted to the CAA by stakeholders raising issues about the change proposal after implementation.
- We have described the traffic patterns in relation to the relevant London Boroughs and the new procedures, with the aim of identifying whether or not the complainants identified any effects that were not expected at the time of implementation.
- We noted, where relevant, it those locations were likely to be experiencing an increase or decrease in noise levels as a result of the proposed change being implemented.

Note 1. When we reviewed complaints by Borough, there was no geographical reference on track distribution data samples to accurately determine Borough boundaries. Therefore, in order to analysis the impact of the complainants provided in a Borough basis, we have interpolated Borough boundaries from a different mapping source and estimated

General conclusions:

- The implementation of this change has, for the most part, removed dispersion and introduced a more concentrated traffic pattern.
- All of the feedback received came from individuals residing in London Boroughs that were overflown before the change was implemented.
- Some locations in each of the Boroughs will be exposed to a greater concentration of traffic patterns and will therefore have experienced an increase in the number of aircraft flying overhead and in the associated noise impact. However, as a result of this concentration, other locations within the Boroughs will have fewer aircraft and should therefore be experiencing less noise.
- There was no feedback identified from locations that are likely to be experiencing a decrease in noise impact such as those communities which are likely to have fewer aircraft flying overhead because of the implementation of this change.

Table 1 - Summary of Correspondence to LCA*

Number of individual complainants	141
Number of complaints	175
Total feedback items	**175**

*London City also received four separate petitions:

- Lewisham (70 signatures)
- Waltham Forest and Redbridge Green (355 signatures) – copy sent to the CAA.
- Lewisham (91 signatures)
- Waltham Forest and Redbridge (676 signatures)

Table 2 - Summary of Correspondence to NATS

Number of individual complainants	0
Number of complaints	0
Total feedback items	**0**

Table 3 - Summary of Correspondence to the CAA*

Number of individual complainants	44
Number of complaints	46
Total feedback items	**46**

***The CAA was also presented with a copy of the Waltham Forest and Redbridge petition (355 signatures).

Table 4 – Locations for complaints to London City Airport

Top locations by feedback numbers							
London Borough (a)	**Rwy (b)**	**Number of individual complainants To LCA (c)**	**Total number of complaints to LCA (d)**	**Number of Enquiries/ Complaints to NATS (e)**	**Number of Enquiries/ complaints to the CAA (f)**	**Total Complaints (g)**	**Remarks (h)**
Waltham Forest	27 (Dep)	47	59	0	0	59	Two separate petitions (676 and 355 signatures) also received by the change sponsor from Waltham Forest and Redbridge.
Redbridge	09/27 (Dep)	16	19	0	2	21	Two separate petitions (676 and 355 signatures) also received by the change sponsor from Waltham Forest and Redbridge.
Havering	09/27 (Arr/Dep)	15	15	0	16	31	
Lewisham	09 (Arr)	13	18	0	5	23	Two separate petitions (91 and 70 signatures) also received by the change sponsor from Lewisham.
Tower Hamlets	09/27 (Arr/Dep)	12	12	0	3	15	

CAA Commentary and Comparison of Correspondents' Location to Aircraft Traffic Patterns

London Borough (and number of complaints) (1)	Typical altitude (amsl) of aircraft based on a review of radar track diagrams (2)	Location in respect departure/arrival procedures (3)	Description of traffic pattern before the change (4)	Description of traffic pattern after the change and the associated impact (5)
Waltham Forest 59 complaints (all to LCA) 47 complainants (all to LCA)	**2013** All westerly departures are between 2,000 and 4,000 feet when passing over the Borough. **2016** All westerly departures are between 2,000 and 4,000 feet when passing over the Borough.	The Borough lies below the DVR, CLN and BPK westerly departure procedures.	TRACK DENSITY DIAGRAM The track density diagrams are the most suitable set of diagrams to show the impact on Borough of Waltham Forest. **2013 westerly departure diagram.** From the 00-40 track density plots, the Borough was directly overflown with concentrated track patterns showing 20 or more flights per day. Focussing on the southern extremity of the Borough (Leyton area) there are noticeably two main patterns that can be seen; there is a denser pattern which passes over Leyton, whilst there is a less dense pattern located further to the west (towards the Hackney Marshes area).	TRACK DENSITY DIAGRAM The track density diagrams are the most suitable set of diagrams to show the impact on Borough of Waltham Forest. **2016 westerly departure diagrams** From the 00-40 track density plots, a more concentrated track pattern is noticeable over the southern (Leyton) and northern (Chingford) extremities of the Borough. The purple shading indicates that since the change there are more aircraft flying concentrated patterns along the departure routes passing over the Borough. We therefore conclude that the impact of the change is that the Borough is still considered as being overflown. Whilst some locations in the Borough will be seeing an increase in the number of aircraft flying overhead and therefore experiencing an increase in noise impact, other areas will have fewer aircraft and should be experiencing less noise.

London Borough (and number of complaints) (1)	Typical altitude (amsl) of aircraft based on a review of radar track diagrams (2)	Location in respect departure/arrival procedures (3)	Description of traffic pattern before the change (4)	Description of traffic pattern after the change and the associated impact (5)
Boroughs to the north of London City airport in relation to arrivals.			**Arrivals – In General.** **Runway 09.** Prior to the change, arrivals for Runway 09 from Lambourne would be vectored towards the south and from the track density diagrams, traffic is evident just to the west of the Romford gyratory, then passing over Dagenham. **Runway 27.** Prior to the change arrivals for Runway 27 were sometimes vectored over Romford then positioned to join the arrival pattern on the extended centreline from the south east, but the main core of direct arrivals is vectored to the east of Upminster.	**Arrivals in general.** **Runway 09.** In 2016, this Runway 09 arrival pattern was no longer evident as aircraft are following the revised arrival flightpaths. **Runway 27.** In 2016, this Runway 27 arrival pattern is no longer evident in the same manner as aircraft are following the revised arrival flightpaths. However, those aircraft which have had to execute a missed approach, for example in the strong winds of Storm Imogen in February 2016, are vectored over Romford for re- positioning to join the arrival sequence.
Redbridge 21 complaints (19 to LCA and 2 to CAA) 18 complainants (16 to LCA and 2 to CAA)	**2013** All westerly departures are between 2,000 and 4,000 feet when passing over the Borough.	The Borough lies below the DVR, CLN and BPK westerly departure procedures. It also lies below the easterly BPK	TRACK DENSITY DIAGRAM The track density diagrams are the most suitable set of diagrams to show the impact on the Borough.	TRACK DENSITY DIAGRAM The track density diagrams are the most suitable set of diagrams to show the impact on the Borough.

London Borough (and number of complaints) (1)	Typical altitude (amsl) of aircraft based on a review of radar track diagrams (2)	Location in respect departure/arrival procedures (3)	Description of traffic pattern before the change (4)	Description of traffic pattern after the change and the associated impact (5)
	All easterly departures are between 2,000 and 7,000 feet when passing over the Borough. **2016** All Westerly Departures are between 2,000 and 4,000 feet when passing over the Borough. All Easterly Departures are between 2,000 and 7,000 feet when passing over the Borough.	departure procedure.	**2013 westerly departure diagram.** From the 00-40 track density plots, the Borough was directly overflown with concentrated track patterns showing 20 or more flights per day. The plots also show a considerable amount of dispersion over the southern parts of the Borough. **2013 easterly departure diagram.** From the 00-40 track density plots, the Borough was directly overflown with concentrated track patterns showing 20 or more flights per day. Focussing on the BPK departure procedure, there is some dispersion over the Ilford area. See above for arrivals.	**2016 westerly departure diagram.** From the 00-40 track density plots, there is significantly less dispersion over the southern parts of the Borough as the tracks associated with the westerly DVR and CLN departure procedures are clearly much more concentrated. With regards to the BPK departure, the pattern has become wider over the Woodford Green area. **2016 easterly departure diagram.** From the 00-40 track density plots, the tracks associated with the easterly BPK departure procedure are more concentrated over the Ilford area. We therefore conclude that the impact of the change is that the Borough is still considered to be overflown. Whilst some locations in the Borough will be experiencing an increase in the number of aircraft flying overhead and therefore experiencing an increase in noise impact, other areas will have fewer aircraft and should be experiencing less noise. See above for arrivals.

London Borough (and number of complaints) **(1)**	**Typical altitude (amsl) of aircraft based on a review of radar track diagrams** **(2)**	**Location in respect departure/arrival procedures** **(3)**	**Description of traffic pattern before the change** **(4)**	**Description of traffic pattern after the change and the associated impact** **(5)**
Havering 31 complaints (15 to LCA and 16 to CAA) 17 complainants (15 to LCA and 2 to CAA)	**2013** All easterly departures are between 2,000 and 7,000 feet when passing over the Borough. **2016** All easterly departures are between 2,000 and 7,000 feet when passing over the Borough.	The Borough lies below the DVR and CLN westerly and easterly departure procedures. Before the change, it also lies below the base leg approach path for westerly arrivals. And to some extent the easterly arrivals. When the change was implemented, the arrival flight paths changed – see Column 5	TRACK DENSITY DIAGRAM The track density diagrams are the most suitable set of diagrams to show the impact on the Borough. **2013 westerly departure diagram.** From the 00-40 track density plots, the Borough was directly overflown with a great deal of traffic dispersion appearing across the central area of the Borough. **2013 easterly departure diagram.** From the 00-40 track density plots, the Borough was directly overflown with a great deal of traffic dispersion appearing across the southern area of the Borough. **2013 westerly arrival diagram.** From the 00-40 track density plots, the Borough was directly overflown; there is clearly a concentrated pattern	TRACK DENSITY DIAGRAM The track density diagrams are the most suitable set of diagrams to show the impact on the Borough. **2016 westerly departure diagram.** From the 00-40 track density plots, the pattern is more concentrated over the Borough and this concentration is aligned with the centreline of the new DVR and CLN departure procedures. There is also some concentration (5 to 9.9 flights a day) located to the south of these procedures, which passes over the Romford and Hornchurch areas. **2016 easterly departure diagram.** From the 00-40 track density plots, the pattern is more concentrated over the Borough. However, the concentration is not quite aligned with the centreline of the new DVR and CLN departure procedures, particularly around the initial left-hand turn to the north and the subsequent right-hand turn to the east. **2016 westerly arrival diagram.** From the 00-40 track density plots, there is very little traffic dispersion over the Borough, with the majority of traffic

London Borough (and number of complaints) (1)	Typical altitude (amsl) of aircraft based on a review of radar track diagrams (2)	Location in respect departure/arrival procedures (3)	Description of traffic pattern before the change (4)	Description of traffic pattern after the change and the associated impact (5)
			over the southern extremity of the Borough (Rainham Marshes), there is also some traffic dispersion over the eastern boundary of the Borough. See above for arrivals.	concentrated on the final approach path which passes over the southern extremity of the Borough (Rainham Marshes). We therefore conclude that the impact of the change is that the Borough is still considered as being overflown. Whilst some locations in the Borough will be experiencing an increase in the number of aircraft flying overhead and therefore experiencing an increase in noise impact, other areas will have fewer aircraft and should be experiencing less noise. See above for arrivals.
Lewisham 23 complaints (18 to LCA and 5 to CAA) 17 complainants (13 to LCA and 5 to CAA)	Aircraft must have reached 2000ft by the time they are passing south of LCA, and remain level at 2000ft until descent on final approach (after London Bridge).	Lambeth is directly overflown by the easterly arrival procedure.	TRACK DENSITY DIAGRAM The track density diagrams are the most suitable set of diagrams to show the impact on the Borough. **2013 easterly arrival diagram.** From the 00-40 track density plots, the main core of arrivals passes directly over the Borough.	TRACK DENSITY DIAGRAM The track density diagrams are the most suitable set of diagrams to show the impact on the Borough. **2016 easterly arrival diagram.** From the 00-40 track density plots, the tracks are noticeably more concentrated and for the most part, there is good alignment with the new arrival procedure, albeit on the southern extremity of it.

London Borough (and number of complaints) **(1)**	**Typical altitude (amsl) of aircraft based on a review of radar track diagrams** **(2)**	**Location in respect departure/arrival procedures** **(3)**	**Description of traffic pattern before the change** **(4)**	**Description of traffic pattern after the change and the associated impact** **(5)**
				We therefore conclude that the impact of the change is that the Borough is still considered as being overflown. Whilst some locations (e.g. Catford) in the Borough will be experiencing an increase in the number of aircraft flying overhead and therefore experiencing an increase in noise impact, other areas will have fewer aircraft and should be experiencing less noise.
Tower Hamlets 15 complaints (12 to LCA and 3 to CAA) 15 complainants (12 to LCA and 3 to CAA)	**2013** All westerly departures are between 1,000 and 4,000 feet when passing over the Borough. **2016** All westerly departures are between 1,000 and 4,000 feet when passing over the Borough.	The Borough lies below the DVR, CLN and BPK westerly departure procedures. It also lies below the final approach path for easterly arrivals.	TRACK DENSITY DIAGRAM The track density diagrams are the most suitable set of diagrams to show the impact on the Borough. **2013 westerly departure diagram.** From the 00-40 track density plots, the main core of westerly departure procedures passes overhead of the Borough. **2013 easterly arrival diagrams.** From the 00-40 track density plots, the Borough was directly overflown	TRACK DENSITY DIAGRAM The track density diagrams are the most suitable set of diagrams to show the impact on the Borough. **2016 westerly departure diagram.** From the 00-40 track density plots, the concentrated traffic pattern seems to have widened around the northern extremity of the Borough (Bow area). Although there is good alignment when comparing the traffic pattern with the new BPK and DVR procedures, the pattern suggests that the aircraft are performing in a slightly different way to what the procedure had intended. **2016 easterly arrival diagram.** From the 00-40 track density plots, there is very little difference in the traffic

London Borough (and number of complaints) (1)	Typical altitude (amsl) of aircraft based on a review of radar track diagrams (2)	Location in respect departure/arrival procedures (3)	Description of traffic pattern before the change (4)	Description of traffic pattern after the change and the associated impact (5)
			with a clear concentration of traffic on the final approach path.	pattern; this is unsurprising given the close proximity of the Borough to the airport. We therefore conclude that the impact of the change is that the Borough is still considered as being overflown. Whilst some locations (e.g. Catford) in the Borough will be experiencing an increase in the number of aircraft flying overhead and therefore experiencing an increase in noise impact, other areas will have fewer aircraft and should be experiencing less noise.