Safety and Airspace Regulation Group

Report of the CAA's Post Implementation Review of the London Airspace Management Programme (LAMP) Phase 1A Module D Airspace Change Proposal – London Luton Airport: Standard Instrument Departure (SID) Switch Proposal

CAP 1692 D

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This report is part of a series of PIR reports for LAMP Phase 1A Airspace change proposal implemented on 4 February 2016.

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The latest version of this document is available in electronic format at www.caa.co.uk

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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 to 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. Stage 7 of this process is a Post Implementation Review (PIR) that normally begins one year after introduction of the revised procedures. There are five individual elements (referred to as Modules) of the LAMP Phase 1A proposal.

2. NATS submitted a proposal to the CAA to switch aircraft using the Standard Instrument Departure (SID) route via Detling to Dover, onto the existing MATCH SIDs routeing towards Clacton until aircraft could be radar vectored by Air Traffic Control towards Kent to exit UK airspace at KONAN (approximately 24 NM to the east of Dover), or via a low used route via RINTI (approximately 12NM southeast of Dover).

3. 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 on 18 October 2017. The content and outcome of this review process by the CAA is discussed in detail in this report including its annexes.

4. On 2 January 2018, the CAA introduced a new process for making a decision whether or not to approve proposals to change airspace design (CAP 1616). 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).

5. During the review process, the CAA considered data provided by the sponsor, NATS. As a result, the CAA has reached the following conclusions:

Operational Conclusion:

6. From an efficient use of airspace viewpoint, the SID switch has been successful in that it has taken the main core of Detling departures away from the London City EKNIV departure flight paths onto the flight path of the extant MATCH SIDs and then subsequent routeing to KONAN via airway M85 (albeit aircraft are vectored by ATC and integrated with other traffic). Thus, this has enabled the change proposed by the network changes in Module C in which the London City departures using the EKNIV SIDs to the south/southeast are now able to climb above the new London City arrival flight paths. Without the Luton and Northolt SID switch taking place, this would not have been achievable.

7. The re-routed Detling departures now using the MATCH SIDs are achieving a better continuous climb than they previously did using the Detling SIDs.

8. The re-routeing of the Detling departures have been integrated into the London Terminal Control and Area Control operations without causing disruptions to other traffic flows, thus from an ATC airspace management viewpoint, the SID switching has achieved the aims and objectives of the change proposal.

Environmental Conclusion

9. The noise impact is not as anticipated. Our decision was taken on the basis that there would be no change to traffic patterns below 7000ft and therefore no noise impact anticipated or taken into account. However, the impact that is revealed by the PIR is benefit; a general improvement in climb profile has resulted in fewer aircraft being held at altitudes below 7000ft which in turn has resulted in a reduction in the area regularly overflown below 7000ft and a related reduction in noise impact.

10. This Module has achieved a reduction in annual CO_2 emissions that is consistent with the anticipated reduction.

Confirmation of LAMP Phase 1A Module D Implementation

11. In respect of Module D of LAMP Phase 1A the CAA confirms that this change is now confirmed. Therefore, the CAA's airspace change process in respect of NATS' airspace change request dated 16 February 2015 has now concluded.

12. 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. 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

13. 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).

14. 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.

15. 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.

16. 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

17. 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 Luton airport SIDs were proposed as Module D which is the subject of this report. In our Decision document dated 22 December 2015 (as corrected on 4 March 2016), 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

18. The following conditions were placed on the sponsor:

- When D138A is activated by NOTAM above the normal upper limit of 6000ft, NATS is to radar monitor all aircraft using (U)M84 to ensure that aircraft are kept clear of D138A.

No Mandatory Occurrence Reports were raised concerning inadvertent penetration of D138A, therefore the CAA is satisfied this condition has been met.

Relevant events since change

19. Since the implementation of this ACP, aircraft movements at Luton which have flight planned to use the Detling and MATCH have increased as follows:

Table 1 – Luton SID usage comparison.

Pre-implementation SID usage 4 Feb 15 – 3 Feb 16			Post Implementation SID Usage 4 Feb 16 – 3 Feb 17		
DET	12,742	(42.8%)	DET	123	(0.4%)
MATCH	17,446	(57.8%)	MATCH	34,483	(99.6%)
Total	30,188		Total	34,606	

Data provided by sponsor

The Luton data illustrates that from 4th February 2016 the overall departures on both Detling and MATCH SIDs has increased considerably from 30,188 to 34,406 an increase of 4218 movements (approximately 14%) through Detling and Dover although the number of Detling SIDs is extremely low.

Since the implementation of this ACP, aircraft movements at Northolt which have flight planned to use the Detling and MATCH have reduced as follows:

Table 2 – Northolt SID usage comparison.

Pre-implementation SID usage 4 Feb 15 – 3 Feb 16			Post Implementation SID Usage 4 Feb 16 – 3 Feb 17		
DET	1,256	(62.2%)	DET	4	(0.2%)
MATCH	763	(37.8%)	MATCH	1,844	(99.8%)
Total	2,019		Total	1,848	

Data provided by sponsor

Data collected for the purpose of the PIR

Sources of Information

Change Sponsor

20. 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 the evidence provided 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.

21. During the review process, the CAA considered:

    - Route utilisation data.
    - Radar track data samples pre, and post change.
    - NATS analysis of the impacts of the change.
    - Mandatory Occurrence Report (MOR) data.

22. We have noted that the change sponsor provided all of the data requested. Where we have asked for subsequent explanatory detail, we have made reference to this in our report.

Operators and Airlines

23. No specific data was required from operators and airlines as the proposal moved aircraft from flying the Detling SIDs onto the extant MATCH SIDs, and

therefore we have seen no specific feedback from aircraft operators relating to Module D.

Air Navigation Service Provider

24. 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.

Groups and residents local to Luton and Northolt Airport

25. The CAA did not receive any particular feedback relating to impacts of this change.

Other data we have considered

26. No other data was received for this Module.

Objectives and Anticipated Impacts

The original proposal and its objectives

27. NATS explained in its change proposal that:

- The change was sponsored by NATS.
- Flights that currently depart Luton and Northolt Airports towards Kent (south east) were becoming more inefficient as the airspace they flew through became more congested. This proposal sought to place most of these flights onto the extant eastbound departure flight paths, so that they may avoid the congestion; this was to reduce the risk of delay, reduce fuel consumption and the amount of CO_2 generated.
- There would also be overall noise benefits since the aircraft would be able to climb more quickly and people beneath the current departure route would be overflown less; however, people beneath the eastbound departure route would be overflown more often.
- This change would also ensure that the Luton and Northolt operation fits into a wider LAMP Phase 1A programme of change to the use of airspace structures supporting airports in South East England. NATS believed that this part of the proposal was justified on the basis of the direct fuel and CO_2 benefits; however, it was also an enabler for the implementation of Point Merge at London City Airport. This was because the removal of extant SIDs which are procedurally capped at 5000ft would enable the London City departures to climb above the London City arrivals which the proposal would reposition over the Thames Estuary (see Module C for details).

28. In our decision we explained that:

- The re-routeing of Luton and Northolt SIDs via MATCH would enable an improvement in the efficiency of integrating traffic through the busy controlled airspace in the south-east of England, in particular, through the

very busy and congested area in the vicinity of and above Detling. Prior to the change, the Luton departures were routinely held below arriving traffic inbound to Heathrow. (Other traffic departing from Stansted and London City also follow similar routeings as the Luton and Northolt traffic towards Detling, and like the Luton and Northolt SIDs, were subject to similar restrictions in climb profiles.) This would no longer be necessary if the changes proposed in Module A, B and C were approved.

- Moreover, it was anticipated that by removing the Luton and Northolt departures from this busy flow, this would alleviate the traffic congestion and enable better departure profiles to be achieved by the London City departures to the south-east which is described in Module C. In turn, these changes to routeings would not only enable better climb profiles for Luton and Northolt departures, they would also enable better climb profiles for London City departures. This was because the London City departures would be able to climb earlier without having to be integrated with the Luton and Northolt departures; this enabled more efficient and semi-systemised arrival routes for London City. When Module D and the changes outlined in Module A for Stansted departures are combined with the proposals for London City network changes in Module C, the end result was anticipated to be that the whole LAMP Phase 1A design package produces an overall more efficient route network: not just for traffic departing from Luton and Northolt (outlined in this Module), but also for Stansted departures (proposed in Module A), and the new network arrival system for London City as proposed in Module C.

Anticipated Impacts

29. In our decision, the CAA Environmental Assessment concluded that despite the extra lateral track miles there would be an overall reduction in CO_2 emissions resultant from a reduction in fuel burn due to an improvement in vertical profile of the affected departing aircraft. In particular, the CAA's Environmental Research and Consultancy Department (ERCD) Environmental Assessment Report concluded that:

- The re-routed SIDs could be managed safely on the MATCH SID routeing and integrated with all other routes in the south-east. Whilst this was expected to result in up to an extra 8NM in track mileage compared with the distance to Dover using the Detling SID, the extra track miles were offset by the benefits realised with the improved climb performance. The CAA Environmental Assessment concluded that despite the extra track miles, there was expected to be an overall reduction in CO2 emissions resulting from a reduction in fuel burn. In particular, the CAA's Environmental Research and Consultancy Department (ERCD) Environmental Assessment report concluded that:
  Based upon the assessment presented in the ACP (the overarching Environmental Benefits Section – see Reference B), and the subsequent adjustment by the CAA, the annual estimate for the CO_2 reduction as a result of this Module (once the enabled fuel figures have been adjusted to account for tactical vectoring, a reduction of 21%) is a range from 2,280 – 4,560 tonnes in 2016 (1,439 tonnes of fuel x 3.18) and a range from 2,726 – 5,451 tonnes in 2020 (1,714 tonnes of fuel x 3.18).

30. In terms of anticipated noise impact, the CAA concluded that because all affected aircraft (that is aircraft displaced or located differently as a consequence of the proposed change) would be above 7000ft AMSL, there would be no significant noise impact. Nevertheless, we acknowledged that there would be a difference in traffic flows above 7000ft AMSL, and as a consequence of that, there was also likely to be a change in the noise impact from aircraft above 7000ft AMSL, but because of the altitude of the flights any such noise impact would be minor even if the noise is perceptible by some.

CAA Assessment

Operational Assessment

31. 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 an analysis of the re-routed traffic and compiled a report which is at Annex B. The following is a summary of the CAA's conclusions.

Safety

32. Statistics concerning MOR, AIRPROX and Air Safety Reports events were examined to assess whether the revised airspace design was a contributory factor in those incidents or in reducing the number of incidents.

33. Regarding the Annex A requirements, NATS provided evidence to satisfy all the PIR requirements. Regarding requirement D1, no MORs appeared to have specific reference to Luton or Northolt departures, although in two overload reports, presentation of traffic to Maastricht area control centre appears to have been an issue, but it was unclear if this was associated with Stansted or Luton departures. These occurrences were early on during the first year of operations and were most likely associated with controller familiarity with the new procedures. There were no further reports in the first year of operations.

Operational Feedback

34. There has been no feedback to the sponsor from the operators.

35. Feedback received from other airports regarding the impacts this ACP has had on their operations is covered in the other LAMP PIR Modules.

Air Navigation Service Provision

36. Whilst we noted some of the overload incidents reported to us, in the absence of any further issues being notified, once controllers gained familiarity with the new procedures, the re-routeing of Luton and Northolt SIDs via the MATCH routeing appears to have been successful from an ATC viewpoint.

37. There was no specific change in controlled airspace relating to this Module, therefore no other airspace users are impacted by this change.

38. There has been a notable climbing performance improvement for Luton departures.

39. NATS has stated that 32% of departures have moved from the below FL100 band into the FL150-FL200 band as departures pass through the red gate shown in Figure 5 of the PIR data which is a result of the SID switch change. We also note that a higher percentage of departures (now 56%), compared to 23% moved into the band FL150-FL200 when passing through the red gate. We would agree with the NATS analysis and conclude that Luton and Northolt departures are therefore achieving improved climb profiles.

Letters of Agreement

40. Whilst the use of M85 was subject to the activity on the Shoeburyness Danger Area complex (EGD138 etc), this change has not impacted other stakeholders' activities.

41. When danger area activity in D138 is notified above 13,000ft on an occasional basis only, such notification would necessitate a re-routeing from M85 onto (U)M84; this only occurred on eight occasions throughout the first year. With airway M84 being aligned east of the danger area D138A NATS controllers were also to ensure aircraft were kept clear of D138A when activation was notified above its normal upper limit of 6000ft (as per condition of the approval). This has not affected the operating arrangements with the MOD danger area authority and therefore there has been no impact to danger area operations.

Utilisation and Track Keeping

42. The CAA carried out an analysis of the traffic patterns achieved by viewing traffic samples in the commentary provided by NATS (D3-data-D-Env2-D-Env3 v 3.1). The analysis report is detailed in Annex B. The commentary is included with the data on the CAA website.

43. The track plot data provided illustrates the traffic flows before the change and the likely forecast distribution of traffic above 7000ft after the change, together with the actual track plots flow by Luton and Northolt departures in the 10-day

traffic sample. The results have demonstrated that the expected track distribution after BPK has been as expected with the rerouted Detling SIDs.

Traffic

44. There was an increase in traffic departing from Luton using the Brookmans Park SIDs and a slight decrease in Northolt departures. This was covered in paragraph 19.

Environmental Assessment

Noise

45. In making our original decision, we accepted the sponsor's rationale and evidence that this Module would not affect aircraft below 7000ft, and on that basis we were satisfied that no assessment or further consideration of noise impacts was required.

46. In undertaking this PIR we have sought evidence that this expectation has been borne out, namely there has been no change to traffic patterns below 7000ft, either laterally or vertically, as a result of the airspace change. The sponsor has analysed radar tracks for two representative samples of departures from Luton and Northolt, to allow a comparison between pre- and post-implementation traffic patterns.

47. These track diagrams / whisker plots clearly show that there has been a change in traffic pattern, specifically the general absence of tracks beyond the BPK waypoint and none beyond MATCH in the post-implementation illustration whereas in the pre-implementation sample there are a number of tracks that continue much further beyond these points. In particular the sponsor has used a "gate analysis" to show that the proportion of traffic within an altitude band of FL68-FL75 has changed from 22% of departures to 1% of traffic, in conjunction with a clear reduction in aircraft below FL75. These track diagrams plus the associated gate analysis support a conclusion that there has been a change in traffic pattern below 7000ft.

48. This change in traffic pattern below 7000ft was not expected based upon the proposal and was therefore not considered as part of the potential environmental impacts (other than to conclude there would be no change to noise impacts below 7000ft) that would result from the proposal. When making

our decision on the airspace change we did not consider that there would be a noise impact below 7000ft, either positive or negative.

49. However, the change in traffic pattern below 7000ft is consistent with the evidence of an improvement in climb profile, and shows that there are fewer aircraft being held at altitudes below 7000ft because more aircraft are achieving a continuous climb following implementation of the airspace change. More so, if fewer aircraft are being held at altitudes below 7000ft, this will result in a reduction in noise impact, particularly for those locations that would have been previously overflown by those aircraft. Whilst this positive impact would not be assessed as significant, it is still likely to have resulted in a minor benefit for those locations no longer regularly overflown at those altitudes.

CO_2 Emissions

50. The ACP forecast an average additional 8NM for Luton and Northolt departures re-routed via the MATCH SIDs. The PIR Fuel and CO_2 analysis shows that the actual change in track mileage has been an average increase of 2NM per flight.

51. The impact of the Module D change has been such that departures from Luton have benefitted from this change resulting in improved fuel burn and CO_2 emissions due to an improvement in vertical profiles that has compensated for an increase in lateral track mileage. Whilst Northolt departures also had an average increase in track mileage of 2NM, this has resulted in a slight increase in fuel burn and CO_2 emissions.

52. Module D has achieved a CO_2 reduction that is slightly less than the estimated change in emission that was proposed and considered when the CAA made its decision to approve the proposed airspace change. However, that difference is minor and the impact is consistent with the range of anticipated CO_2 emission reduction.

53. Further detail of the PIR assessment of the change in fuel burn and CO_2 emissions can be found in Annex C of this report which summarises the impacts across all of the LAMP Phase 1A Modules.

Community Stakeholder observations

54. As detailed above, the implementation of Module D affected aircraft activity above 7,000 feet amsl. Whilst we acknowledged in our regulatory decision that

"there will be a difference in traffic flows, and as a consequence, noise" we also reached the conclusion that "because of the altitude of the flights any such noise impact will be minor even if the noise is perceptible by some". As a result of these conclusions, the CAA determined that there was no requirement for the change sponsor to collate related stakeholder observations following the implementation of Module D.

55. The Air Navigation (Civil Aviation Authority) Directions 2001 places a duty on the CAA to provide a focal point for receiving and responding to aircraft related environmental complaints from the general public. This duty is fulfilled through the online Airspace Use Report (FCS 1521) form and a review of the associated database indicates that the CAA has received no direct feedback that can be positively ascribed to Module D.

Ministry of Defence Operations

56. Operations by the Ministry of Defence were not affected by the proposals in Module D other than traffic from RAF Northolt being required to follow the re-routeing via the MATCH SIDs.

Conclusion

Operational Conclusions.

57. From an efficient use of airspace viewpoint, the SID switch has been successful in that it has taken the main core of Detling departures away from the London City EKNIV departure flight paths onto the flight path of the extant MATCH SIDs and then subsequent routeing to KONAN via airway M85 (albeit aircraft are vectored by ATC and integrated with other traffic). Thus, this has enabled the London City departures using the EKNIV SIDs to the south/southeast to climb above the new London City arrival flight paths. Without the Luton and Northolt Stansted SID switch taking place, this would not have been achievable.

58. The re-routed Detling departures now using the MATCH SIDs are achieving a better continuous climb than they previously did using the Detling SIDs.

59. From the data received, the re-routeing of the Detling departures have been integrated into the London Terminal Control and Area Control operations without causing disruptions to other traffic flows, thus from an ATC airspace management viewpoint, the SID switching has achieved the aims and objectives of the change proposal.

Environmental Conclusions.

60. The noise impact is not as anticipated. Our decision was taken on the basis that there would be no change to traffic patterns below 7000ft and therefore no noise impact anticipated or taken into account. However, the impact that is revealed by the PIR is benefit; a general improvement in climb profile has resulted in fewer aircraft being held at altitudes below 7000ft which in turn has resulted in a reduction in the area regularly overflown below 7000ft and a related reduction in noise impact.

61. This Module has achieved a reduction in annual CO_2 emissions that is consistent with the anticipated reduction.

Note on plain language

62. 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. Luton & Northolt SID switch proposal, usage and CAA analysis of change.

Annex C. CO_2 Emissions Summary

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

LAMP PHASE 1A PIR DATA PROVISION REQUIREMENTS
ANNEX A TO LAMP PHASE1A PIR REVIEW REQUIREMENTS DATED 20 MAY 2016

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).
  1.
- 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				
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 D Operational	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

Source Material	Data Required	Remarks	Responsibility	Evidence
D1				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 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.	See note 3 and 4.	NATS	See evidence filename: D3-data-D-Env2-D-Env3-commentary See Bridging Module files: Bridge-Fuel-CO2-Analysis

Source Material	Data Required	Remarks	Responsibility	Evidence
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

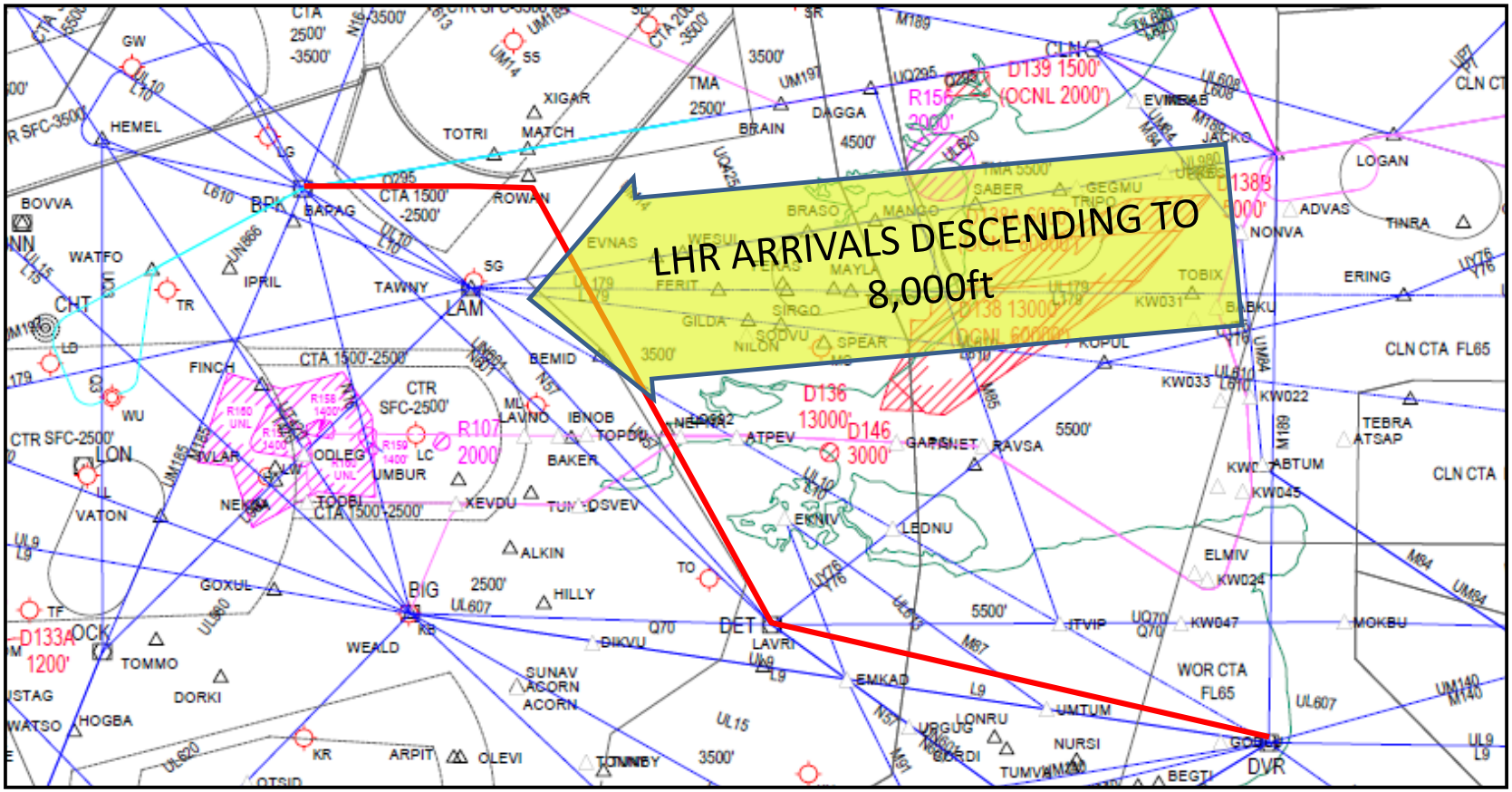
Annex B - Module D – Luton & Northolt SID switch proposal, usage and CAA analysis of change

SID flight planned routeings before the change.

From the ACP diagrams reproduced below from the ACP Fig 3, all MATCH SIDs track to Brookmans Park (BPK) VOR (navigation beacon) then route eastbound to MATCH (a navigation waypoint at Matching Green), then towards Clacton on ATS route Q295, although traffic is predominately radar vectored before BPK due to other interacting traffic and do not always follow the precise SID routeing after BPK.

All Detling (DET) SIDs track to BPK, then route towards the east for approximately 10NM before turning towards Detling, after which they either route to Dover or Lydd as appropriate, although traffic is predominately radar vectored due to other interacting traffic and do not always follow the precise SID routeing prior to or after BPK.

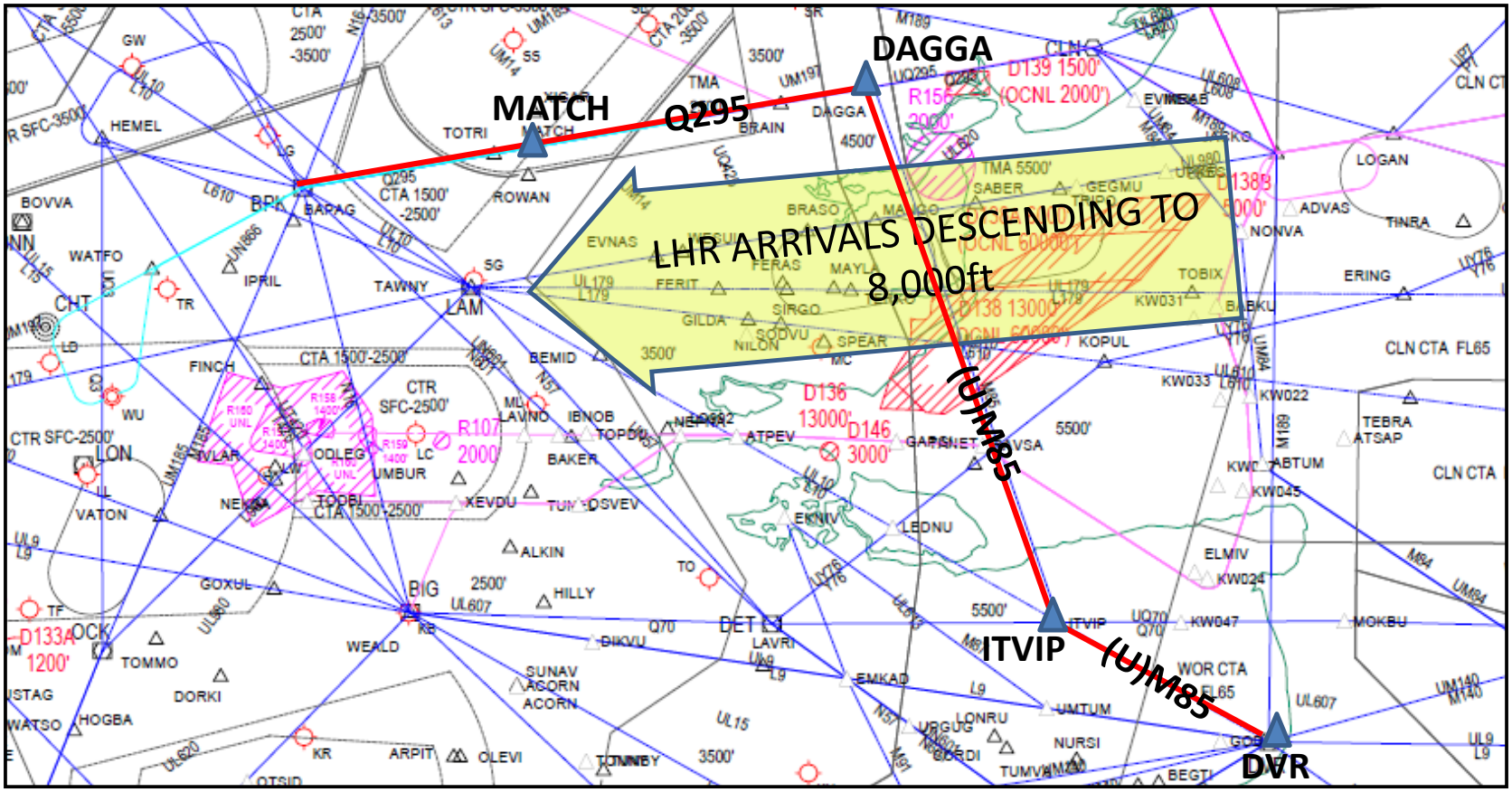
ACP Figure 1: Pre-change Luton, Northolt departure situation



SID flight planned routeings after the change.

The SID switch re-routeing (reproduced below from the ACP Fig 4) illustrated that departures would follow the routeing towards Clacton using the MATCH SID, but at a position DAGGA, they would then join a new route (M85) towards ITVIP then Dover (DVR) then resume the pre-change routes to leave UK airspace.

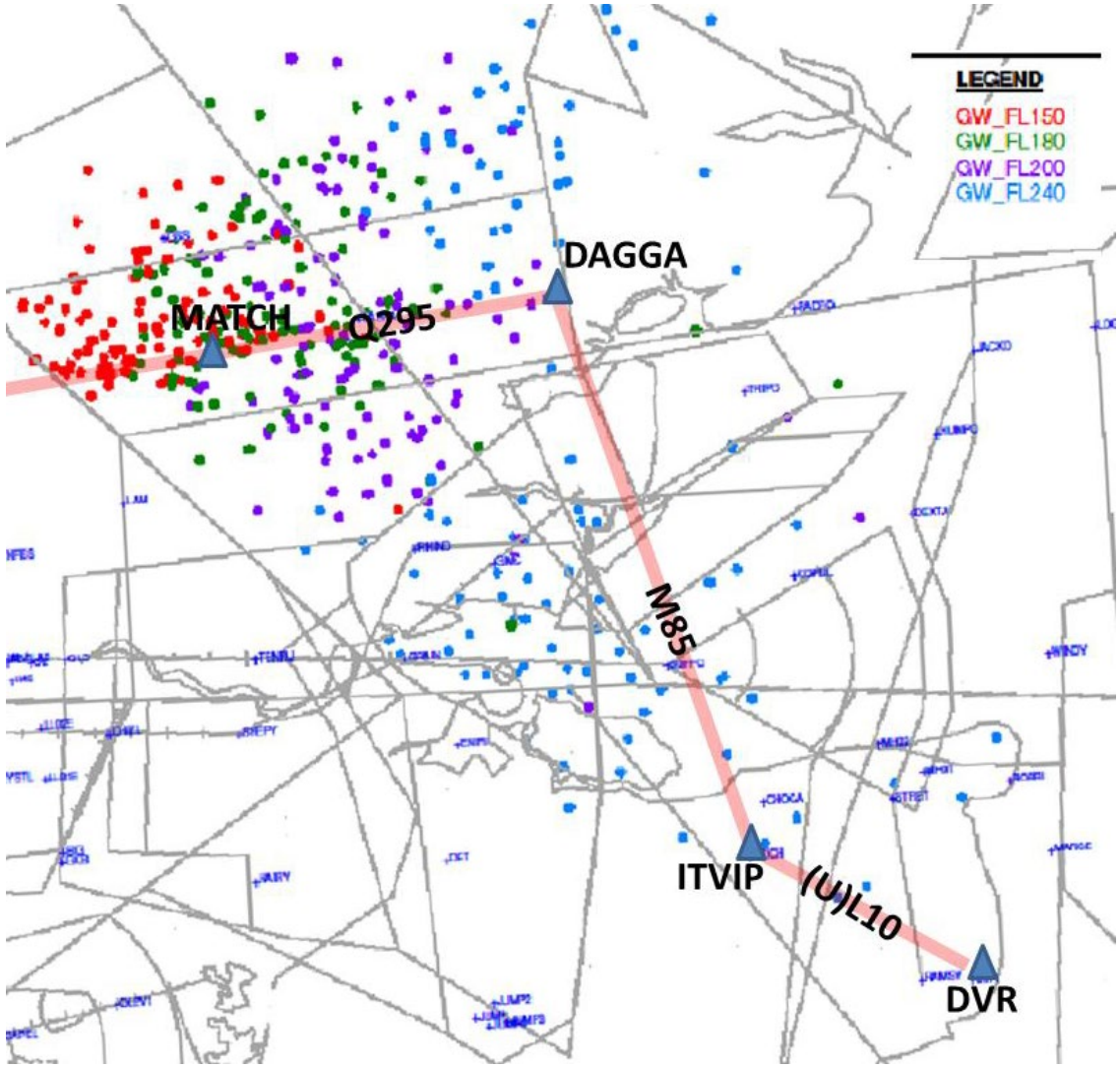
ACP Figure 2: Proposed Luton, Northolt departure situation



After the change, NATS forecast that in practice, most Luton and Northolt departures were expected reach FL150 before DAGGA and would be tactically turned off the Q295 on a southerly heading when they were sufficiently above any conflicting Heathrow traffic.

Variation in climb performance and conflicting Heathrow traffic would result in a spread of flights turning south from Q295. This spread would be from around MATCH out to DAGGA. The tactical turn south would generally be at levels between FL150 and 200 – as shown in Figure 5 below which is data taken from the 'Real Time' simulation before the change.

The ACP Figure 5 (reproduced below from the ACP) demonstrates that only a very small proportion of Luton and Northolt departures were expected to be held at FL150 to cross beneath the Heathrow arrivals (i.e. there is only one aircraft that does this in the real-time sample shown overleaf – represented by the single red dot over South Essex). The coloured dots reflect the expected altitudes as illustrated in the legend.



ACP Figure 3: Plot from real-time simulation showing Luton and Northolt departures passing FL150, FL180, FL200 and FL240

Summary of route utilisation including traffic numbers.

PIR data supplied by NATS (reproduced below from data version 1) illustrates traffic numbers prior to, and after the change:

	Pre-implementation SID usage 4 Feb 15 – 3 Feb 16	Post Implementation SID Usage 4 Feb 16 – 3 Feb 17	CAA Remarks
Luton	DET 12,742 (42.8%) MATCH 17,446 (57.8%) Tot 30,188	DET 123 (0.4%) MATCH 34,483 (99.6%) Tot 34,606	
Northolt	DET 1,256 (62.2%) MATCH 763 (37.8%) Tot 2,019	DET 4 (0.2%) MATCH 1,844 (99.8%) Tot 1,848	

The Luton data illustrates that from 4th February 2016 the overall departures on both DET and MATCH SIDs has increased considerably from 30,188 to 34,406 an increase of 4218 movements through Detling and Dover although the number of DET SIDs is extremely low.

Flights using the Detling SID Routeing.

From additional PIR data (version 2) in Slide 4, NATS added that the use of the Luton Detling SIDs in 2016-2017(123) reflects that most of the Luton departures using this SID are positioning flights to Gatwick (there were 105 of these flights). There were very few Northolt departures using this route.

Flights routeing via RINTI to via the MATCH SID and M85.

The route for Luton departures leaving UK airspace via RINTI (RINTI is located mid English Channel) is now mostly flown by traffic flying the MATCH SID, then joining the Route M85 to ITVIP then L10 to Dover then RINTI. Again, there are few Northolt departures using this route.

PIR Track dispersion plots

The sponsor provided a 10-day sample of track dispersion plots comparing traffic patterns of Luton and Northolt departures between 1-10 August 2015 with the traffic patterns experienced after the change during 1-10 August in 2016. Our assessment of these traffic patterns and their impacts are set out in Table 1 below.

General observations from the track dispersion plots

- Evidence for improvement in climb profiles, as expected.

- Post-implementation there are few departures using either Detling SID, therefore resulting in fewer aircraft overflying those areas and locations that had previously been overflown by the Detling departures.
- The traffic patterns are generally as expected with the exception of the change in traffic patterns of aircraft below 7000ft.

Table Key:

Column (a) illustrates the PIR data reference diagrams.

Column (b) is the anticipated impact as forecast in the ACP.

Column (c) is a commentary on the description of traffic dispersion on the Match and Detling SIDs prior to the change.

Column (d) is a commentary on the description of traffic dispersion on the Match and Detling SIDs after the change.

Column (e) indicates CAA remarks.

Table 1 – Luton & Northolt SID Switch analysis.

Track Analysis **(a)**	**Anticipated impact as forecast in the ACP** **(b)**	**Pre-implementation SID usage 2013 Track Commentary 10-day** **10-day sample period: 1 Aug 15-10 Aug 15** **(c)**	**Post Implementation SID Usage Actual 2016 Track Commentary on Match SID track plot** **10-day sample period: 1 Aug 16 – 10 Aug 16** **(d)**	**CAA Remarks** **(e)**
Flight Planned routeing as portrayed in the ACP & SID charts	The existing flight planned route was shown in the ACP at Fig 3; the proposed flight planned route was shown in the ACP at Fig 4.			
ACP Page 13 and PIR submission Page 7 & 8 Luton & Northolt deps	**Forecast traffic distribution** **ACP page 13 (NATS description)** In practice, most Luton and Northolt departures were expected to reach FL150 before DAGGA and be tactically turned off the ATS route Q295 on a southerly heading when they are	**1 -10 Aug 15 track dispersion plot** **(PIR submission page 7)** **Luton and Northolt departures.** Majority of departures (deps) (shown in Blue for Luton and Grey for Northolt) are routed towards BPK with a spread of vectoring both north and south of BPK. This wide distribution of traffic is then turned towards the	**1 -10 Aug 16 track dispersion plot** **(PIR submission page 8)** **Luton and Northolt departures.** Majority of departures (deps) (shown in Blue for Luton and Grey for Northolt) are still routed towards BPK with a spread of vectoring both north and south of BPK but the predominate flow is towards MATCH then towards	The Northolt departure track is evident up to BPK after which they are embedded with the Luton departure flow (shown in blue).

Track Analysis **(a)**	**Anticipated impact as forecast in the ACP** **(b)**	**Pre-implementation SID usage 2013 Track Commentary 10-day** **10-day sample period: 1 Aug 15-10 Aug 15** **(c)**	**Post Implementation SID Usage Actual 2016 Track Commentary on Match SID track plot** **10-day sample period: 1 Aug 16 – 10 Aug 16** **(d)**	**CAA Remarks** **(e)**
	sufficiently above any conflicting Heathrow traffic. Variation in climb performance and conflicting Heathrow traffic will result in a spread of flights turning south from Q295. This spread will be from around MATCH out to DAGGA. The tactical turn south will generally be at levels between FL150 and 200 - see Figure 5 overleaf showing data taken from the Real-Time simulation. Figure 5 demonstrates that only a very small proportion of Luton and Northolt departures are expected to be held at FL150 to cross beneath the Heathrow arrivals (i.e. there is only one aircraft that does this in the real-time sample shown overleaf – represented by the single red dot over South Essex).	southeast; as can be seen, traffic is spread across a wide area from BPK through MATCH towards the east before they take up a track towards Kent. The wide spread of traffic takes departures past Southend towards the Isle of Sheppey where further course changes are provided to enable the departures to leave UK airspace at KONAN. Heathrow arrivals from the east are shown in yellow and can be see following the arrival flightpath towards Lambourne or Biggin after which they are vectored by ATC to the final approach track for Heathrow.	Clacton. This wide distribution of traffic is then in the main turned towards the southeast when it reaches MATCH or thereafter between MATCH and DAGGA (just east of Tiptree). Some aircraft are routed towards Kent before they reach MATCH Traffic is then spread across a wide area from MATCH to DAGGA towards the south east before they take up a track towards Kent. The wide spread of traffic takes departures past Southend towards the Isle of Sheppey where further course changes are provided to enable the departures to leave UK airspace at KONAN. The spread of traffic is similar to the situation before the change, but the main spread of departures towards the southeast (after	The departure flow after BPK is as expected from the portrayal of expected track plots as shown in the real-time simulation diagram on page 13 Fig 5.

Track Analysis **(a)**	**Anticipated impact as forecast in the ACP** **(b)**	**Pre-implementation SID usage 2013 Track Commentary 10-day** **10-day sample period: 1 Aug 15-10 Aug 15** **(c)**	**Post Implementation SID Usage Actual 2016 Track Commentary on Match SID track plot** **10-day sample period: 1 Aug 16 – 10 Aug 16** **(d)**	**CAA Remarks** **(e)**
			passing BPK) has moved further to the east. As departures approach the north coast of Kent, they are turned towards the UK exit point of KONAN.	
ACP Page 13 And PIR submission Page 9 & 10 Luton Gate Analysis	**Forecast traffic distribution** **ACP page 13 Fig 5** See above.	**2015 Gate Analysis Luton departures** **BPK – DAGGA.** **PIR submission Page 9** **317 movements** When passing this gate (as shown by the red line through BPK to DAGGA), 35% of aircraft are at or below FL100 (approximately 10,000ft amsl);	**2016 Gate Analysis Luton departures BPK – DAGGA.** **PIR submission Page 10** **440 movements** When passing this gate (as shown by the red line through BPK to DAGGA), 3% of aircraft are at or below FL100 (approximately 10,000ft amsl);	It appears clear that climb profile has been

Track Analysis **(a)**	**Anticipated impact as forecast in the ACP** **(b)**	**Pre-implementation SID usage 2013 Track Commentary 10-day** **10-day sample period: 1 Aug 15-10 Aug 15** **(c)**	**Post Implementation SID Usage Actual 2016 Track Commentary on Match SID track plot** **10-day sample period: 1 Aug 16 – 10 Aug 16** **(d)**	**CAA Remarks** **(e)**
		41% are in the Band FL100-FL150 23% are in the band FL150-FL200 Less than 1% are at FL200 or above.	40% are in the Band FL100-FL150 56% are in the band FL150-FL200 Less than 1% are at FL200 or above. NATS has stated that 32% of departures have moved from the below FL100 band into the FL150-FL200 band as departures pass through the red gate which is a result of the SID switch change. Aircraft are therefore achieving improved climb profiles.	improved on the re-route via MATCH. The improved vertical departure profile after BPK was forecast in the ACP and has been achieved as a result of the re-routed DET SIDs.

Track Analysis **(a)**	**Anticipated impact as forecast in the ACP** **(b)**	**Pre-implementation SID usage 2013 Track Commentary 10-day** **10-day sample period: 1 Aug 15-10 Aug 15** **(c)**	**Post Implementation SID Usage Actual 2016 Track Commentary on Match SID track plot** **10-day sample period: 1 Aug 16 – 10 Aug 16** **(d)**	**CAA Remarks** **(e)**
ACP page 13 and PIR submission Page 11 & 12 Northolt Gate Analysis	**Forecast traffic distribution** **ACP page 13 Fig 5.** See above.	**2015 Gate Analysis Northolt departures BPK – DAGGA.** **PIR submission Page 11** **24 movements** When passing this gate (as shown by the red line through BPK to DAGGA), 37% of aircraft are at or below FL100 (approximately 10,000ft amsl); 17% are in the Band FL100-FL150 46% are in the band FL150-FL200 0% are at FL200 or above. Note: This is a low traffic sample compared with Luton – one movement is circa 4%.	**2016 Gate Analysis Northolt departures BPK – DAGGA.** **PIR submission Page 12** **17 movements** When passing this gate (as shown by the red line through BPK to DAGGA), 18% of aircraft are at or below FL100 (approximately 10,000ft amsl); 29% are in the Band FL100-FL150 47% are in the band FL150-FL200 6% are at FL200 or above. NATS has stated fewer departures have crossed the gate below FL100 and more departures are in the FL100-	It appears clear that climb profile has been improved on the re-route via MATCH. The improved vertical departure profile after BPK was forecast in the ACP and has been achieved as a result of the re-routed DET SIDs.

Track Analysis **(a)**	**Anticipated impact as forecast in the ACP** **(b)**	**Pre-implementation SID usage 2013 Track Commentary 10-day** **10-day sample period: 1 Aug 15-10 Aug 15** **(c)**	**Post Implementation SID Usage Actual 2016 Track Commentary on Match SID track plot** **10-day sample period: 1 Aug 16 – 10 Aug 16** **(d)**	**CAA Remarks** **(e)**
			FL150 band as departures pass through the red gate which is a result of the SID switch change. Aircraft are therefore achieving improved climb profiles.	
PIR submission Page 13 & 14 Heathrow arrivals Gate Analysis		**2015 Gate Analysis Heathrow arrivals from the east.** **PIR submission Page 13**	**2016 Gate Analysis Heathrow arrivals from the east.** **PIR submission Page 14**	

Track Analysis **(a)**	**Anticipated impact as forecast in the ACP** **(b)**	**Pre-implementation SID usage 2013 Track Commentary 10-day** **10-day sample period: 1 Aug 15-10 Aug 15** **(c)**	**Post Implementation SID Usage Actual 2016 Track Commentary on Match SID track plot** **10-day sample period: 1 Aug 16 – 10 Aug 16** **(d)**	**CAA Remarks** **(e)**
		2752 movements When passing this gate (as shown by the red line (pointing towards ITVIP) 4% of aircraft are at or below FL100 (approximately 10,000ft amsl); 83% are in the Band FL100-FL150 12% are in the band FL150-FL200 <1% are at FL200 or above. Most of the traffic is between FL100-FL150 and generally above the Luton Dover flow.	**2885 movements** When passing this gate <3% of aircraft are at or below FL100 (approximately 10,000ft amsl); 86% are in the Band FL100-FL150 11% are in the band FL150-FL200 <1% are at FL200 or above. The Heathrow traffic pattern shows no significant change.	As expected.
PIR submission Page 15 & 16 FL75 cut-off plus BPK/MATCH gate analysis	ACP forecast no change in traffic patterns (laterally or vertically) below 7000ft AMSL.	**2015 Analysis – Luton & Northolt departures** **PIR submission Page 15** **339 movements**	**2015 Analysis – Luton & Northolt departures** **PIR submission Page 16** **463 movements**	These two traffic samples illustrate an improvement in the climb profile for these departures following

Track Analysis **(a)**	**Anticipated impact as forecast in the ACP** **(b)**	**Pre-implementation SID usage 2013 Track Commentary 10-day** **10-day sample period: 1 Aug 15-10 Aug 15** **(c)**	**Post Implementation SID Usage Actual 2016 Track Commentary on Match SID track plot** **10-day sample period: 1 Aug 16 – 10 Aug 16** **(d)**	**CAA Remarks** **(e)**
		Evidence of tracks beyond BPK, continuing east towards MATCH and then south-east towards DET. 25% of aircraft are at or below FL75 (approximately 7500ft amsl) as they cross the “gate”; 1% are below FL60 2% are in the Band FL60-FL68 22% are in the band FL68-FL75 67% are at FL75 or above.	Generally, few tracks beyond BPK and none beyond MATCH. In all other aspects, the pattern is similar to the 2015 sample. 2% of aircraft are at or below FL75 (approximately 7500ft amsl) as they cross the “gate”; <1% are below FL60 <1% are in the Band FL60-FL68 1% are in the band FL68-FL75 97% are at FL75 or above.	implementation, such that there appear to be markedly fewer aircraft being held between FL68 and FL75.

Annex C - 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[1]	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**[2] (no separate figures for Biggin Hill)	6,352	20,199	10,099 - 20,199	LCY = -3,779 Gatwick = 178 Southend = - 81	-11,709

[1] 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.

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.

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.