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| **Title of Airspace Change Proposal** | **London City Airport Replications – Module B of LAMP Phase 1a ACP** |
| **Change Sponsor** | **London City Airport / Prepared by Airspace Change Assurance NATS** |
| **SARG Project Leader** | [redacted] |
| **Case Study commencement date** | **Received 17 February 2015. Commenced Case Study 4 March 2015** |
| **Case Study report as at** | **28 July 2015 V 2.2 (Updated on 17 Sep 15)** |

## Instructions

In providing a response for each question, please ensure that the 'Status' column is completed using the following options:

- **Yes**
- **No**
- **Partially**
- **N/A**

To aid the DAP Project Leader's efficient Project Management it may be useful that each question is also highlighted accordingly to illustrate what is resolved ( Green ), **not resolved** ( Amber ) or **not compliant** ( Red ) as part of the DAP Project Leader's efficient project management.

| 1. | Justification for change and "Option Analysis" | Status |
|---|---|---|
| 1.1 | **Is the explanation of the proposed change clear and understood?** | Yes |

The proposed changes covered by this Module B of the LAMP Phase 1A ACP are to the departure and arrival routes from and to London City Airport (LCY) up to an altitude of 4000ft. Hence, the associated consultation and ACP covers changes close in to LCY; the LAMP Network ACP in Module C covers changes for departures and arrivals beyond the scope of this ACP Module which is sponsored by LCY. The objective of these changes is to introduce Performance Based Navigation (PBN) Standard Instrument Departures (SID) "RNAV Replications" of the current conventional procedures i.e. RNAV1 SIDs which replicate the current conventional SIDs, and arrival transitions which replicate the current concentration of radar vectored arrival flight paths.

This proposal is to replicate the low altitude portions of the existing 10 conventional SIDs with RNAV1 PBN SID replications, and to introduce an RNAV1 replication of the radar vectored arrival flight paths to intercept the Instrument Approach Procedures (IAP) for both Runway (Rwy) 09 and Rwy 27 with RNAV1 arrival transitions as listed in ACP page 10 Table 2; this is reproduced in the Table on page 3 below. (Note: for Rwy 09 arrivals, there is a manual termination point at ODLEG – see below and explained later).

It should be noted that the EKNIV RNAV SIDs replicate the Dover (DVR) and Lydd (LYD) conventional SIDs as far as the positions as indicated below, after which the SIDs follow a **new** route alignment. This new route alignment was subjected to consultation by NERL from October 2013 – January 2014 and is covered in LAMP Phase 1A Module C – the LCY Network ACP. Therefore, it is important to understand that there are new tracks over the ground for the Rwy 27 EKNIV1A and Rwy 09 EKNIV1H as indicated below:

Rwy 27 DVR/LYD5T SID is replicated by EKNIV1A up to LCN06, then the new track routeing is: LCN06-LCE06-SODVU-EKNIV (termination point).

Rwy 09 DVR/LYD5U SID is replicated by EKNIV1H up to LCE03, then the new track routeing is: LCE03-LCE06-SODVU-EKNIV (termination point).

Except for the new portions of route alignment as indicated above, the proposed replications are covered by Module B and the LCY consultation up to 4000ft for all SIDs although the Clacton (CLN) SIDs (with a tactical climb), extend beyond 4000ft to CLN. Note, in stating this, the top altitudes of all SIDs still have an artificial level cap due to the interaction of other EGLL traffic above. Tactical climb above 3000ft is managed by ATC for all departures. In addition, the arrival routes (RNAV Transitions) are covered from 4000ft to either the Final Approach Fix (FAF) on Rwy 27, or a manual termination point (ODLEG) on the base leg for Rwy 09, after which aircraft are vectored to intercept the Instrument landing System (ILS) (the difference is explained later). Note 1. The Rwy 09 RNAV1 arrival Transition will also be used by suitably approved aircraft flying into Biggin Hill; these arrivals will have a common flight path until a position on the LCY downwind track where the transition for Biggin Hill will terminate to enable aircraft to intercept the IAP for Biggin Hill.

Note 2: For the arrival tracks, this ACP and the associated consultation by LCY covers the flight path of arrivals where they are already concentrated on the ILS Centreline (CL) for Rwy 27, and from a position upwind for Rwy 09, where aircraft are concentrated by radar vectoring due to the constraints of controlled airspace. This is demonstrated in the Consultation Document (Con Doc) page 33 at Fig 23.

**ACP Page 10 - Table 1 Replication end points (interface with network) Bold 5LNCS are new RNAV waypoints**

| Procedure | Start point of replication | End point of replication | Entire procedure? |
|---|---|---|---|
| EKNIV 1A (27) | EGLC | LON R075 D25.5 (**LCN06**) (51 36 08.68N 000 11 18.82E) | No* |
| EKNIV 1H (09) | EGLC | LON R081 D27.0 (**LCE03**) (51 33 46.90N 000 14 36.66E) | No* |
| CLN 7T (27) | EGLC | CLN VOR (51 50 54.50N 001 08 51.32E) | Yes |
| CLN 7U (09) | EGLC | CLN VOR (51 50 54.50N 001 08 51.32E) | Yes |
| BPK5T (27) | EGLC | BPK VOR (51 44 59.05N 000 06 24.25W) | Yes |
| BPK5U (09) | EGLC | BPK VOR (51 44 59.05N 000 06 24.25W) | Yes |
| CPT6T (27) | EGLC | CPT VOR (51 29 29.66N 001 13 10.89W) | Yes |
| CPT6U (09) | EGLC | CPT VOR (51 29 29.66N 001 13 10.89W) | Yes |
| RWY27 LAVNO Arrivals | **ATPEV** (51 29 18.05N 000 33 22.74E) | **LAVNO** (51 29 59.14N 000 13 29.17E) | No* |
| RWY09 ODLEG Arrivals | **ATPEV** (51 29 18.05N 000 33 22.74E) | **ODLEG** (51 29 59.14N 000 13 29.17E) | No* |

**Table 2 Replication end points (interface with network) Bold 5LNCS are new RNAV waypoints**

*Note: the procedures above for which the replication does not go to the end of the procedure, are to be continued by the NATS LAMP ACP Module C, which describes the changed route structure at higher altitudes that integrate with the network design. The scope of this ACP only covers the replication of the procedures between the start/end points as stated in Table 3.

| 1.2 | **Are the reasons for the change stated and acceptable?** | Yes |
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Extracted from ACP Section 3:

The introduction of RNAV1 procedures is justified in part by LCY by the requirement to conform to European legal requirements and proposed CAA mandates as detailed below. LCY's intention is to meet these requirements with the minimum impact to stakeholders; hence LCY is seeking to replicate all the existing conventional routes with equivalent RNAV routes rather than designing new ones. The aim of replication is to match the existing conventional routes as closely as possible whilst in line with regulatory guidance and within the rules of what is allowed for RNAV routes.

Approximately 70% of aircraft flying from London City Airport are equipped to fly RNAV routes; the remainder still rely on conventional navigation. **LCY therefore proposes to retain the conventional routes for use alongside the proposed RNAV replications, until such time as RNAV1 is fully adopted, after which the conventional routes will be removed.** The CAA has issued an AIC (ref CAA_B) notifying that all operators will be mandated to be RNAV1 approved by November 2017, and airports in the London area will be mandated to replace all conventional procedures by November 2019. After the implementation of the RNAV routes at London City Airport now planned for February 2016 (was December 2015), the majority of those aircraft which are approved for RNAV1 will use the new routes. There will then be a transitional period to 2017 where the remaining airlines progressively adopt full RNAV1 operations. The conventional procedures will then be withdrawn by November 2019.

A further justification for the London City route replication is that they will enable connectivity with the RNAV route structure as proposed in the NATS London Airspace Management Programme (LAMP) Phase 1A 'Network' airspace change proposal (Module C) which NATS has submitted to the CAA concurrently with this proposal. End to end RNAV1 connectivity between the en-route network and the arrivals & departure routes will enable the ATC network to operate more efficiently. There are environmental benefits which will be achieved by enabling departures to climb higher earlier, and repositioning higher level arrival routes over the Thames Estuary.

SARG Case Officer (CO) Note: The benefit outlined above will be covered in the Network ACP.

As a result, the combined LAMP proposal will both reduce the $CO_2$ impact of each flight, and also 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 LCY proposal to replicate the low level routes for London City Airport.

| 1.3 | **Have all appropriate alternative options been considered, including the 'do nothing' option?** | Yes |
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See ACP Section 7.1:

The option to "do nothing" and maintain the current conventional SIDs & arrival transitions would work in the short term. However, doing nothing would not allow the improvements for PBN procedures to be implemented, would not provide connectivity with the LAMP changes proposed in Module C, and would not fulfil the mandate for the introduction of RNAV procedures, which has to be complied with by 2019.

Therefore, to enable a benefit in February 2016 and to comply with the upcoming regulatory mandate (ACP Ref CAA_B), the 'do nothing' option has been discounted.

The SARG CO agrees with this position.

Other Instrument Flight Procedure (IFP) designs using alternative RNAV SID design criteria with different path terminators were considered as shown in ACP Section 7.2:

In designing the replications there were several different permutations of RNAV coding which were explored. Three different options for coding were discussed with CAA Procedure Design regulators at the Framework Briefing. It was agreed that of these the ARINC 424 "Direct to Fix" (DF) coding was the best fit for replication of the first turn after take-off for the London City SIDs and this fulfilled all requirements for replication. Hence the proposed SIDs use the ARINC 424 DF waypoint type for the waypoint on the exit of the first turn.

The two other options considered were procedures based on using ARINC 424:

- "Fly Over + Course to Fix" (FO CF) waypoints, and
- "Fly Over + Course to Fix/Track to Fix" (FO CF/TF) waypoints.

The SARG IFP Regulator was asked by the SARG CO to confirm whether the proposal represented a fair replication proposal as per the SARG Policy Statement. Following SARG IFP analysis, and a number of queries with the sponsor, the SARG IFP regulator presented a summary of the SID design and replication characteristics to the CAA ACP analysis team on Friday 5 June. To supplement this, the SARG CO presented an analysis template to assist the SARG Exec in the review of the proposal. This was completed by the SARG IFP regulator on completion of his analysis to help to demonstrate that the SID designs reflect a PBN replication SID, and is attached at Appendix 1 to this report.

As a result of the IFP analysis, the AR team is satisfied that the designs meet the criteria in the SARG Policy Statement.

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| 1.4 | **Is the justification for the selection of the proposed option sound and acceptable?** | Yes |
| | The LCY changes in Module B of LAMP Phase 1A are designed such that the routeing of the EKNIV SIDs will enable integration into the LAMP Phase1A Network changes. There are substantial benefits to be realised by a semi-systemised route network design such that the SIDs to the south via EKNIV will be tactically climbed above the arrivals flying down the Thames estuary via merge point RAVSA. There will be a reduction in controller workload, a reduction in flight deck workload, both factors being a significant contribution to enhancement of flight safety, as departures will be flying RNAV procedures following the designed flight path as coded up into the aircraft Flight Management System (FMS), and as will be demonstrated in the NERL Module C LAMP Network ACP, there will be environmental benefits due to the re-alignment of departure and arriving flight paths.<br><br>From ACP Section 4.3:<br><br>Whilst the low level replication change is not being implemented to overcome complexity or network efficiency issues in the London City Airport's airspace, in the network airspace (above 4000ft) implementation of RNAV will reduce complexity and make the sequencing of arrivals more systemised. While changes to the network route structure are outside the scope of this LCY replication ACP, the low level replications as proposed in this module of the ACP are an integral part of the end to end RNAV solution. Without these LCY proposals, significant efficiency gains as described in Module C and the Bridging ACP would not be able to be fully realised.<br><br>Note: As LCY SIDs have to be capped initially at 3000ft because of other traffic in the London Terminal Control Area (LTMA) (e.g. Heathrow arrivals), the design cannot be fully systemised; therefore, whilst the traffic will fly the pre-determined flight paths as per the navigation database coding for each procedure, this alleviates the controller vectoring, hence a reduction in workload. The controller still has to issue the vertical climb, but even so, the benefits achieved by use of the new procedures will contribute considerably to a reduction in workload for both ATC and flight deck crews. | |
| **2.** | **Airspace Description and Operational Arrangements** | **Status** |
| 2.1 | **Is the type of proposed airspace clearly stated and understood?** | Yes |
| | RNAV1 SID replications and RNAV1 arrival transitions replicating the radar vectored arrival flightpaths. | |
| 2.2 | **Are the hours of operation of the airspace and any seasonal variations stated and acceptable?** | N/A |
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| 2.3 | **Is any interaction with adjacent domestic and international airspace structures stated and acceptable including an explanation of how connectivity is to be achieved? Has the agreement of adjacent States been secured in respect of High Seas airspace changes?** | Yes |
| | The integration of the PBN Replicated SIDs into the Air Traffic Services (ATS) en-route network is unchanged except for the new RNAV1 SIDs for Rwy 09 and 27 via EKNIV. These SIDs will be integrated into the ATS en-route network at EKNIV where they will join a new ATS route. The replicated arrival flight paths are based on RNAV1 Transitions from a new arrival Point Merge procedure. Connectivity is covered in the NERL Module C LAMP Network ACP and associated Op Report. | |
| 2.4 | **Is the supporting statistical evidence relevant and acceptable?** | Yes |
| | Traffic numbers are not a factor in this part of the LAMP Phase 1A package. See Section 1.2 above for stats on RNAV1 compliance. See ACP section 4.1 for traffic stats and aircraft types. | |
| 2.5 | **Is the analysis of the impact of the traffic mix on complexity and workload of operations complete and satisfactory?** | Yes |
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See Section 1.4 above. Additionally, until conventional SIDs are withdrawn, there will be a mix of operations at LCY. The ACP has adequately explained this and how traffic will be managed by ATC. This is an important factor, and therefore the text is re-produced below.

**Non-RNAV1 Capable Aircraft (ACP Section 5.3)**

All aircraft operating at London City Airport must be RNAV5 capable. The proposed new SIDs & arrival transitions require RNAV1 capability. Since initially, not all aircraft operating at the airport will be RNAV1 capable, the conventional procedures will remain available for use for those aircraft/crews that are not RNAV1 equipped/certified. ATC will be aware of traffic that is not RNAV1 capable and this traffic will be sequenced accordingly, using ATC vectoring. Within London Terminal Control (LTC) units the strips for non-RNAV1 equipped aircraft will include "R5" to indicate the RNAV5 equipage of the aircraft. The strip will also be placed in a cream coloured strip holder to make it stand out.

**Arriving Aircraft (ACP Section 5.3.1)**

RNAV1 certified aircraft will utilise the point merge structure described in Module C of the ACP and feed traffic directly into the replicated arrival tracks described in this ACP.

Non RNAV1 certified aircraft will be able to file RNAV5 STARs to the JACKO or GODLU stacks. From there they will file SPEAR – ALKIN or DET-ALKIN respectively. Real Time Simulation (RTS) has confirmed that in practice, ATC will vector the non-RNAV1 aircraft along the sequencing legs towards the merge point in sequence and then vector to establish on the ILS. The aircraft will be vectored along the same tracks as the RNAV traffic (with slightly broader tolerances) and will be manually sequenced with other arriving aircraft.

**Departing Aircraft (ACP Section 5.3.2)**

Non-RNAV1 capable departing aircraft will use the remaining conventional SIDs. Controller intervention will be required once airborne to integrate them with the RNAV en-route network structure. (These flights will also require a telephone coordination between LCY Tower and City Radar).

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| | These issues have been discussed with SARG ATM Ops inspectors to ascertain that there would be no operational issues regarding traffic mix with this proposal. The ATM Ops Inspectors have confirmed that **adequate measures will be in place to cater for the mix of RNAV and conventional arrivals and departures.**<br><br>One further issue not covered by this ACP module is how the Non RNAV 1 arrivals for Biggin Hill and Rochester would be handled by ATC (Traffic to these airfields currently use the existing LCY STARs to ALKIN). This is out with this Module and is dealt with in Module C. | |
| 2.6 | **Are any draft Letters of Agreement and/or Memoranda of Understanding included and, if so, do they contain the commitments to resolve ATS procedures (ATSD) and airspace management requirements?** | N/A |
| 2.7 | **Should there be any other aviation activity (low flying, gliding, parachuting, microlight site etc) in the vicinity of the new airspace structure and no suitable operating agreements or ATC Procedures can be devised, what action has the sponsor carried out to resolve any conflicting interests?** | N/A |
| 2.8 | **Is the evidence that the Airspace Design is compliant with ICAO SARPs, Airspace Design & FUA regulations, and Eurocontrol Guidance satisfactory?** | Yes |
| | The SARG IFP analysis concluded that all designs were compliant with extant regulations except for a small number of instances where mitigation will be provided. No critical design issues were evident. A summary of non compliances is below together with action to address the issue.<br><br><u>SIDs</u><br><br>There was one design non-compliance - the location of the first waypoint is closer than 1NM + along track tolerance. It was accepted at the Framework Briefing that this could be accepted if the design proved flyable in the formal flight simulator flyability checks. This has proved to be the case and therefore is accepted. The BPK SIDs were initially designed with a speed of 250 kts at BPK. This has been revised to 200kts to ensure the turn at LNN05 can be satisfactorily performed.<br><br><u>Charts</u><br><br>Comments on the Draft Charts will be fed back to AIS for incorporation into the formal AIP charts subject to ACP approval. | |

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| 2.9 | **Is the proposed airspace classification stated and justification for that classification acceptable?** | N/A |
| 2.10 | **Within the constraints of safety and efficiency, does the airspace classification permit access to as many classes of user as practicable?** | N/A |
| 2.11 | **Is there assurance, as far as practicable, against unauthorised incursions? (This is usually done through the classification and promulgation)**<br>The RNAV designs will be promulgated via a double AIRAC cycle. | Yes |
| 2.12 | **Is there a commitment to allow access to all airspace users seeking a transit through controlled airspace as per the classification, or in the event of such a request being denied, a service around the affected area?** | N/A |
| 2.13 | **Are appropriate arrangements for transiting aircraft in place in accordance with stated commitments?** | N/A |
| 2.14 | **Are any airspace user group's requirements not met?**<br>There was over-whelming support from the main operators at LCY. | No |
| 2.15 | **Is any delegation of ATS justified and acceptable? (If yes, refer to Delegated ATS Procedure).** | N/A |
| 2.16 | **Is the airspace structure of sufficient dimensions with regard to expected aircraft navigation performance and manoeuvrability to contain horizontal and vertical flight activity (including holding patterns) and associated protected areas in both radar and non-radar environments?**<br>Aircraft on the replicated procedures remain in Controlled Airspace (CAS), except for the existing situation where the SIDs require tactical climb by ATC above 3000ft which remains unchanged. The new EKNIV SIDs have to be climbed above Southend CAS and reach MSL by SODVU to climb above the LCY arrivals – this is covered in Module C.<br><br>The RNAV Hold protected area for **ATPEV** contingency holds (a tactical hold on the LCY arrival transition, either left hand not below 4000ft, or right hand not below 6000ft), is fully contained within existing CAS but overlaps the Shoeburyness danger area complex. A Regulatory Requirement therefore needs to be issued to NATS to ensure traffic entering the ATPEV Hold does not enter the danger areas to the northeast. This has been highlighted in the Route Design Assurance Report (RDAR) – explained later. | Yes |

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| 2.17 | **Have all safety buffer requirements (or mitigation of these) been identified and described satisfactorily (to be in accordance with the agreed parameters or show acceptable mitigation)? (Refer to buffer policy letter).** | Yes |
| | The contingency hold at ATPEV result in the hold protected areas infringing Shoeburyness danger areas. However, the RDAR document has addressed this issue and mitigations for controller monitoring are already address by NATS for the implementation. | |
| 2.18 | **Do ATC procedures ensure the maintenance of prescribed separation between traffic inside a new airspace structure and traffic within existing adjacent or other new airspace structures?** | Yes |
| | On submission of the ACP, the SARG CO and SARG ATM Ops inspectors have assessed the NATS RDAR submission Issues 1, 2, 3A, 3B & 3C. The initial proposal required a number of clarifying comments to be added along with a number of additional mitigations to assure that the route spacing would be acceptable. For example, it was necessary to provide historical track dispersion for a number of Heathrow departures to illustrate how close the flight profiles are to the LCY departures and arrivals. Initial CAA comments have been addressed, and a Draft Issue 3 was presented on 26 May for CAA review. A number of further refinements to the mitigations were required.<br><br>Historical data has since been provided to SARG; following receipt and review of RDAR Issue 3B on 19 June, and Issue 3C on 17 July, ATM Ops and the SARG CO are content that these interactions have now been supported with historical data and that the traffic downwind for LCY Rwy 09 against Heathrow departures result in no reductions in separation standards. Similarly, the LCY Rwy 27 departures interacting with Heathrow Rwy 09 departures results in no reduction in separation standards. Nevertheless, in the absence of formal policy for route spacing against turning procedures, SARG has elected to issue the sponsor with regulatory requirements for the TC North/South controllers as appropriate to provide radar monitoring of the LHR traffic as appropriate.<br><br>The arrival procedure downwind for Rwy 09 will require the Thames controller to monitor the aircraft to ensure it does not fly outside CAS as the restrictive airspace precludes the design meeting the requirements of the SARG containment policy. This situation is equally applicable with existing the radar directed procedure, given existing airspace constraints.<br><br>A summary of all regulatory requirements to be issued to the sponsors is in the concluding comments section, and will be incorporated into a consolidated list of requirements together with any others from the Modules A, B, D & E, and any requirements if they arise from the SARG Exec review of the proposals (This may then be used to send to the sponsor subject to ACP approval). At time of submission to the SARG Exec, the consolidated list is at Appendix 4 of Module C and is subject to updates as required following SARG Exec review, ACP decision and approval. | |

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| 2.19 | **Is the airspace structure designed to ensure that adequate and appropriate terrain clearance can be readily applied within and adjacent to the proposed airspace?** | Yes |
| | Appropriate terrain clearance is maintained with the RNAV1 designs. | |
| 2.20 | **If the new structure lies close to another airspace structure or overlaps an associated airspace structure, have appropriate operating arrangements been agreed?** | Yes |
| | The replicated SIDs are closer to Southend Airport than the existing DET SIDs. The existing arrangements for Thames to ensure departures are above Southend CAS is retained, due to the fact that Thames have to climb the SIDs to remain inside CAS before crossing the LTMA 3500ft boundary bdy, and that they must reach Minimum Min Stack Level (MSL) by SODVU. | |
| 2.21 | **Where terminal and en-route structures adjoin, is the effective integration of departure and arrival routes achieved?** | Yes |
| | The integration of the PBN Replicated SIDs into the ATS en-route network is unchanged except for the new RNAV1 SIDs for Rwy 09 and 27 via EKNIV. These SIDs will be integrated into the ATS en-route network at EKNIV where they will join a new ATS route. The replicated arrival flight paths are based on RNAV1 Transitions from a new arrival Point Merge procedure. The connectivity is covered in the NERL Module C LAMP Network ACP. | |
| **3.** | **Supporting Resources and CNS Infrastructure** | **Status** |
| 3.1 | **Is the evidence of supporting CNS infrastructure together with availability and contingency procedures complete and acceptable? The following are to be satisfied:** | |
| | ▪ **Communication**: Is the evidence of communications infrastructure including RT coverage together with availability and contingency procedures complete and acceptable? Has this frequency been agreed with S&S Section? | Yes |
| | No change | |
| | ▪ **Navigation**: Is there sufficient accurate navigational guidance based on in-line VOR or NDB or by approved RNAV derived sources, to contain the aircraft within the route to the published RNP value in accordance with ICAO/Eurocontrol Standards? Eg. Navaids – has coverage assessment been made eg. a DEMETER report, and if so, is it satisfactory? | Yes |
| | Adequate DME coverage is available, although, CLN has been identified as a critical DME; this is not an issue (it is not unusual) and an appropriate note may be included on the appropriate charts – yet to be confirmed by SARG IFP. | |

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| | ▪ **Surveillance:** Radar Provision – have radar diagrams been provided, and do they show that the ATS route / airspace structure can be supported? | N/A |
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| 3.2 | **Where appropriate, are there any indications of the resources to be applied, or a commitment to provide them, in line with current forecast traffic growth acceptable?** | N/A |
| | Within the scope of this proposal, this is not relevant. | |
| **4.** | **Maps/Charts/Diagrams** | **Status** |
| 4.1 | **Is a diagram of the proposed airspace included in the proposal, clearly showing the dimensions and WGS84 co-ordinates?**<br>**(We would expect sponsors to include clear maps and diagrams of the proposed airspace structure(s) – they do not have to accord with AC&D aeronautical cartographical standards (see CAP725), rather they should be clear and unambiguous and reflect precisely the narrative descriptions of the proposals. AC&D work would relate to regulatory consultation charts only).** | Yes |

The formal IFP design charts from the NATS PDG design organisation were examined for content and accuracy as per the design. The charts will be returned to NATS with SARG IFP comments. These charts will then be provided to NATS AIS for formal AIP chart preparation and will be checked by the IFP regulator before being released for publication (subject to ACP approval).

The charts provided to demonstrate the impact of the replications are the charts as presented in the RNAV replication consultation document. All maps can be electronically zoomed for greater magnification.

**Page 14 & 15 Figs 1&2** – illustrate current flight paths for arrivals and departures showing a swathe which has a colour key to indicate the number of flights per day. The supporting textual material to explain the charts clearly signposted the purpose of these charts to show where aircraft currently fly.

**Page 15 & 16 Figs 3&4** - illustrate indicative altitudes.

In the following figures, diagrams show current flight path swathes with superimposed dotted lines to illustrate the area where most flights would be concentrated which are based on predicted flight paths derived from a Eurocontrol RNAV Validation Tool (RVT) which are shown alongside the swathe diagrams:

Page 22 Fig 5/6 - Rwy 27 DVR/LYD
Page 23 Fig 7/8 - Rwy 09 DVR/LYD
Page 24 Fig 9/10 - Rwy 09 CLN and Page 25 Fig 11/12 - Rwy 09 CLN - RVT zoomed out view
Page 26 Fig 13/14 - Rwy 27 CLN and Page 27 Fig 15 - Rwy 27 CLN - RVT zoomed out view
Page 28 Fig 16/17 - Rwy 09 CPT/BPK and Page 29 Fig 18 – Rwy 09 CPT/BPK – RVT zoomed out view
Page 30 Fig 19/20 - Rwy 27 CPT/BPK and Page 31 – Fig 21 – Rwy 27 CPT/BPK – RVT zoomed out view
Page 33 Fig 23 - Rwy 09 Arrivals and Page 34 Fig 24 – Rwy 09 Arrivals –RVT
Page 35 Fig 25 - Rwy 27 Arrivals.

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| 4.2 | **Do the charts clearly indicate the proposed airspace change?** | Yes |
| | These charts show existing flight paths by portraying a swathe of the distribution of departures and arrivals, together with a colour coded key to indicate the number of flights per day. The proposed flight paths are illustrated by showing black dots – use of the dots is to enable underlying text on the diagrams to be seen. It is more obvious on an expanded electronic version rather than on the A4 diagrams in the hard copy documentation. The proposed flight paths are based on predicted flight paths using a Eurocontrol computerised RVT Tool. | |
| 4.3 | **Has the Change Sponsor identified AIP pages affected by the Change Proposal and provided a draft amendment?** | Yes |
| | The new SIDs and arrival routes will be portrayed in IFP charts and associated RNAV database coding tables to be included into the UK AIP once SARG IFP approvals have been issued subject to ACP approval.<br>Draft AIP amendments were provided for the AD section which will be reviewed when the designs have been accepted by SARG IFP. These include reference to RCF procedures. Note: these RCF procedures are subject to ongoing review within the CAA by SARG ISP, ATM Ops and SARG IFP. Final AIP amendments will be approved for publication subject to ACP approval from Gp Dir SARG. | |
| **5.** | **Operational Impact** | **Status** |
| 5.1 | **Is the Change Sponsor's analysis of the impact of the change on all airspace users, airfields and traffic levels, and evidence of mitigation of the effects of the change on any of these, complete and satisfactory?**<br>**Consideration should be given to:**<br>**a) Impact on IFR GAT, on OAT or on VFR general aviation traffic flow in or through the area.** | Yes |
| | The interaction of the LCY Rwy 09 traffic downwind against the Heathrow DET SIDs was analysed in the RDAR document as part of the network route spacing analysis on the principle that the LCY aircraft downwind are now flying a pre-defined track rather than being radar vectored. As there is no guidance to cover route spacing for this particular interaction – the LCY arrival turning base leg against the Heathrow SID climbing to reach 3000ft by DET D29, it was concluded by SARG that a regulatory requirement should be placed on the Thames Radar controller to monitor the vertical profile of the Heathrow SID, and if required, initiate appropriate action to ensure adequate separation is maintained. After discussion with NATS on 17 July, this was later changed to reflect the responsibility being placed upon the TC South controller to monitor the Heathrow SIDs climb performance and intervene if required. The interaction of the LCY Rwy 27 RNAV1 SIDs were analysed against the Heathrow Rwy 09 BPK and BUZAD SIDs in the RDAR document as part of the network route spacing analysis, given that new RNAV SID designs were being introduced. As there is no guidance to cover route spacing for this particular interaction – the LCY departures turning in the climb to 3000ft against the Heathrow SIDs climbing to 3000ft by LON D10, then 4000ft by BPK D10 for the BPK SIDs, or 5000ft by BIG D20 for the BUZAD SIDs, it was concluded by SARG that a regulatory requirement should be placed on the Thames Radar controller to monitor the vertical profile of the Heathrow SIDs, and if required, initiate appropriate action to ensure adequate separation is maintained. This was also reversed to place the onus on the TC North controller. See also Section 5.1 d. | |

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| | **b) Impact on VFR Routes.** | N/A |
| | | |
| | **c) Consequential effects on procedures and capacity, ie on SIDS, STARS, holds. Details of existing or planned routes and holds.** | Yes |
| | The departure and arrival procedures are contained within existing CAS. The ATPEV contingency holds are available for contingency purposes (e.g. runway change) as described in Section 2.16/2.17. | |
| | **d) Impact on Airfields and other specific activities within or adjacent to the proposed airspace.** | Yes |
| | The existing conventional southbound SIDs route through the newly established Southend CAS (Southend CTA1 1500-3500ft). When this CAS was established in April 2015, agreements were established between NATS London Terminal Control (LTC) and Southend to ensure that the LCY traffic was climbed above the Southend CAS. In the existing airspace structure, as has been the case since the LCY SIDs were introduced, the LCY SIDs still have to be climbed above by LTC above 4000ft before they cross the LTMA bdy at 3500 ft just before the LON VOR D30. This still remains the case with the proposed EKNIV SIDs, although the new SIDs will be re-routed further east to ensure ample airspace is available for these departures to be climbed to reach MSL by SODVU. This is a requirement of the new airspace design which enables the departures to be climbed above the arrivals flying westbound along the Thames estuary. This therefore ensures that the LCY departures will be safely integrated with the Southend traffic. All Southend departures are subject to a release from Thames Radar so both departures are de-conflicted by the Thames controller before the Southend departures are cleared for take-off.<br><br>The impact of the RNAV arrivals and departures against adjacent Heathrow departures and arrivals is not expected to change. Interactions have been covered by the Route Design Analysis Report (RDAR) and have been assessed by SARG ATM Ops inspectors and the SARG AR CO. Specific details of this assessment will be covered in the NATS network Module C Op Report together with any mitigations required to assure separation of the RNAV 1 procedures against other interacting procedures. The NATS analysis is an extensive document of 180+ pages and is available on electronic folders if required for scrutiny. | |
| | **e) Any flight planning restrictions and/or route requirements.** | Yes |

| | | |
|---|---|---|
| | RNAV 1 procedures are only available for certified and approved aircraft and appropriately trained crews. Aircraft will be given clearance to fly the appropriate RNAV SID with their pre-departure clearance. Aircraft not equipped, and crews not approved will continue to be able to use conventional SIDs as described earlier. These departures will be tactically vectored once airborne to follow any RNAV1 departures which have departed ahead, as the Thames Radar controller will have to ensure that these conventional SIDs have adequate airspace to reach MSL before crossing the arrival traffic in the estuary.<br><br>Non RNAV1 arrivals will be vectored from the end of the RNAV5 STAR into the arrival sequence of any RNAV1 arrivals ahead. | |
| 5.2 | **Does the Change Sponsor Consultation letter reflect the likely operational impact of the change?** | Yes |
| | The Consultation Document, as highlighted in Section 4.1, clearly demonstrated the anticipated impacts of the predicted flight paths following the PBN SID replications and the RNAV arrival routes based on the predictions of the Eurocontrol RVT tool. Once implemented, the track dispersion of the new procedures will need be to be analysed to check whether the anticipated impact of concentration/dispersion is achieved. Whilst flyability checks in the flight simulators do show how the aircraft performed in particular met conditions programmed into the flight simulator scenario, live data should be analysed as soon as it is available after implementation.<br><br>It is recommended that the change sponsor conducts a monthly analysis after implementation to determine whether the predicted flight paths match the flight paths flown by the aircraft.<br><br>The ACP illustrates a reduction in ATC and flight deck crew workload given the nature of RNAV ops in that workload for controllers will be reduced as the requirements for radar vectoring will reduce. It should be noted that whilst early ATC development simulation indicated aircraft would be flying the Rwy 09 arrival procedure to intercept the ILS localiser, following the evolution of the design for the Rwy 09 arrival procedure, it became clear that such a design was not achievable given the very short distance between the track downwind and the runway centreline, and also the fact that there was insufficient distance for the aircraft to be established on the runway CL at least 5NM before the Final Approach Fix (FAF) for Rwy 09.<br><br>As a result, the Rwy 09 arrival transition will have a manual termination point on the base leg at a position known as 'ODLEG'. ATC will then be required to vector aircraft onto the ILS localiser; this was not envisaged in the initial design, and therefore, the original benefits with reduced controller workload for the Thames controllers will not be as high as originally envisaged before the ACP was submitted.<br><br>As the replication procedures do not require new CAS, users of Class G airspace are not affected by the replication procedures below 4000ft | |

| 6. | Economic Impact | Status |
|---|---|---|
| 6.1 | **Is a provisional economic impact assessment to all categories of operations and users likely to be affected by the change included and acceptable?**<br>**(This may include any forecast capacity gains and the cost of any resultant additional track mileage).** | No |
| | Not required – confirmed 30 Jul 15 - see Environmental Report v 1.7. | |

| Case Study Conclusions – To be completed by DAP Project Leader | Yes/No |
|---|---|
| **Has the Change Sponsor met the DAP Airspace Change Proposal requirements and Airspace Regulatory requirements above?** | Yes |

The sponsor has met the requirements for the PBN replication of conventional SIDs in that the RNAV1 SIDs replicate as far as possible the existing nominal track of the existing conventional SIDs. However, this should be analysed after implementation to determine if the impacts are as portrayed in the consultation document.

It is expected that the RNAV arrival replications will result in a more concentrated flight path downwind and base leg for Rwy 09 than is achieved by radar vectoring, however, this should be analysed after implementation to determine if the impacts are as portrayed in the consultation document. As aircraft will continue to establish on the ILS for Rwy 27 the expected change for this procedure as far as replication is concerned is minimal.

The introduction of RNAV1 SIDs and RNAV1 arrival procedures will reduce crew flight deck workload. ATC workload with vectoring aircraft downwind for Rwy 09 will also be reduced, although the TC South controller will have to monitor Heathrow DET SIDs to ensure standard separation is not compromised - this will be a regulatory requirement for TC South. Additionally, Thames Radar will have to monitor the aircraft to ensure they turn base leg without infringing the Heathrow Radar Manoeuvring Area (RMA), however [redacted]

As the Heathrow BPK and BUZAD SIDs are currently in proximity to the existing conventional SIDs, it is anticipated that the RNAV SIDs will be no closer than the existing conventional SIDs. However, the TC North controllers will have to monitor these Heathrow SIDs to ensure standard separation is not compromised - this will be a regulatory requirement for TC North.

This proposal is recommended for implementation.

**Outstanding Issues**

| Serial | Issue | Action Required |
|---|---|---|
| 1 | SID design minor issues. | Revisions to be checked by SARG IFP regulator. |
| 2 | Radio Communication Procedures – presentation on charts. | Details to be agreed with SARG IFP regulator. |
| 3 | IFP charting format. | Details to be confirmed by SARG IFP regulator. |

| Additional Compliance Requirements (to be satisfied by Change Sponsor) | |
|---|---|
| **Serial** | **Requirement** |
| 1 | Thames Radar controller to ensure that traffic entering the ATPEV Hold does not enter the Shoeburyness danger areas to the northeast. |
| 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. |
| | |

| Recommendations | Yes/No |
|---|---|
| **Is the approval of the SoS for Transport required in respect of the Environmental Impact of the airspace change?** | No |
| Not required | |
| **Is the approval of the MoD required in respect of National Security issues surrounding the airspace change?** | No |
| | |

## General Summary

A comprehensive ACP package for SID and arrival replications. On departure, traffic is expected to be more concentrated, however, post implementation, early analysis is required given that the design criteria used may result in some dispersion around the first turns after departure. The package provides benefits to both ATC controllers and flight deck crews with reduction in workload which PBN procedures enable.

## Comments

A monthly analysis should be carried out by LCY post implementation to determine whether the impacts of the change have as been predicted in consultation Both from an operational and environmental perspective. The sponsor should also keep local reaction to the concentration under review.

Appropriate guidance should be provided to LCY by SARG IFP to ensure that appropriate data is gathered for evaluation after implementation to enable LCY to produce adequate material for the PIR review.

## Observations

The requirements for consultation with the Mayor of London in certain circumstance became apparent during the ACP review. The consultation regulator should consider whether a note regarding this requirement needs to be included in any CAA documentation for further dissemination to change sponsors in the area of interest.

| Operational Assessment Sign-off/Approvals | | | |
|---|---|---|---|
| | **Name** | **Signature** | **Date** |
| **Operational Assessment completed by (SARG AR Project Leader)** | | | 28 Jul 15 |
| **Operational Assessment approved by (Head of Section)** | | | 28 Jul 15 |

| Case Study Sign-off/Approvals | | | |
|---|---|---|---|
| | **Name** | **Signature** | **Date** |
| **Case Study Assessment Conclusions approved by (Head AAA)** | | | |

**SARG Group Director Comment/Approval**

Approved subject to condition

| Name M SWAN | Signature | Date 16 Oct 15 |
|---|---|---|

## LCY SIDS FOR LAMP – DETERMINATION OF REPLICATION ACCEPTABILITY – DISCUSSION PAPER

Assumptions: LCY / NATS will have to gather track data for monthly stats to satisfy whether consultation expectation is realised; and if not, suspend and re-consider design. If suspended, conv SID remains in use – no issue. But not possible with EKNIVs as these are critical.

| SID | Does Conv SID NT Match Main Concentration of Dispersion on first turns | Does RNAV SID NT Match Conv SID NT (is it Replicated as Close as Possible) | Does RNAV SID Match Main Concentration of Conv SIDs Dispersion on first turn | Is RNAV design expected to fly over the Dots in Consultation Doc | Is RNAV SID Critical for LAMP1A Implementation | Does CAA accept RNAV Design | Suspend/ re-design if issues |
|---|---|---|---|---|---|---|---|
| Rwy 27 EKNIV | - | Yes (CLN) | Don't know until flown | Evidence from simulator validations suggests yes, however, it is not possible to be 100% sure until SIDs are flown. | Yes | Yes with minor coding amendment associated with the 1st waypoint | Not possible |
| Rwy 09 EKNIV | - | Yes (CLN) | Don't know until flown | Printouts from simulator validations suggest that RNAV tracks should be very close to those flown at present. | Yes | Yes with minor coding amendment associated with the 1st waypoint | Not possible |
| Rwy 27 CLN | No | Yes | Don't know until flown | Printouts from simulator validations suggest that RNAV tracks should be very close to those flown at present. | No | Yes with minor coding amendment associated with the 1st waypoint | Yes |
| Rwy 09 CLN | Yes | Yes | Don't know until flown | Printouts from simulator validations suggest that RNAV tracks should be very close to those flown at present. | No | Yes with minor coding amendment associated with the 1st waypoint | Yes |
| Rwy 27 BPK/CPT | No | Yes | Don't know until flown | Printouts from simulator validations suggest that RNAV tracks should be very close to those flown at present. | No | Yes with minor coding amendment associated with the 1st waypoint and revised speed restriction at BPK | Yes |

| SID | Does Conv SID NT Match Main Concentration of Dispersion on first turns | Does RNAV SID NT Match Conv SID NT (is it Replicated as Close as Possible) | Does RNAV SID Match Main Concentration of Conv SIDs Dispersion on first turn | Is RNAV design expected to fly over the Dots in Consultation Doc | Is RNAV SID Critical for LAMP1A Implementation | Does CAA accept RNAV Design | Suspend/ re-design if issues |
|---|---|---|---|---|---|---|---|
| RWY 09 BPK/CPT | No | Yes | Don't know until flown | Printouts from simulator validations suggest that RNAV tracks should be very close to those flown at present. | No | Yes with minor coding amendment associated with the 1st waypoint and revised speed restriction at BPK | Yes |

Arguments:

On the principle that ac accelerate up to the max publish speed on the chart/nav coding database, ac will not necessarily follow the NT of the designs on the first turns because of the first **flyover** WP, as after passing that WP, ac will commence turn to next WP and still be accelerating. Therefore, with a variance in ac type and speed, some dispersion is expected.

On this basis, it is reasonable to accept that the designs will be no worse in terms of flying wider turns than the existing conv SID during the first turns.