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LAMP Phase 1A

Airspace Change Proposal – Module B

London City Airport RNAV Replications

Issue 1.0
February 2015
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Prepared by:
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Issue	Month/ Year	Changes in this issue
Issue 1	February 2015	Initial issue submitted to CAA SARG.

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1 Introduction

This document has been produced by London City Airport who are the sponsors of this change. It provides full details of the proposed airspace change and demonstrates compliance with CAA CAP725 requirements.

The proposed changes described herein are to the arrival and departure routes from/to London City Airport. The objective of these changes is to introduce "RNAV Replications" of the current conventional procedures i.e. RNAV Standard Instrument Departures (SIDs) which replicate the current conventional SIDs, and arrival transitions which replicate the current concentration of arrival flight paths.

If the proposal is approved by the CAA, implementation of the airspace change will occur at an appropriate opportunity but, in any event not before 10th December 2015. (AIRAC 13/2015). The intention is that this airspace change is implemented alongside/as part of LAMP Phase 1A.

The consultation for this proposal ran from 4th September to 27th November 2014. The consultation document and the consultation feedback report are both attached with this ACP.

2 How to Read this Airspace Change Proposal (ACP)

This document forms Module B of the LAMP Phase 1 ACP package. The structure of the ACP is shown in Figure 1 below.

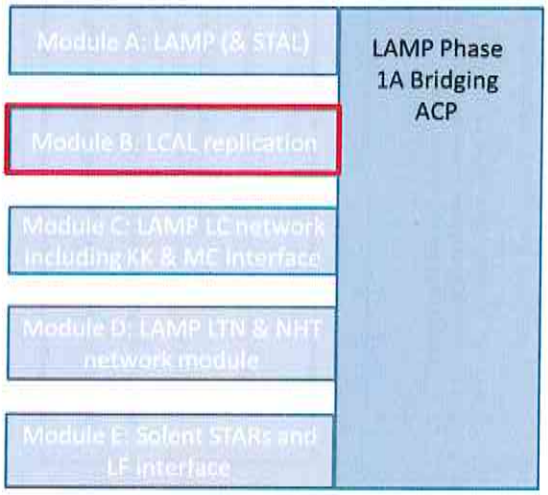

Figure 1: LAMP Phase 1 ACP structure

Much of the evidence of meeting CAP725 requirements has already been documented in the consultation material, feedback report and other technical documents.

This document is therefore designed to demonstrate compliance with CAP725 requirements. As such it provides references to relevant evidence where it exists elsewhere, as well as presenting additional detail where required.

Reference Documents

All referenced documents are provided as part of the ACP. The document map below details the reference documents for all modules of the ACP.

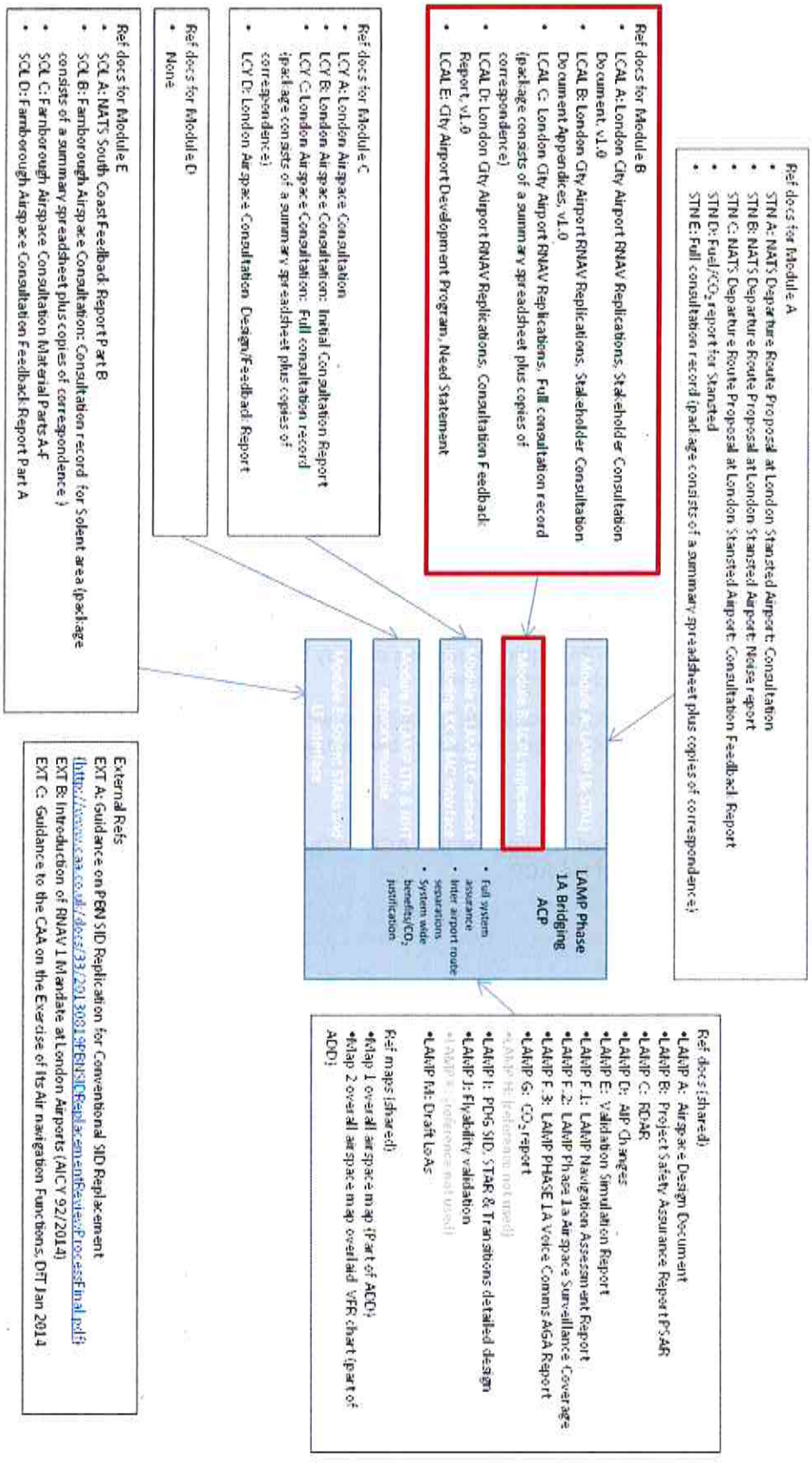

Figure 2: Document Map & References

3 Justification

The introduction of RNAV1 procedures is justified in part by the requirement to conform to European legal requirements and proposed CAA mandates as detailed below. Our intention is to meet these requirements with the minimum impact to stakeholders; hence we are 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. We therefore propose to keep 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 (planned for 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 1 airspace change proposal which NATS are submitting to the CAA concurrently with this proposal. End to end RNAV1 connectivity between the enroute 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. 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 our proposal to replicate the low level routes for London City Airport.

4 Current Airspace Description

4.1 Existing Airspace & Traffic Routings

For details of the existing airspace and current traffic routings, please refer to ref. LCAL_ A (LCA RNAV Replications, Stakeholder Consultation Document), Section 4.

Table 1 below shows the traffic figures for arrivals and departures to London City Airport by month for 2014.

2014	Arrivals	Departures	Total
January	2909	2920	5829
February	2785	2803	5588
March	3065	3070	6135
April	2985	2983	5968
May	3101	3103	6204
June	3283	3285	6568
July	3232	3239	6471
August	2724	2727	5451
September	3275	3291	6566
October	3571	3575	7146
November	3462	3467	6929
December	3237	3241	6478
Total	37629	37704	75333

Table 1 Traffic Statistics: London City by month 2014 (excludes training & positioning flights)

The introduction of RNAV replications will not have any influence on the rate of growth of traffic operating within the airspace. For the purposes of the system wide CO_2 analysis, a level of growth has been assumed – the predicted traffic numbers are presented in the Bridging ACP which discusses network impacts.

4.1.1 Aircraft Types

The aircraft types operating at London City Airport are shown in Table 2 (data taken from LCACC statistics, Aircraft Movements by Aircraft Type: July - Sept 2014):

Aircraft Name	AC Type	Totals	%
Embraer 190	E190	5158	27.8%
Avro RJ-85	RJ85	3129	16.8%
Embraer 170	E170	2535	13.6%
Fokker 50	F50	1826	9.8%
Avro RJ-100	RJ1H	1730	9.3%
Saab 2000	SB20	1110	6.0%
Dash 8 Q400	DH8D	745	4.0%
Dornier 328	D328	506	2.7%
Hawker 800	H25B	364	2.0%
Cessna Citation Excel	C56X	345	1.9%
ATR-42	AT42	286	1.5%
Airbus A318	A318	246	1.3%
Others		117	4.6%

Table 2 Aircraft types using London City Airport, July-Sept 2014

4.2 Traffic Figures

4.2.1 Number of flights using each route

For figures indicating how many flights fly on each route, please refer to ref. LCAL_A (Consultation Doc), Table 3, Page 21 and figures 5-21 (pages 22-31).

4.2.2 Traffic Forecasts

Due to the nature of replication the proposed changes will have no influence on traffic growth at London City Airport.

London City Airport has produced detailed forecasts of expected traffic growth in relation to the City Airport Development Program (CADP) planning application. These forecasts are for the years 2019/2021/2023 (ref. LCAL_E section 3.42).

4.3 Operational Efficiency, Complexity, Delays & Choke Points

The low level replication change is not being implemented to overcome complexity or network efficiency issues in the London City Airport's airspace. However 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 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 the significant efficiency gains as described in Module C and the bridging ACP would not be able to be fully realised.

5 Proposed Airspace Description

5.1 Proposed New Airspace/Route Definition & Usage

For a full description of the proposal please refer to ref. document LCAL_A (Consultation Doc), Section 2.1.

This ACP is intended to introduce RNAV1 replications of all SIDs and 2 RNAV arrival procedures at London City Airport (EGLC). This proposal covers the replication of 10 SIDs and 2 arrival transitions as listed in Table 2. The proposed detailed procedure design, draft charts and RNAV coding tables for the SIDS STARS & transitions is given in ref LAMP_I.

The purpose of this ACP is to introduce RNAV1 replications of the low altitude portions of the existing conventional London City SIDs and approach transitions to both runways. The portions of the procedures which are being replicated are detailed in ref. LCAL_B (Consultation Doc Appendices) Appendix C. Table 3 below also gives precise identification of the start and end points of the replication. The EKNIV RNAV SIDs replicate & supersede the DVR and LYD conventional SIDs.

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	**ROSVU** (51 29 18.05N 000 33 22.74E)	**ODLEG** (51 29 59.14N 000 13 29.17E)	No*

Table 3 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.

This document is Module B of the LAMP Phase 1 ACP package. The NATS LAMP Phase 1 Network ACP (Module C of the LAMP Phase 1 ACP package) is concerned with the higher altitude portions of the procedures and the interfaces with the lower ATS route structure where they differ from today. The replication end points as described in Table 3 above, delineate the transition from the low altitude portion (below 4000ft) which is covered by this ACP, and the high altitude portions which are covered in the NATS LAMP Phase 1 Network ACP. Diagrams illustrating the procedures and which portions are being

replicated with RNAV1, and are covered by this ACP (as listed in Table 3) are given in ref LCAL_ B (Consultation Doc Appendices) Appendix C.

The detailed procedure designs and draft charts are given in ref LAMP_I (PDG SID, STAR & transitions detailed design).

The details of the replication of the low level parts of the procedures (as defined in Table 3) are covered by this ACP. However the procedure design, flyability assurance, airspace design and safety assurance aspects are presented as end to end procedures described in the bridging ACP.

Since the changes proposed herein are RNAV replications of the existing conventional procedures, no changes to the classification or extent of controlled airspace are required.

New waypoints

The new waypoints their positions and the procedure for which they are used, are detailed in ref LAMP_I (PDG SID, STAR & transitions detailed design).

5.2 Vertical profiles

In order to fulfil the requirement for replication, changes to the vertical limits and altitude restrictions could not be considered. However it is expected that the transition to RNAV will indirectly facilitate improved descent profiles for arriving aircraft. This is because the arrival procedure provides a defined track (in the Flight Management System) terminating on the base leg for runway 09 and on the final approach for runway 27. This will allow pilots to have more certainty regarding track miles to go, and hence will be able to plan their descents more effectively.

For departing aircraft on the EKNIV SID the change to RNAV will enable improved climb profiles when above 4000ft (outside the scope of this ACP module). In the longer term, profiles on the other SIDs are also expected to improve when the RNAV network is completed as part of LAMP Phase 2.

5.3 Non-RNAV1 capable aircraft

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.

5.3.1 Arriving Aircraft

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.

5.3.2 Departing Aircraft

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

6 Impacts Summary

6.1 Units Affected by the Proposal

This proposal affects London City Airport, Biggin Hill Airport and NATS London Terminal Control, Swanwick. The proposal is sponsored by London City Airport and supported by NATS and Biggin Hill Airport.

6.2 Safety Issues/Analysis

The proposed procedures have been designed in accordance with ICAO PANS-OPS RNAV procedure design criteria (ref. LAMP_I, PDG SID, STAR & Transitions detailed design). Flyability validation of the procedures has been undertaken on representative aircraft types (ref. LAMP_J, Flyability validation). A Safety Case has been performed and is included as ref. LAMP_B (Project Safety Assurance Report). This includes an SP406 Safety Benefits Analysis.

The CAA Inspector ATS Operations (London City) has been involved throughout the London City Airport RNAV replication project.

6.3 Military Implications & Consultation

There are no impacts upon Military operations. The military has been consulted, and support the proposals (ref LCAL_C, consultation record, NATMAC32-C).

6.4 General Aviation Airspace Users Impact & Consultation

The introduction of RNAV SIDs and arrival transitions at London City Airport will not have any impact upon the General Aviation (GA) community. Representatives of GA organisations were consulted via the NATMAC and have either supported or made no objection to the proposal. (ref LCAL_C, consultation record)

6.5 Commercial Air Transport Impact & Consultation

The benefits of RNAV SIDs and arrival transitions at LCY are recognised and supported by the airline community.

Representatives of all airlines whom operate from LCY were consulted, and have either supported or made no objection to the proposal (ref LCAL_C, consultation record).

6.6 CO_2 Environmental Analysis Impact & Consultation

There are no direct fuel or CO_2 benefits from the replication of routes, however, this proposal is an enabler for wider system benefits which are described in the LAMP Phase 1 bridging ACP and ref LCAL_D (Consultation Feedback Report) section 3.

6.7 Local Environmental Impacts & Consultation

Local environmental impacts capture the predicted impacts of changes on noise, tranquillity, visual intrusion, local air quality & biodiversity. There will be no impact on, local air quality & biodiversity (ref LCAL_D: Consultation Feedback Report, Section 4).

Since the proposed change is to replicate as closely as possible the existing routes, the impact on noise, tranquillity, visual intrusion is not expected to be significant, and in accordance with the CAA's policy on replication (ref CAA_A) no analysis of these has been undertaken.

The LCY RNAV replication stakeholder consultation was of 12 weeks duration commencing on the 3rd September 2014 and ending on 27th November 2014. The consultation document (ref. LCAL_A) which described the changes was sent to NATMAC stakeholders, all members of the London City Airport Consultative Committee and representatives of all airlines which operate from the airport. The full stakeholder list is given in Appendix A of the Consultation Appendices (ref LCAL_B, page 1).

Detailed analysis of the responses is presented in the Consultation Feedback Report (ref. LCAL_D section 3). There were six key themes which were of most concern during consultation. These were:

- Extent of consultation,
- Concentration of flight paths,
- Noise impact,
- Impact on Noise Preferential Routes (NPRs),
- Pollution/local air quality/CO_2 emissions,
- Improved environmental performance and systemisation.

Detailed discussion of these themes is presented in ref. LCAL_D, section 3.

The replications had already been designed to match today's routes as closely as possible and so no changes to the RNAV replications designs have been made as a result of feedback from consultation.

6.8 Economic Impact

London City Airport is not aware of any established methodology that is widely accepted as providing a complete and robust economic valuation of the environmental impacts of changes to airspace structure. Furthermore, London City Airport does not base the case for change on an economic valuation of environmental impact and therefore does not propose to attempt to provide or develop such analysis.

7 Analysis of Options

Various options have been considered throughout the design stage of the project. The design as presented in section 5 provided the closest match to today's procedures and current patterns of over-flight. The proposed detailed procedure design, draft charts and RNAV coding tables for the SIDS, STARS & transitions are given in ref. LAMP_I. All other options listed below were considered but discounted.

7.1 Do Nothing

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 as described in section 3 (Justification), 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 now and to comply with the upcoming regulatory mandate (ref CAA_B), the 'do nothing' option has been discounted.

7.2 Different RNAV Coding Permutations

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.

8 Airspace Description Requirements

CAP 725, Appendix A Paragraph 5, provides a list of requirements for a proposed airspace description. These are listed below:

	CAA CAP725, Appendix A paragraph 5 Requirement. "The proposal should provide a full description of the proposed change including the following:"	**Description for this Proposal**
a	The type of route or structure; e.g. Airway, UAR, Conditional Route, Advisory Route, CTR, SIDs/STARs, Holding Patterns, etc;	RNAV Replications. See Section 5
b	The hours of operation of the airspace and any seasonal variations;	The RNAV Replications will be available H24, 365 days of the year.
c	Interaction with domestic and international en-route structures, TMAs or CTAs with an explanation of how connectivity is to be achieved. Connectivity to aerodromes not connected to CAS should be covered;	See Section 5 and ref LAMP_I (Procedure Design & Draft Charts)
d	Airspace buffer requirements (if any);	n/a.
e	Supporting information on traffic data including statistics and forecasts for the various categories of aircraft movements (Passenger, Freight, Test and Training, Aero Club, Other) and Terminal Passenger numbers;	See section 4.
f	Analysis of the impact of the traffic mix on complexity and workload of operations;	See section 4.3
g	Evidence of relevant draft Letters of Agreement, including any arising out of consultation and/or Airspace Management requirements;	No LoAs are affected.
h	Evidence that the Airspace Design is compliant with ICAO Standards and Recommended Practices (SARPs) and any other UK Policy or filed differences, and UK policy on the Flexible Use of Airspace (or evidence of mitigation where it is not);	See ref LAMP_I.
i	The proposed airspace classification with justification for that classification;	There are no proposed changes to airspace classification
j	Demonstration of commitment to provide airspace users equitable access to the airspace as per the classification and where necessary indicate resources to be applied or a commitment to provide them in-line with forecast traffic growth. 'Management by exclusion' would not be acceptable;	The changes in this proposal are contained wholly within existing CAS there are no changes to the CAS boundaries required.
k	Details of and justification for any delegation of ATS.	n/a

9 Operational Impact

CAA CAP725, Appendix A Paragraph 7, provides a list of requirements for operational impact. These are listed below:

	CAA CAP725, Appendix A paragraph 7 requirements. "An analysis of the impact of the change on all airspace users, airfields and traffic levels must be provided, and include an outline concept of operations describing how operations within the new airspace will be managed. Specifically, consideration should be given to:"	**Evidence of Compliance/Proposed Mitigation**
a	Impact on IFR General Air Traffic and Operational Air Traffic or on VFR General Aviation (GA) traffic flow in or through the area;	See Section 6
b	Impact on VFR operations (including VFR Routes where applicable);	No impact (see Section 6)
c	Consequential effects on procedures and capacity, i.e. on SIDS, STARS, and/or holding patterns. Details of existing or planned routes and holds;	See Section 5, and ref LAMP_I.
d	Impact on aerodromes and other specific activities within or adjacent to the proposed airspace;	No impact (see section 5)
e	Any flight planning restrictions and/or route requirements.	See Section 5

10 Supporting Infrastructure & Resources

CAA CAP725, Appendix A Paragraph 6, provides a list of requirements for supporting infrastructure/resources. These are listed below:

	CAA CAP725, Appendix A Paragraph 6, general Requirements	Evidence of Compliance/Proposed Mitigation
a	Evidence to support RNAV and conventional navigation as appropriate with details of planned availability and contingency procedures.	The proposed LCY RNAV replications are contained within extant CAS where the CNS infrastructure is well proven and appropriate contingency procedures already exist. The existing conventional SIDs will remain available to support non-RNAV equipped aircraft, until the RNAV mandate comes into force.
b	Evidence to support primary and secondary surveillance radar (SSR) with details of planned availability and contingency procedures.	The proposed LCY RNAV replications are contained within airspace where the CNS infrastructure is well proven and appropriate contingency procedures already exist.
c	Evidence of communications infrastructure including R/T coverage, with availability and contingency procedures.	The proposed LCY RNAV replication is contained within airspace where the CNS infrastructure is well proven and appropriate contingency procedures already exist.
d	The effects of failure of equipment, procedures and/or personnel with respect to the overall management of the airspace must be considered.	The proposed LCY RNAV replication is contained within airspace where the CNS infrastructure is well proven and appropriate contingency procedures already exist.
e	The Proposal must provide effective responses to the failure modes that will enable the functions associated with airspace to be carried out including details of navigation aid coverage, unit personnel levels, separation standards and the design of the airspace in respect of existing international standards or guidance material.	The proposed LCY RNAV replication is contained within airspace where the CNS infrastructure is well proven and appropriate contingency procedures already exist.
f	A clear statement on SSR code assignment requirements is also required.	No changes to the extant methods of SSR code allocation to traffic using the LCY RNAV replication is required.
g	Evidence of sufficient numbers of suitably qualified staff required to provide air traffic services following the implementation of a change.	The introduction of RNAV replications of conventional procedures will not require any changes to staffing requirements.

11 Airspace & Infrastructure Requirements

CAA CAP725, Appendix A Paragraphs 11-14, provides a list of requirements for airspace and infrastructure. These are listed below:

	CAA CAP725, Appendix A paragraph 11: General Requirements	Evidence of Compliance/Proposed Mitigation
a	The airspace structure must be of sufficient dimensions with regard to expected aircraft navigation performance and manoeuvrability to fully contain horizontal and vertical flight activity in both radar and non-radar environments;.	The airspace structure is not changing. The proposed RNAV SIDs and arrival transitions are replications of the extant procedures. These will facilitate better track keeping for aircraft on the procedures. The existing CAS will be adequate to contain horizontal and vertical flight activity.
b	Where an additional airspace structure is required for radar control purposes, the dimensions shall be such that radar control manoeuvres can be contained within the structure, allowing a safety buffer. This safety buffer shall be in accordance with agreed parameters as set down in DAP Policy Statement 'Safety Buffer Policy for Airspace Design Purposes Segregated Airspace';	Not applicable.
c	The Air Traffic Management (ATM) system must be adequate to ensure that prescribed separation can be maintained between aircraft within the airspace structure and safe management of interfaces with other airspace structures;	The proposed LCY RNAV replication environment will be managed much the same as the airspace is managed today. ATC will monitor separations as per today, and better track keeping will help ensure separations are maintained.
d	Air Traffic Control (ATC) procedures are in place to ensure required separation between traffic inside a new airspace structure and traffic within existing adjacent or other new airspace structures;	No change to existing airspace structures..
e	Within the constraints of safety and efficiency, the airspace classification should permit access to as many classes of user as practicable;	There are no proposed changes to airspace classification.
f	There must be assurance, as far as practicable, against unauthorised incursions. This is usually done through the classification and promulgation.	There are no proposed changes to airspace classification or access. Promulgation will be over 2 AIRAC cycles.
g	Pilots shall be notified of any failure of navigational facilities and of any suitable alternative facilities available and the method of identifying failure and notification should be specified;	Failure of navigational facilities will be promulgated by NOTAM and ATC will provide navigational assistance using radar when necessary.
h	The notification of the implementation of new airspace structures or withdrawal of redundant airspace structures shall be adequate to allow interested parties sufficient time to comply with user requirements. This is normally done through the AIRAC cycle;	Changes will be published via the normal AIRAC cycles. Two AIRAC cycle notice will be given.
i	There must be sufficient R/T coverage to support the ATM system within the totality of proposed controlled airspace.	There are no proposed changes to the dimensions of CAS and aircraft already fly the proposed routes. R/T coverage is demonstrably adequate for the task.

j	If the new structure lies close to another airspace structure or overlaps an associated airspace structure, the need for operating agreements shall be considered;	No changes to LoAs required.
k	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, the Change Sponsor shall act to resolve any conflicting interests;	n/a

	CAA CAP725, Appendix A paragraph 12: ATS Route Requirements	**Evidence of Compliance/Proposed Mitigation**
a	There must be sufficient accurate navigational guidance based on in-line VOR/DME 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;	The proposed route is contained within airspace currently populated with numerous routes where navigation coverage is well proven and the navaid system is demonstrably appropriate for the task.
b	Where ATS routes adjoin Terminal Airspace there shall be suitable link routes as necessary for the ATM task;	The RNAV routes proposed integrate with the network of link routes, as detailed in Module C of this ACP package.
c	All new routes should be designed to accommodate P-RNAV navigational requirements.	The proposed LCY RNAV replications are specifically designed for RNAV1 use.

	CAA CAP725, Appendix A paragraph 13: Terminal Airspace Requirements	**Evidence of Compliance/Proposed Mitigation**
a	The airspace structure shall be of sufficient dimensions to contain appropriate procedures, holding patterns and their associated protected areas;	The proposed LCY RNAV replication is contained within current CAS. See Section 5 and ref LAMP_I (Procedure Design, Draft Charts & Coding Tables)
b	There shall be effective integration of departure and arrival routes associated with the airspace structure and linking to designated runways and published IAPs;	See Section 5 and ref LAMP_I (Procedure Design, Draft Charts & Coding Tables)
c	Where possible, there shall be suitable linking routes between the proposed terminal airspace and existing en-route airspace structure;	See Section 5 and ref LAMP_I (Procedure Design, Draft Charts & Coding Tables)
d	The airspace structure shall be designed to ensure that adequate and appropriate terrain clearance can be readily applied within and adjacent to the proposed airspace;	See Section 5 and ref LAMP_I (Procedure Design, Draft Charts & Coding Tables)

e	Suitable arrangements for the control of all classes of aircraft (including transits) operating within or adjacent to the airspace in question, in all meteorological conditions and under all flight rules, shall be in place or will be put into effect by Change Sponsors upon implementation of the change in question (if these do not already exist);.	As extant, See Section 5
f	Change Sponsors shall ensure that sufficient VRPs are established within or adjacent to the subject airspace to facilitate the effective integration of VFR arrivals, departures and transits of the airspace with IFR traffic;	No change to extant VRPs.
g	There shall be suitable availability of radar control facilities;	No change to extant availability
h	Change Sponsors shall, upon implementation of any airspace change, devise the means of gathering (if these do not already exist) and of maintaining statistics on the number of aircraft transiting the airspace in question. Similarly, Change Sponsors shall maintain records on the numbers of aircraft refused permission to transit the airspace in question, and the reasons why. Change Sponsors should note that such records would enable ATS Managers to plan staffing requirements necessary to effectively manage the airspace under their control;	No change to extant monitoring methods (UKFDB) or traffic levels expected as a consequence of this proposal.
i	All new procedures should, wherever possible, incorporate Continuous Descent Approach (CDA) profiles after aircraft leave the holding facility associated with that procedure.	Implementation of RNAV arrivals will give pilots improved capability to execute CDAs with more accuracy.

	CAA CAP725, Appendix A paragraph 14: Off Route Airspace Requirements	**Evidence of Compliance/Proposed Mitigation**
	There are no proposed changes to off route airspace structures.	

12 Environmental Requirements

This section details the required elements of an Environmental Assessment for the LCY RNAV replications ACP, based upon CAP 725 Appendix B.

The requirements in this section are grouped by the degree of compliance expected from airspace change sponsors. In following this guidance:

- **Must** – change sponsors are to meet the requirements in full when this term is used.
- **Should** – change sponsors are to meet these requirements unless there is sufficient reason which must be agreed in writing with the DAP case officer and the circumstances recorded in the formal airspace change documentation.
- **May** – change sponsors decide whether this guidance is appropriate to the circumstances of the airspace change.

	Requirement		CAP725 Ref.	CAP725 Page	How met
1	A technical document containing a comprehensive and complete description of the airspace change including the environmental impact will be required and **must** be produced for all airspace changes.	General	Para 25	B-6	See Sections 4, 5 & 6
2	The environmental assessment **must** include a high quality paper diagram of the airspace change in its entirety as well as supplementary diagrams illustrating different parts of the change. This diagram **must** show the extent of the airspace change in relation to known geographical features and centres of population	Airspace Design	Para 28	B-7	See ref LCAL_A, LCAL_B, LAMP_A, LAMP_I
3	The Change Sponsor **must** provide DAP with a complete set of coordinates describing the proposed change in electronic format using World Geodetic System 1984 (WGS 84). In addition, the Sponsor **must** supply these locations in the form of Ordnance Survey (OS) national grid coordinates.	Airspace Design	Para 30	B-7	See Section 6 and refs LAMP_A, LAMP_D LAMP_I
4	This electronic version **must** provide a full description of the horizontal and vertical extent of the zones and areas contained within the airspace change. It **must** include coordinates in WGS 84 that define the centre lines of routes including airways, standard instrument departures (SID), standard arrival routes (STAR), noise preferential routes (NPR) or any other arrangement that has the effect of concentrating traffic over a particular geographical area.	Airspace Design	Para 30	B-7	See Section 6 and refs LAMP_A, LAMP_D, LAMP_I
5	Change Sponsors **must** provide a description of the vertical distribution of traffic in airways, SIDs, STARs, NPRs and other arrangements that have the effect of concentrating traffic over a particular geographical area	Airspace Design	Para 32	B-7	See ref LCAL_A, LCAL_B
6	Change Sponsors **must** include traffic forecasts in their environmental assessment.	Traffic Forecasts	Para 35	B-8	See LAMP Phase 1 bridging ACP

	Requirement		CAP725 Ref.	CAP725 Page	How met
7	Information on air traffic **must** include the current level of traffic using the present airspace arrangement and a forecast. The forecast will need to indicate the traffic growth on the different routes contained within the airspace change volume.	Traffic Forecasts	Para 35	B-8	See Section 4
8	The sources used for the forecast **must** be documented.	Traffic Forecasts	Para 35	B-8	See Section 4
9	Change Sponsors **must** produce $L_{eq,\ 16\ hours}$ noise exposure contours for airports where the proposed option entails changes to departure and arrival routes for traffic below 4,000 feet agl based on the published minimum departure and arrival gradients. Under these circumstances, at least three sets of contours **must** be produced: Current situation – these may already be available as part of the airport's regular environmental reporting or as part of the airport master plan; Situation immediately following the airspace change; and Situation after traffic has increased under the new arrangements (typically five years after implementation although this **should** be discussed with the DAP Project Leader).	Noise	Para 44	B-11	n/a see section 6.7 and LCAL_A, LCAL_D
10	Contours **must** be portrayed from 57 dBA $L_{eq,\ 16\ hours}$ at 3 dB intervals.	Noise	Para 48	B-12	n/a see section 6.7 and LCAL_D (no change to the noise contours)
11	SEL footprints **must** be used when the proposed airspace includes changes to the distribution of flights at night below 7,000 feet agl and within 25 km of a runway. Night is defined here as the period between 2300 and 0700 local time. If the noisiest and most frequent night operations are different, then footprints **should** be calculated for both of them. A separate footprint for each of these types **should** be calculated for each arrival and departure route. If SEL footprints are provided, they **should** be calculated at both 90 dBA SEL and 80 dBA SEL.	Noise	Para 56	B-13	n/a see section 6.7. LCY is closed at night. (after 2200 in winter/ 2100 in summer)
12	Change Sponsors **must** demonstrate how the design and operation of airspace will impact on emissions. The kinds of questions that need to be answered by the sponsor are: Are there options which reduce fuel burn in the vertical dimension, particularly when fuel burn is high e.g. initial climb? Are there options that produce more direct routeing of aircraft, so that fuel burn is minimised? Are there arrangements that ensure that aircraft in cruise operate at their most fuel-efficient altitude, possibly with step-climbs or cruise climbs?	Climate Change	Para 102	B-22	n/a see section 6.7

	Requirement		CAP725 Ref.	CAP725 Page	How met
13	Change Sponsors **must** produce information on local air quality only where there is the possibility of pollutants breaching legal limits following the implementation of an airspace change. The requirement for local air quality modelling will be determined on a case by case basis as discussed with the DAP Project Leader and ERCD. This discussion will include recommendations of the appropriate local air quality model to be used. Concentrations **should** be portrayed in microgrammes per cubic metre ($\mu g.m^{-3}$). They **should** include concentrations from all sources whether related to aviation and the airport or not. Three sets of concentration contours **should** be produced: Current situation – these may already be available as part of the airport's regular environmental reporting or as part of the airport master plan; Situation immediately following the airspace change; and Situation after traffic has increased under the new arrangements – typically five years after implementation although this **should** be discussed with the DAP Project Leader.	Local Air Quality	Para 115	B-25	Not Applicable
14	In order to ensure that the various areas for environmental assessment by DAP are addressed, Change Sponsors **should** submit the documentation with the following clearly defined sections: Description of the airspace change (refer to 28 – 33); Traffic forecasts (refer to 34 – 38); An assessment of the effects on noise (refer to Sections 4 and 5); An assessment of the change in fuel burn/CO_2 (refer to Section 6); An assessment of the effect on local air quality (refer to Section 7); and An economic valuation of environmental impact, if appropriate (refer to Section 9).	General	Para 2	B-1	See sections 4 and 5 n/a see section 6.7 n/a see section 6.8
15	Environmental assessment **should** set out the base case or current situation so that changes can be clearly identified.	General	Para 19	B-4	See refs LCAL_A, LCAL_B and section 4
16	Environmental assessment **should** follow the Basic Principles listed in CAP 725.	General	Para 20	B-4	These principles have been borne in mind when providing the detailed response to the requirements listed in this set of tables.
17	The proposal **should** consider and assess more than one option, then demonstrate why the selected option meets safety and operational requirements and will generate an overall environmental benefit or, if not, why it is being proposed.	Airspace Design	Para 29	B-7	See section 7.

	Requirement		CAP725 Ref.	CAP725 Page	How met
18	Change Sponsors **should** provide indications of the likely lateral dispersion of traffic about the centre line of each route. This **should** take the form of a statistical measure of variation such as the standard deviation of lateral distance from the centre line for given distances along track in circumstances where the dispersion is variable.	Airspace Design	Para 31	B-7	See ref. LCAL_A, LCAL_B and LCAL_D.
19	For departing traffic, sponsors **should** produce profiles of the most frequent type(s) of aircraft operating within the airspace. They **should** show vertical profiles for the maximum, typical and minimum climb rates achievable by those aircraft.	Airspace Design	Para 32	B-7	See ref. LAMP_J (Flyability validation report).
20	A vertical profile for the slowest climbing aircraft likely to use the airspace **should** also be produced.	Airspace Design	Para 32	B-8	See ref. LCAL_A and LAMP_J (Flyability validation report).
21	All profiles **should** be shown graphically and the underlying data provided in a spread-sheet with all planning assumptions clearly documented.	Airspace Design	Para 32	B-8	See ref. LCAL_A and LAMP_J (Flyability validation report).
22	Change Sponsors **should** explain how consideration of CDA and LPLD is taken into account within their proposals	Airspace Design	Para 33	B-8	See section 5.2
23	Typically, forecasts **should** be for five years from the planned implementation date of the airspace change. There **may** be good reasons for varying this – for example, to use data that has already been made available to the general public at planning inquiries, in airport master plans or other business plans	Traffic Forecasts	Para 36	B-8	See LAMP Phase 1 bridging ACP
24	Traffic forecasts **should** contain not only numbers but also types of aircraft. Change Sponsors **should** provide this information by runway (for arrivals/departures) and/or by route with information on vertical distribution by height/altitude/flight level as appropriate.	Traffic Forecasts	Para 38	B-9	See LAMP Phase 1 bridging ACP
25	The contours **should** be produced using either the UK Aircraft Noise Contour Model (ANCON) or the US Integrated Noise Model (INM) but ANCON **must** be used when it is currently in use at the airport for other purposes.	Noise	Para 46	B-12	n/a see section 6.7.
26	Terrain adjustments **should** be included in the calculation process (i.e. the height of the air routes relative to the ground are accounted for).	Noise	Para 47	B-12	n/a see section 6.7.

	Requirement		CAP725 Ref.	CAP725 Page	How met
27	Contours **should** not be produced at levels below 54 dBA $L_{eq, 16\ hours}$ because this corresponds to generally low disturbance to most people.	Noise	Para 48	B-12	n/a.
28	A table **should** be produced showing the following data for each 3 dB contour interval: Area (km^2); and Population (thousands) – rounded to the nearest hundred.	Noise	Para 49	B-12	n/a
29	It is sometimes useful to include the number of households within each contour, especially if issues of mitigation and compensation are relevant: This table **should** show cumulative totals for areas/populations/households. For example, the population for 57 dBA will include residents living in all higher contours. The source and date of population data used **should** be noted adjacent to the table. Population data **should** be based on the latest available national census as a minimum but more recent updated population data is preferred. The areas calculated **should** be cumulative and specify total area within each contour including that within the airport perimeter.	Noise	Para 50	B-12	n/a
30	Contours for assessment **should** be provided to DAP in **both** of the following formats: Electronic files in the form of a comma delimited ASCII text file containing three fields as an ordered set (i.e. coordinates should be in the order that describes the closed curve) defining the contours in Ordnance Survey National Grid in metres: Field Field Name Units 1 Level dB 2 Easting six figure easting OS national grid reference (metres) 3 Northing six figure northing OS national grid reference (metres) Paper version overlaid on a good quality 1:50 000 Ordnance Survey map. However, it **may** be more appropriate to present contours on 1:25 000 or 1:10 000 Ordnance Survey maps.	Noise	Para 51	B-13	n/a

	Requirement		CAP725 Ref.	CAP725 Page	How met
31	SEL footprints for assessment **should** be provided to DAP in **both** of the following formats: Electronic files in the form of a comma delimited ASCII text file containing three fields as an ordered set (i.e. coordinates should be in the order that describes the closed curve) defining the footprints in Ordnance Survey National Grid in metres: Field Field Name Units 1 Level dB 2 Easting six figure easting OS national grid reference (metres) 3 Northing six figure northing OS national grid reference (metres) Paper version overlaid on a good quality 1:50 000 Ordnance Survey map. However, it **may** be more appropriate to present footprints on 1:25 000 or 1:10 000 Ordnance Survey maps.	Noise	Para 57	B-14	n/a
32	Change Sponsors **should** estimate the total annual fuel burn/mass of carbon dioxide in metric tonnes emitted for the current situation, the situation immediately following the airspace change and the situation after traffic has increased under the new arrangements – typically five years after implementation. Sponsors **should** produce estimates for each airspace option considered.	Climate Change	Para 106	B-23	See section 6.6
33	Change Sponsors **should** provide the input data for their calculations including any modelling assumptions made. They **should** state details of the aircraft performance model used including the version numbers of software employed.	Climate Change	Para 107	B-23	See section 6.6
34	Where the need to provide additional airspace capacity, reduce delays or mitigate other environmental impact results in an increase in the total annual fuel burn/ mass of carbon dioxide in metric tonnes between the current situation and the situation following the airspace change, Sponsors **should** provide justification.	Climate Change	Para 108	B-23	n/a
35	Contours for assessment **should** be provided to DAP in similar formats to those used for noise exposure contours. Where Change Sponsors are required to produce concentration contours they **should** also produce a table showing the following data for concentrations at 10 $\mu.m^{-3}$ intervals: Area (km^2); and Population (thousands) – rounded to the nearest hundred.	Local Air Quality	Para 116	B-25	LAQ analysis not required.
36	The source and date of population data used **should** be noted adjacent to the table. Population data **should** be based on the latest available national census as a minimum but more recent updated population data is preferred.	Local Air Quality	Para 117	B-25	n/a

	Requirement		CAP725 Ref.	CAP725 Page	How met
37	It is considered unlikely that airspace changes will have a direct impact on animals, livestock and biodiversity. However, Change Sponsors should remain alert to the possibility and **may** be required to include these topics in their environmental assessment.	General	Para 18	B-4	See section 6.7
38	It **may** be appropriate for Change Sponsors to produce a more general description of the airspace change and the rationale for its proposal in an easy-to-read style for public consumption. If such an additional separate document is produced, it **must** contain details of the environmental impact of the proposal.	General	Para 25	B-6	See ref LCAL_A.
39	Sponsors **may** supply the outputs from simulation to demonstrate the lateral dispersion of traffic within the proposed airspace change or bring forward evidence based on actual performance on a similar kind of route. It may be appropriate for Sponsors to explain different aspects of dispersion e.g. dispersion within NPRs when following a departure routeing and when vectoring – where the aircraft will go and their likely frequency	Airspace Design	Para 31	B-7	See ref LCAL_A section 5.4
40	In planning changes to airspace arrangements, sponsors **may** have conducted real and/or fast time simulations of air traffic for a number of options.	Traffic Forecasts	Para 34	B-8	See ref LCAL_A
41	It **may** also be appropriate to provide forecasts further into the future than five years: examples are extensive airspace changes or where traffic is forecast to grow slowly in the five-year period but faster thereafter.	Traffic Forecasts	Para 36	B-8	See LAMP Phase 1 bridging ACP..
42	It **may** be appropriate for Change Sponsors to outline the key factors [affecting traffic forecasts] and their likely impact. In these circumstances, Sponsors **should** consider generating a range of forecasts based on several scenarios that reflect those uncertainties – this would help prevent iterations in the assessment process.	Traffic Forecasts	Para 37	B-8	n/a.
43	Types of aircraft **may** be given by aircraft type/engine fit using ICAO type designators. If this is not a straightforward exercise, then designation by the UK Aircraft Noise Contour Model (ANCON) types or by seat size categories would be acceptable	Traffic Forecasts	Para 38	B-9	n/a
44	Change Sponsors **may** include the 54 dBA $L_{eq,\ 16\ hours}$ contour as a sensitivity analysis but this level has no particular relevance in policy making.	Noise	Para 48	B-12	n/a

	Requirement		CAP725 Ref.	CAP725 Page	How met
45	It is sometimes useful to include the number of households within each contour, especially if issues of mitigation and compensation are relevant: Where Change Sponsors wish to exclude parts of the area within contours, for example, excluding the portion of a contour falling over sea – this **may** be shown additionally and separately from the main table of data; and Sponsors **may** include a count of the number of schools, hospitals and other special buildings within the noise exposure contours.	Noise	Para 50	B-12	n/a
46	Contours for a general audience **may** be provided overlaid on a more convenient map (e.g. an ordinary road map with a more suitable scale for publication in documents). The underlying map and contours **should** be sufficiently clear for an affected resident to be able to identify the extent of the contours in relation to their home and other geographical features. Hence, the underlying map **must** show key geographical features, e.g. street, rail lines and rivers.	Noise	Para 53	B-13	n/a
47	SEL footprints **may** be used when the airspace change is relevant to daytime only operations. If SEL footprints are provided, they **should** be calculated at both 90 dBA SEL and 80 dBA SEL.	Noise	Para 56	B-14	n/a
48	SEL footprints for a general audience **may** be provided overlaid on a more convenient map (e.g. an ordinary road map with a more suitable scale for publication in documents). The underlying map and footprints **should** be sufficiently clear for an affected resident to identify the extent of the footprints in relation to their home or other geographical features. Hence, this underlying map **must** show key geographical features, e.g. streets, rail lines and rivers. Calculations **should** include terrain adjustments as described in the section on L_{eq} contours	Noise	Para 58	B-14	n/a
49	Change Sponsors **may** use the percentage highly annoyed measure in the assessment of options in terminal airspace to supplement L_{eq}. If they choose to use this method, then the guidance on population data for noise exposure contours set out **should** be followed. Sponsors **should** use the expression and associated results in calculating the number of those highly annoyed. If they wish to use a variant method, then this would need to be supported by appropriate research references.	Noise	Para 65	B-15	n/a

	Requirement		CAP725 Ref.	CAP725 Page	How met
50	Change Sponsors **may** use the L_{DEN} metric but, if they choose to do so, they **must** still produce the standard $L_{eq,\ 16\ hours}$ contours as previously described. If airspace change sponsors wish to use the L_{DEN} metric they **must** do so in a way that is compliant with the technical aspects of the Directive and any supplementary instructions issued by DEFRA. Sponsors **should** note the requirement for noise levels to be calculated as received at 4 metres above ground level. In particular, the guidance on how contours are to be portrayed, as described in the section dealing with L_{eq} contours applies. Calculations **should** include terrain adjustments as described in the section on L_{eq} contours. An exception regarding L_{DEN} contours is the production of a table showing numerical data on area, population and households which **should** be presented by band (e.g. 55 dBA to 60 dBA) rather than cumulatively as for UK L_{eq} contours (e.g. >55 dBA). Change Sponsors **should** make it clear where areas/counts are by band or cumulative.	Noise	Para 67 & 69 & 70	B-15 & B-16	n/a
51	Change Sponsors **may** use the L_{Night} metric within their environmental assessment and consultation. If they do so, SEL footprints **must** also be produced. Calculations **should** include terrain adjustments as described in the section on L_{eq} contours.	Noise	Para 73	B-16	n/a
52	Change Sponsors **may** use difference contours if it is considered that redistribution of noise impact is a potentially important issue.	Noise	Para 78	B-17	n/a
53	Change Sponsors **may** use PEI as a supplementary assessment metric.	Noise	Para 85	B-19	n/a
54	Change Sponsors **may** use the AIE metric as a supplementary assessment metric. If the sponsor uses PEI as a supplementary metric then AIE **should** also be calculated as both metrics are complementary.	Noise	Para 87	B-19	n/a
55	Change Sponsors **may** vary the information displayed in Operations Diagrams providing that the diagram is a fair and accurate representation of the situation portrayed.	Noise	Para 88	B-20	Noted.
56	Change Sponsors **may** use maximum sound levels (L_{max}) in presenting aircraft noise footprints for public consumption if they think that this would be helpful. This does not replace the obligation to comply with the requirement to produce sound exposure level (SEL) footprints, where applicable.	Noise	Para 95	B-21	n/a
57	Change Sponsors **may** produce diagrams portraying maximum sound event levels (L_{max}) for specific aircraft types at a number of locations at ground level beneath the airspace under consideration. This may be helpful in describing the impact on individuals. It is usual to include a table showing the sound levels of typical phenomenon e.g. a motor vehicle travelling at 30 mph at a distance of 50 metres.	Noise	Para 96	B-21	n/a

	Requirement		CAP725 Ref.	CAP725 Page	How met
58	Change Sponsors **may** wish to conduct an economic appraisal of the environmental impact of the airspace change, assessing the economic benefits generated by the change. If undertaken, this **should** be conducted in accordance with the guidance from HM Treasury in the Green Book (HM Treasury, 2003). If Change Sponsors include a calculation of NPV then they **must** show financial discount rates, cash flows and their timings and any other assumptions employed. The discount rate **must** include that recommended in the Green Book currently set at 3.5%. Additionally, other discount rates **may** be used in a sensitivity analysis or because they are representative of realistic commercial considerations	Economic Valuation	Para 124 & 126	B-27	n/a