LONDON SOUTHEND AIRPORT

AIRSPACE CHANGE PROPOSAL

Introduction of Standard Instrument Departure Procedures
to Routes in the London Terminal Control Area –
Sponsor Consultation – 2016

Part B

Proposed SID Procedures

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PART B - PROPOSED SID PROCEDURES

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13. Description of procedures - introduction

13.1. This Part of the consultation document, together with the accompanying technical **Annexes**, details individually each of the SID procedures from each runway and explains where they differ, if they do, from the existing departure routes. Any potential environmental impact of any changes is also addressed. We have also outlined other options that have been considered in the development of the final procedures and the reasons why these other options are unsuitable.

13.2. The "Do Nothing" option is not available because the CAA requires that all Instrument Departure Procedures be designed in accordance with the ICAO PANS-OPS criteria and in accordance with the PBN Policy and are to be designated as SIDs. The existing PDRs predate these regulatory and procedure design requirements and therefore the CAA has stated that they cannot be sustained in their current format. However we have endeavoured to reflect the legacy PDR tracks as closely as practicable where these are appropriate to the new LTMA arrangements for LAMP Phase 1a.

13.3. As a basic principle, the SID procedures (including their appropriate protection areas) from LSA should be wholly contained within the new controlled airspace which has been established around LSA.

13.4. Three basic routes are used by aircraft departing from LSA to enter the route structure of the London TMA:

- To the north-west (via navigational positions EVNAS[1] and Lambourne (LAM)): This route is applicable to aircraft departing to destinations in the west and north of the UK and Ireland and for aircraft going further afield to some Mediterranean destinations (the latter dictated by the orientation of routes over western mainland Europe). Historically, additional extensions of the route via LAM to the navigation facilities at Brookmans Park (BPK) and Compton (CPT) were published as separate PDRs; these are no longer required[2] and the SIDs will terminate at LAM. However, it is noted at this stage that the portion of the SID between EVNAS and LAM exists for procedure design conformance purposes only because the procedure must provide linkage to the Network (Airways) ATS System. On a day-to-day basis aircraft would have been given climb clearance and a more direct routing before reaching EVNAS. This is explained in more detail in the body of the document and appropriate **Annexes**.

[1] ATS Significant navigational positions which are not marked by a ground-based navigation aid are given a 5 letter pronounceable Name Code (5LNC) allocated by ICAO. Navigational positions which are at ground-based navigational aids (e.g. VOR, NDB (See Glossary)) are described by the 3 letter identification code of the navigation aid. RNAV waypoints which are not intended to be used in RTF between pilots and ATC are given alphanumeric 5-digit identifier.

[2] Based on the principles outlined in CAA Policy Statement issued on 13 May 2014 *"Standard Instrument Departure Truncation Policy"*.

- To the north-east (via navigational position Clacton (CLN)): This route is applicable to aircraft departing via the North Sea to destinations in Scandinavia, The Netherlands and beyond.

- To the south (via navigational positions EKNIV and EMKAD and new Airway M91[3] established as part of LAMP Phase 1a): This route is applicable to aircraft departing to destinations in mainland Europe (other than the destinations detailed above) and the Channel Islands. EKNIV and EMKAD are new navigation positions introduced as part of the NATS LAMP Phase 1a to reflect the previous tactical routing of LCY and LSA departing aircraft, adjusted slightly to reflect the changes to the arrival routing to LCY. Historically, extensions of the PDR to the south were published to Dover (DVR), Lydd (LYD) and Southampton (SAM) navigational facilities; these are no longer necessary, due to the introduction of the TMA transit airway M91, and the SIDs will terminate at EKNIV from Runway 23 and EMKAD from Runway 05.

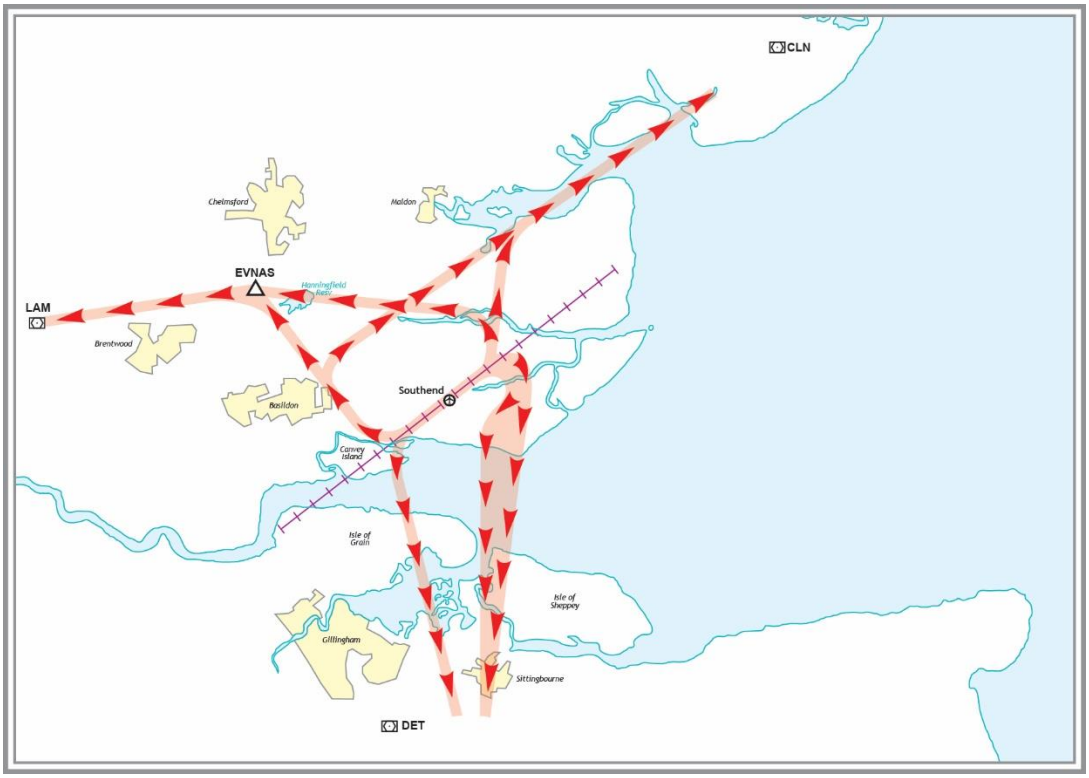

Figure 1: Schematic diagram of LTMA access for LSA aircraft

13.5. A SID procedure has been developed for each of these basic routes from each of LSA's runways, making 6 SID procedures in all.

[3] Airway M91 in the LTMA aligned SODVU (approximately Billericay) – EKNIV (approximately Medway Estuary) – EMKAD (approximately Challock) - LYD (near Lydd). NB This Airway is above 4000ft and was encompassed within the NATS consultation. It is not the subject of this consultation.

13.6. It must be emphasised that the departure routes from LSA are only one element of the myriad of routes accessing the overlying LTMA airspace. Safety is paramount at all times in the development and design of both the individual procedures and the overall route structure. This means that sometimes we cannot put a route precisely where we would prefer to put it because of the overriding ATM system safety requirements.

13.7. Similarly, air traffic controllers at both LSA and at NATS LTC must retain the operational flexibility to integrate aircraft flight paths with one another to achieve the most effective and efficient overall traffic flow and to get departing aircraft climbing to their cruising levels as quickly as possible. (This is explained in **Part A** of the consultation document and is amplified where necessary in the technical **Annexes** for each SID route.) Thus, once aircraft have passed the end of the NAP (position or altitude), ATC has operational flexibility to route aircraft tactically away from the nominal route when clear of other aircraft but with the proviso that the aircraft must be kept vertically and laterally within controlled airspace. Thus, as explained in **Part A** of the consultation document, communities may see departing aircraft flying over areas outside the SID routes. Notwithstanding this, the SID procedures do represent an efficient strategic route structure, within the necessary procedure design and environmental constraints, for integrating the traffic flows with the minimum of inter-controller co-ordination.

13.8. Figure 2 and 3 below provide an illustration of typical tracks of aircraft departing from LSA over 5-week periods in July/August 2014 and July/August 2015.

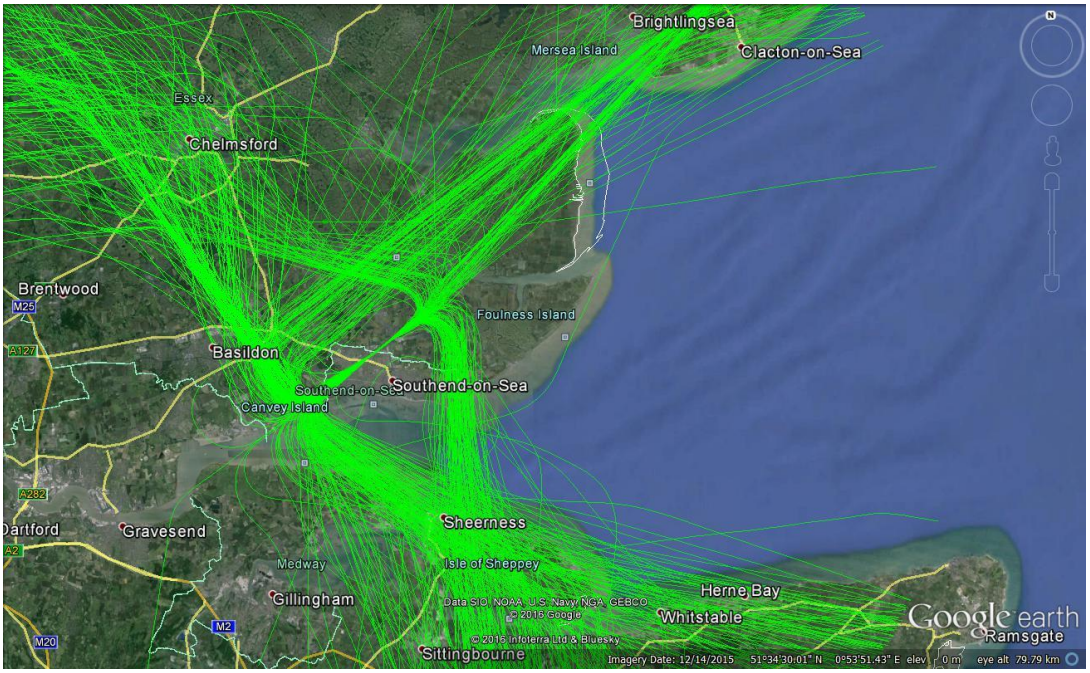

Figure 2: Sample departure tracks July/August 2014

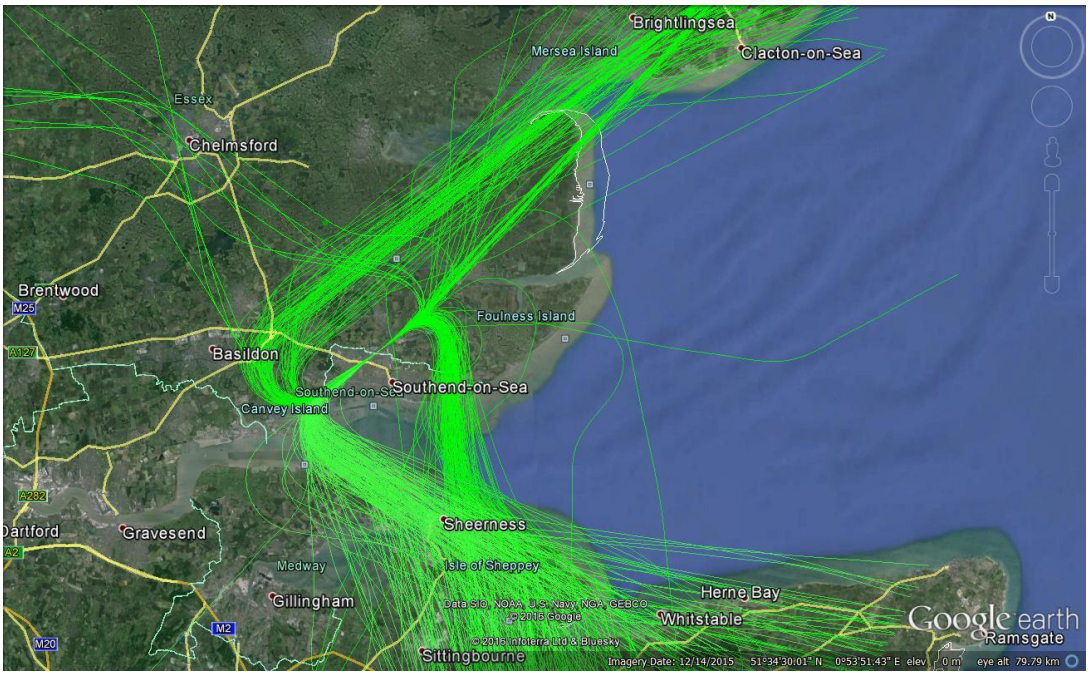

Figure 3: Sample departure tracks July/August 2015

13.9. In each SID description detailed in the **Annexes** we have included an estimated weekly utilisation of the route based on Summer 2015 scheduled services. We have then given a forecast daily utilisation for 5 years beyond the implementation of the SIDs (2021) based on forecast traffic growth.

14. Proposed SID procedures - Runway 23

14.1. Overview

14.1.1. This section of the Consultation Document describes the SID procedures for Runway 23. The description of the NAP part of the SIDs, which is common to all three procedures, is detailed in paragraph 14.2 below. The detailed and more technical descriptions of the individual procedures, supported by diagrams, are given as separate documents, **Annexes A, B and C** as follows:

- **Annex A** Runway 23: Departures to the north-west (EVNAS – LAM);
- **Annex B** Runway 23: Departures to the north-east (CLN);
- **Annex C** Runway 23: Departures to the south (EKNIV).

Consultees can view the particular routes of interest to them as separate documents without the need to download all of the information for all routes.

14.1.2. There are no changes to the main access points in the LTMA for aircraft departing towards the west (EVNAS/LAM) or to the north-east (CLN).

14.1.3. To the south, the three current published PDRs (to Dover (DVR), Lydd (LYD) and Southampton (SAM)), which share a common initial routing via the navigational beacon at Detling (DET), have not been in regular use for a number of years due to the complexity of merging departing traffic from LCY and LSA together with routes inbound to and outbound from LHR and STN crossing above. Instead, both LCY and LSA departing flights have been routed further to the east on a tactical ATC procedure (known internally between LSA ATC and NATS LTC as the "Thames Gate" procedure). This has allowed more efficient use of the airspace and earlier climb clearance for departing aircraft. Aircraft on this route diverge towards their respective UK exit points when well south of the Sittingbourne/Faversham area or when well above their initial departure altitude. As part of the restructuring of traffic flows south of the River Thames for LCY and LSA arriving and departing flights within the NATS LAMP Phase 1a project, the SID procedure will route towards new positions "EKNIV" (over the Medway Estuary) and "EMKAD"[4] (near Egerton, Kent) before diverging via Airways towards their UK exit points. The routing towards EMKAD via EKNIV reflects, as closely as practicable within the safety and operational constraints, the current routing of departing aircraft.

[4] "EKNIV" and "EMKAD" are points on a new Airway "M91" established for flight planning purposes as a LTMA transit route as part of the LAMP project to simplify the network of LCY and LSA SID procedures and to allow the CAAs SID Truncation Policy to be utilised. It does not form part of this consultation.

14.2. Noise Abatement Segment for all procedures

14.2.1. As detailed in Section 6.3 in **Part A** of the consultation document, the NAP from Runway 23 requires aircraft above 5.7 tonnes (Maximum Certified Weight) to climb straight ahead to 2.5NM from the end of the runway **and** an altitude of at least 1500ft has been reached, before any turn is made.

14.2.2. In the ICAO procedure design criteria to which RNAV procedures must be designed, it is not possible to design-in an "either/or/whichever is later" double conditional instruction into an RNAV SID design as this is not compatible with the algorithms coded in aircraft navigation systems. The aircraft navigation systems are only designed to carry out a progressive series of instructions, not to make conditional "judgements" as to which instruction to follow.

14.2.3. Empirical evidence shows that almost all aircraft over 5.7 tonnes will have achieved 1500ft amsl at or before reaching 2.5NM. Therefore we have predicated the design of the turn at the 2.5NM position whilst still making provision within the procedure coding for slower-climbing aircraft to continue straight ahead if necessary.

14.2.4. We have specified the initial straight ahead requirement of the NAPs by using a "straight ahead" track (CF leg) to a "flyover" waypoint which defines the start of the turn. (See paragraph 4.12 in **Part A** of the consultation document for explanation of flyover and flyby waypoints).

14.2.5. In designing RNAV procedures the procedure designer has to make allowance for the "fix tolerance"[5] of the RNAV fix, which in this case for "along-track tolerance" (ATT) is ±0.8NM. Therefore to ensure that an aircraft cannot, under any adverse navigational circumstances, start to turn before the geographical position of D2.5, it is necessary under the PANS-OPS procedure design criteria to locate the waypoint at 3.3NM from the runway end. This waypoint is designated MCW03.

14.2.6. In addition, the designer must take into account, and specify within the procedure design if necessary, minimum climb gradients. In this case the procedure design has been predicated on a minimum climb gradient of 7% (425ft/NM) which is known to be achievable by almost all aircraft using the SID procedures.

14.2.7. Therefore, taking into account the additional 0.8NM "straight ahead" to allow for the RNAV ATT Fix Tolerance, the minimum turn altitude of 1500ft required by the NAP, at 7% climb gradient, can be specified at 3.3NM coincidentally at the waypoint position.

14.2.8. Although not specified as part of the NAPs themselves, we have included a maximum Indicated Airspeed (IAS) of 210kt in the initial part of the SID design to constrain the turn radius of faster accelerating jet aircraft once they start to turn so

[5] Because all navigation facilities (including GNSS) and aircraft navigation systems have accuracy tolerances, the geographic point which is represented by the waypoint therefore also has a tolerance area which surrounds the nominal point. This is known as the Fix Tolerance and must be taken into account in procedure development.

that they do not fly a wider turn. This should ensure greater track consistency and keeps LSA departing aircraft further away from LCY procedures.

14.2.9. Thus, the SID procedures for all three departure routes reflect and incorporate the existing NAPs as detailed above.

14.2.10. It should be noted that in the development of the noise abatement and first turn segments of all SID procedures LSA evaluated outline designs based on both flyby/flyby waypoint sequences and flyover with CF waypoint sequences. In each case it was established that the flyover with CF configuration provided a closer replication of existing flight profiles and better facilitated the "double conditional" nature of the NAPs.

14.3. Upper limit of all SIDs

14.3.1. As noted previously, the eastern part of the LTMA contains a complex array of interacting departure and arrival procedures, all of which must be designed to ensure safe separation between aircraft on a strategic basis.

14.3.2. In particular, in proximity to LSA are departure routes from LCY climbing eastwards towards Airway M91 and towards CLN. The initial upper limit of LCY SID procedures is, in turn, limited to 3000ft by LHR arrival procedures descending above. To the immediate south of LSA, along the Thames Estuary, the new arrival procedures to LCY are on a fixed descent profile to 4000ft.

14.3.3. As a consequence of this interaction of routes all LSA departure procedures must initially be limited to a maximum altitude of 3000ft within the procedure design for flight safety reasons. (NB Although LCY departing aircraft are also initially limited by procedure design to 3000ft, controllers at LTC are required to ensure that climb clearance is given and aircraft are at or above 4000ft to enable LSA departing aircraft to climb to 3000ft.)

14.3.4. Subsequently, once lateral separation is established between the routes it would normally be possible for the procedure designs to include a "stepped climb" to a higher altitude. However, there are two principle risks associated with "stepped climbs" in SID procedures:

- Firstly, it is possible for flight crews to incorrectly set up their FMS so that the initial "step" level is overlooked by the FMS and the aircraft climbs directly to the higher level (known as a "level bust");
- Secondly, the aircraft SSR Mode S readout on the radar controller's data display indicates the "cleared level" as being the level at the end-point of the procedure, thus indicating to the controller that the aircraft is going to "level bust" even if the flight crew flies the procedure correctly.

14.3.5. Furthermore, LSA departure routes lie in proximity to the confluence of 3 LTC Sectors, only one of which will be the "receiving" Sector. It is essential that Mode S

indications do not infer any un-co-ordinated climb into a non–receiving Sector's airspace.

14.3.6. Therefore, in order to ensure that safety is strategically built-in to the route structure, the published upper limit of all SID procedures from LSA will be 3000ft altitude.

14.3.7. A climb clearance above 3000ft will be given on a tactical basis in accordance with Standing Agreements established between LSA and NATS LTC Sectors. This will ensure that aircraft can be instructed to continue to climb above the published upper limit of the SID procedures as soon as it is safe to do so with respect to other aircraft. The Standing Agreements establish positions and arrangements for climb clearance to be given without resorting to complex controller-to-controller co-ordination.

14.4. Description of individual procedures

14.4.1. The individual procedures to EVNAS/LAM, CLN and EKNIV are detailed in the separate **Annexes A, B and C** respectively.

15. Proposed SID procedures - Runway 05

15.1. Overview

15.1.1. This Section of the Consultation Document describes the SID procedures for Runway 05. The description of the NAP part of the SIDs, which is common to all three procedures, is detailed in paragraph 15.2 below. The detailed and more technical descriptions of the individual procedures, supported by diagrams, are given as separate documents, **Annexes D, E and F**, as follows:

- **Annex D** Runway 05: Departures to the northwest (EVNAS – LAM);
- **Annex E** Runway 05: Departures to the east (CLN);
- **Annex F** Runway 05: Departures to the south (EMKAD).

Consultees can view the particular routes of interest to them as separate documents without the need to download all of the data.

15.1.2. There are no changes to the main access points in the LTMA for aircraft departing from runway 05 towards the north-west (EVNAS/LAM) or to the north-east (CLN), although in the latter case we are introducing a change to the initial access track both to lessen the noise exposure of Burnham-on-Crouch and for ATM purposes. (This is explained in **Annex E**.)

15.1.3. To the south, as for runway 23, the three current published PDRs (to Dover (DVR), Lydd (LYD) and Southampton (SAM)), which share a common initial routing via the navigational beacon at Detling (DET), have not been in regular use for a number of years due to the complexity of the merging of departing traffic from LCY and LSA together with routes inbound to and outbound from LHR and STN crossing above. Instead, both LCY and LSA departing flights are routed further to the east on a tactical ATC procedure (known internally between LSA ATC and NATS LTC as "Thames Gate" procedure). This has allowed more efficient use of the airspace and earlier climb clearance for departing aircraft. Aircraft on this route diverge towards their respective UK exit points when well south of the Sittingbourne/Faversham area or when well above their initial departure altitude. As part of the restructuring of traffic flows south of the River Thames for LCY and LSA arriving and departing flights within the NATS LAMP Phase 1a project, the SID procedure will route towards a new position "EMKAD"[6] (near Egerton, Kent) before diverging via Airways towards their UK exit points. The routing towards EMKAD reflects, as closely as practicable within the safety and operational constraints, the current routing of departing aircraft. However, the Shoeburyness Danger Area complex (D136, D138) to the east and south-east of LSA also impacts on the development of

[6] "EMKAD" is a point on a new Airway "M91" established for flight planning purposes as a LTMA transit route as part of the LAMP project to simplify the network of LCY and LSA SID procedures and to allow the CAAs SID Truncation Policy to be utilised. It does not form part of this consultation.

SID procedures and the general operation of aircraft routing to the south from runway 05. This is explained in **Annex F**.

15.2. Noise Abatement Segment for all procedures

15.2.1. As detailed in Section 6.4 in **Part A** of the consultation document, the NAP from Runway 05 requires aircraft over 5.7 tonnes (Maximum Certified Weight) to climb straight ahead to 1.0NM from LSA **and** to an altitude of at least 1500ft, before any turn is started.

15.2.2. Once again, as explained previously in paragraph 14.2.2 above, the "either/or/whichever-is-later" double-conditional requirement is not compatible with the ICAO procedure design criteria to which RNAV procedures must be designed.

15.2.3. Empirical evidence shows that almost all aircraft over 5.7 tonnes will not have achieved 1500ft amsl at or before reaching 1.0NM. Therefore, ensuring that aircraft are at 1500ft or above before turning becomes the predominant aspect of the procedure design.

15.2.4. We have predicated the design of the noise abatement segment on the later achievement of 1500ft before turning. This results in "turn at an altitude" (CA leg) becoming the predominant turn definition (as is currently the case), with a safeguard built into the procedure coding to prevent early turns (i.e. before 1NM from the runway) by exceptionally fast-climbing aircraft.

15.2.5. "Turn at an altitude" inevitably results in a wider distribution of departure tracks because the climb performance of every aircraft, thus the point at which it will reach 1500ft, is different. This is a longstanding and agreed feature of LSA noise abatement procedures and ensures that faster-climbing jet departures turn left or right well before reaching Burnham-on-Crouch. As stated in Section 6 of **Part A** of the consultation document, it is not our intention to seek a change to the NAPs and this consultation is not about the NAPs.

15.2.6. Thus we have specified the initial "straight ahead" requirement of the NAPs by using a "Straight ahead" track (CF leg) to a flyover waypoint (this is designated as MCE02) followed by a "straight ahead" track to 1500ft (CA leg). The SID procedures then turn left or right, as detailed in the individual technical **Annexes**, towards the SID end points.

15.2.7. In designing RNAV procedures the procedure designer has to make allowance for the "fix tolerance"[7] of the RNAV fix, which in this case for "along-track tolerance" (ATT) is ±0.8NM. Therefore to ensure that an aircraft cannot, under any adverse navigational circumstances, start to turn before the geographical position of D1.0.

[7] Because all navigation facilities (including GNSS) and aircraft navigation systems have accuracy tolerances, the geographic point which is represented by the waypoint therefore also has a tolerance area which surrounds the nominal point. This is known as the Fix Tolerance and must be taken into account in procedure development.

it is necessary under the PANS-OPS procedure design criteria to locate the waypoint MCE02 at 1.8NM from the runway end.

15.2.8. In addition, the procedure designer must take into account, and specify within the procedure design if necessary, minimum climb gradients. In this case the procedure design has been predicated on a minimum climb gradient of 7% (425ft/NM) which is known to be achievable by almost all aircraft using the SID procedures. Aircraft climbing at 7% climb gradient can be expected to achieve an altitude of approximately 900ft by MCE02. Therefore this has been specified as a requirement in the SID design.

15.2.9. Although not specified as part of the NAPs themselves, we have included a maximum Indicated Airspeed (IAS) of 210kt for aircraft turning left and 195kt for aircraft turning right within the SID procedure design. This is to constrain the turn radius of faster accelerating jet aircraft and thereby enable a smaller radius of turn to be used, which more accurately reflects normal aircraft performance shortly after departure. It prevents aircraft from accelerating rapidly to higher speeds resulting in a wider radius of turn towards Burnham-on-Crouch. These initial speed limits are acceptable to the aircraft types which will use the SIDs.

15.2.10. Thus the SID procedures for all three departure routes from runway 05 reflect and incorporate the existing NAPs as detailed above

15.2.11. It should be noted that in the development of the noise abatement and first turn segments of all SID procedures LSA evaluated outline designs based on both flyby/flyby waypoint sequences and flyover with CF waypoint sequences. In each case it was established that the flyover with CF configuration provided a closer replication of existing flight profiles and better facilitated the “double conditional” nature of the NAPs.

15.3. Upper limit of all procedures

15.3.1. As for runway 23 (see paragraph 14.3) overlying routes and procedures within the LTMA constrain the initial maximum altitude that can be allocated to aircraft departing from LSA.

15.3.2. To the west (EVNAS – LAM) aircraft are converging with eastbound aircraft from LCY. Towards CLN aircraft are passing beneath inbound aircraft to LSA from the east (GEGMU). To the south, over the Thames Estuary, the stream of aircraft inbound to LCY is descending on a fixed profile to 4000ft.

15.3.3. Thus, for flight safety and traffic integration purposes, the initial altitude available for all LSA SID procedures is 3000ft.

15.3.4. Similarly, as explained in paragraph 14.3 for runway 23, whilst “stepped climbs” could potentially be built into the SID procedures once lateral separation is achieved against the overlying procedures, for reasons of safety it has been agreed

that the published upper limit for all LSA SID procedures will be 3000ft. All climb clearance above 3000ft will be issued on a tactical basis once the departing aircraft is safely separated from other aircraft and Standing Agreements between LSA ATC and NATS LTC Sectors will ensure that this takes place at the earliest opportunity.

15.4. Description of individual procedures

15.4.1. The individual procedures to LAM, CLN and EMKAD are detailed in the separate **Annexes D, E and F** respectively.

16. Summary

16.1. LSA is developing an ACP for the introduction of SID procedures to replace the existing PDRs in order to:

- Reflect current CAA policies for the design and application of departure procedures and PBN in UK airspace;
- Reflect the recent introduction of controlled airspace to support LSA operations;
- Reflect the changes to the airspace and route structures in the eastern part of the LTMA associated with the LAMP Phase 1a project;
- Bring LSA into line with other airports connected to busy TMA airspace.

16.2. The SID procedures detailed in this document have been designed in accordance with the ICAO PANS-OPS procedure design safety criteria and principles specified in PANS-OPS, as required by the CAA. The procedures also reflect current environmental guidance for the design of departure procedures.

16.3. In most cases the procedures have been designed to reflect the flight paths currently flown by aircraft departing from LSA, as closely as is practicable within the procedure design and airspace safety requirements.

16.4. Where a significant change to a route has been developed, this has been to reduce the environmental impact of departing aircraft on Burnham-on-Crouch or because of the change to the airspace arrangements to the south of LSA associated with the NATS LAMP Phase 1a project.

16.5. Throughout the development of the procedures safety has been paramount. However, at all times a high importance has been placed on consideration of the environmental impact of departing aircraft on communities both in the vicinity of LSA and further out along the flight paths.

16.6. It is emphasised that the introduction of SID procedures is not for the purposes of attracting growth in CAT operations at LSA over and above that which is already approved by the Local Planning Authorities under the Section 106 Agreement.

17. Annexes to Part B

17.1. The following technical **Annexes** are published as separate documents to support **Part B** of this consultation document:

- **Annex A** Runway 23: Departures to the northwest (EVNAS – LAM);
- **Annex B** Runway 23: Departures to the east (CLN);
- **Annex C** Runway 23: Departures to the south (EKNIV);
- **Annex D** Runway 05: Departures to the northwest (EVNAS – LAM);
- **Annex E** Runway 05: Departures to the east (CLN);
- **Annex F** Runway 05: Departures to the south (EMKAD)

17.2. Consultees can therefore review the procedures of interest to their locality without downloading the full spectrum of procedures.