London Luton Airport

Low Noise Arrival Metric Study (LNAM)

Contents

Introduction

Improving airport operations will always be a continuing project, part of this report is looking at airport arrivals and how these can be improved. Some of these improvements can be measured by the reduction of CO2, fuel and noise. This can be done in many ways including the development of technology, improved airframe designs and reduction of power/ thrust.

Continuous descent operations (CDO) is a part of how operational practice can impact these measurable targets.

At London Luton Airport (LLA), most arrivals use the international standard Instrument Landing System (ILS) 3 degree glide path at final approach. As part of our Noise Action Plan (2024-2028) LLAOL committed to assess if Low Noise Arrival Metric (LNAM) can be adopted and implement recommendations by 2026.

A major government review of noise from arriving aircraft, published in 1999, identified that the use of Continuous Descent Operations (CDO) was the primary means of reducing noise experienced on the ground beneath arriving aircraft.

Civil Air Navigation Services Organisation (CANSO), International Air Transport Association (IATA) and Eurocontrol signed up to a flight efficiency plan in September 2008 which included a specific target to increase European CDO performance and followed in 2009 by the European

Joint Industry CDO Action Plan, and set out specific actions for the European Aviation industry to ensure CDO's rapid deployment.

In 2020, Eurocontrol led a new collaborative initiative to produce the European CCO/ CDO action plan. The document outlines best practices, guidelines and tools for ANSPs, Airlines and Airports to deliver continued improvement of operations in noise, fuel burn and emissions.

Stakeholders Affected

Airport stakeholders have a vested interest in this study due to the benefits it is predicted to have on fuel for arriving aircraft, which will reduce cost and emissions, assisting the goal for Jet-zero by 2050. For operators at LLA it can have operational and economic benefits seeing benefits to the community in noise and emission reduction.

Continuous descent operation (CDO)

This is a type of procedure for arriving aircraft which is the avoidance of prolonged level flight. Level flight requires additional thrust to maintain altitude and CDO is measured for 2.5nm, any level flight lasting longer than 2.5nm is then classed as a Non-CDO approach. CDO uses a generalised 3 degree glide path on approach to most airports.

What is the Low noise arrival metric (LNAM)

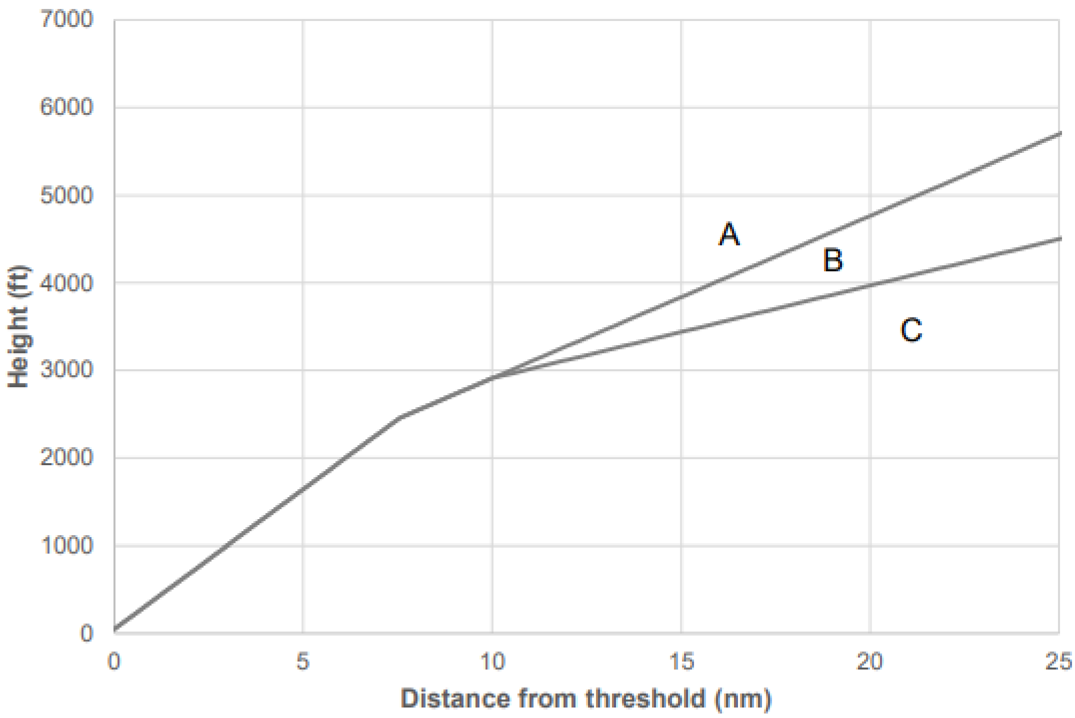
The LNAM is a new measure of CDO which has been highlighted in 2017 with preliminary research by the CAA's Environmental research and consultancy department (ERCD), that CDO needs to be reviewed. This particularly applies to newer aircraft in a low power/ low drag (LP/ LD) setup in order to optimise efficiency of the aircraft. The metric focuses on the main concern of approach noise between 7,000ft and 1,800ft above aerodrome level.

The issues identified in this research with CDO is that some shallow angle approaches are still classed as a CDO however, could be noisier as opposed to a non-CDO approach remaining higher for longer. Additionally, newer and more aerodynamic aircraft with the improvements of technology and design have increased the efficiency of the aircraft and reduced drag. However, on approach aircraft are given their approach speed by Air Traffic Control (ATC), and in certain conditions the more efficient aircraft (reduced drag airframe) may require other methods of reducing speed such as earlier landing gear deployments, higher flap settings and the use of speed brakes which overall increases the noise of aircraft. With this, aircraft may require shallower descent segments or level flight on approach in order to reduce speed, when incorporated with ATC restraints CDO is not always possible in order to follow ATC instruction.

This study which reviews CDO, chose four aircraft, including the A320, A380, B787-8 and the Bombardier Dash 8. It found that the B787-8 had the most difficulties slowing down on descent due to it having the lowest drag airframe. Optimum noise is achieved for intermediate approach angles around 2.5 degrees, to achieve a 3 degree approach angle, this requires additional drag and ultimately generating higher airframe noise.

These insights led to the development of height-based criteria for a LNAM that would monitor descent angles, but not to the extent that would need any changes in speed control or aircraft configuration. In order to generate low noise arrival performance, two height boundary conditions are proposed as illustrated below, creating three height zones or low noise categories.

Figures



(Figure 1- Boundary categories)

<u>The upper and lower boundaries are defined as:</u>

Upper boundary:

▪ A line starting at 50-ft height above the landing runway threshold, extending out to 7.5 nm at an angle of 3 degrees

▪ A line at an angle of 1.75 degrees between 7.5 NM and 10 NM

A line at an angle of 1.75 degrees between 10 NM and 6,000ft altitude above mean sea level (AMSL)

Lower boundary:

▪ A line starting at 50-ft height above the landing runway threshold, extending out to 7.5 nm at an angle of 3 degrees

▪ A line at an angle of 1.75 degrees between 7.5 NM and 10 NM

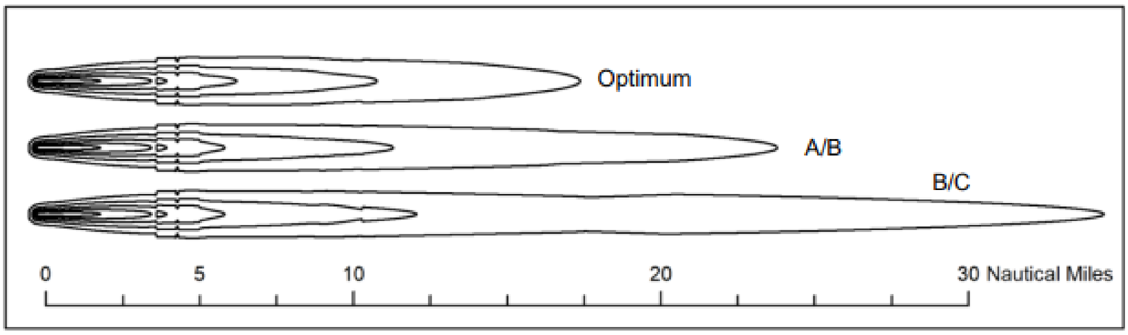
▪ A line at an angle of 1.0 degrees between 10 NM and 6,000ft above mean seal level (AMSL)

Initially to produce noise comparisons, the category boundaries, i.e. upper (A/B) boundary and lower (B/C) boundary, are compared against the optimum approach. The intermediate descent angles are thus:

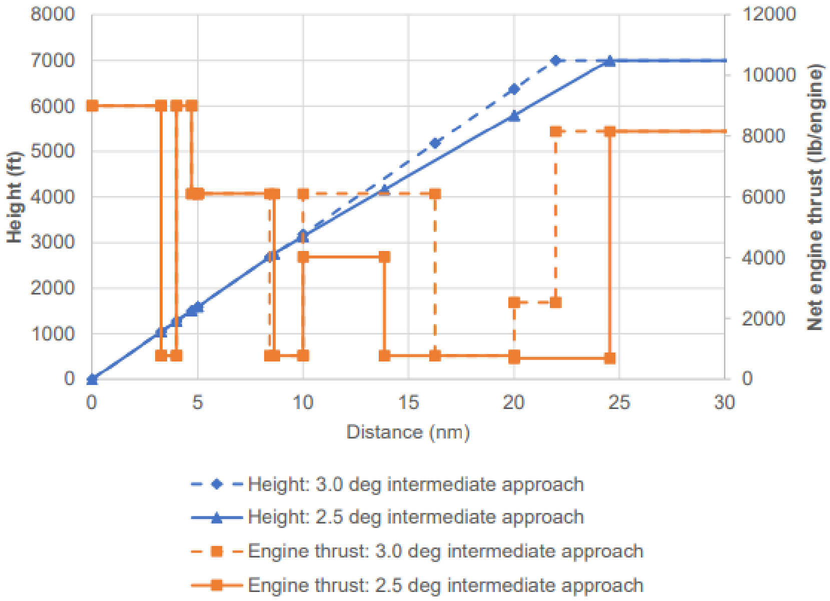
▪ Optimum approach: 2.5 degrees

▪ Upper (A/B) boundary: 1.75 degrees

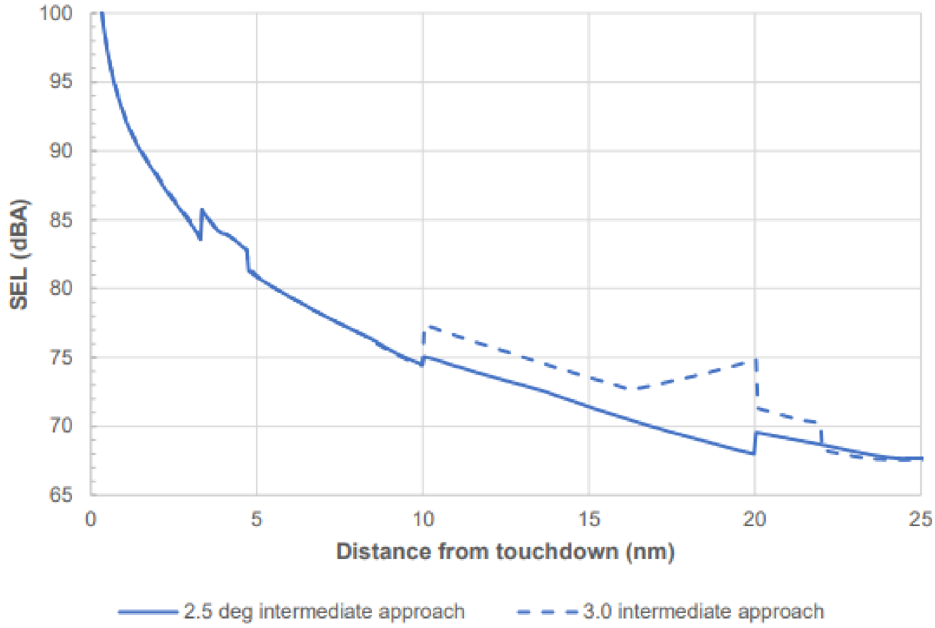
▪ Lower (B/C) boundary: 1.0 degrees



(Figure 2- Noise footprints for B787-8 aircraft with descent profiles for an optimum approach and the upper (A/B) boundary and lower (B/C) boundary profiles respectively (contours plotted from 70 to 90 dB SEL in 5dB steps))



(Figure 3- Effects of engine thrust and additional flap drag on noise to achieve 3 degree intermediate approach segment)



(Figure 4- SEL dB graph for 2.5 vs 3.0 degree approach)

Summary

In summary these two graphs (Figures 3 and 4) identify the effects a 3 degree vs 2.5 degree intermediate approach has on noise and engine thrust. Due to a 3 degree approach requiring additional drag to be achieved, this increases overall airframe noise compared to the optimum 2.5 degree angle. In figure 3 there is a reduction in engine thrust with the 2.5 deg intermediate approach, from 25nm to 10 nm. At 10nm the engine thrust remains the same between the two degree approaches. Figure 4 showing a reduction in noise SEL between 10nm and 20nm. Beyond this point airframe noise is the primary noise factor and is limited to change due to safety and operational requirements. Improvements could be seen in delayed landing gear deployment and reduction of flap settings however this would be dependent on not having any impact to safety. It has been identified that shallow CDO approaches are noisier than when compared to a non-CDO approach, so whilst CDO is being encouraged, in order to achieve it, it could sometimes be having a negative effect on these events. Other future changes include airspace modernisation which would see developments and adaptions to processes, routes and procedures that could impact aircraft operations. CDO approaches would be further measured based on these boundaries, further detailing each approach performance with A/B being preferential compared to B/C. The study shows potential for further analysis when looking at CDO and adding further categorisation, thus giving stakeholders further improvements to aim for and ways to improve.

Related case study and trial by other airports

This LNAM study is being carried out by another airport however it is reported that a lot more of data is required by them in order to further support and present to the ERCD.

Implementation at LLA

Whilst this study looks promising, it has been concluded that it is not possible to implement the trial at LLA the reasons for this are:

- LLA do not have the variety of aircraft required for the study as our runway is not able to take widebody passenger aircraft. Therefore, LLA is not the best suited airport to support the trial as we cannot make clear comparisons with other larger UK airports who can facilitate larger aircraft.
- LLA's current monitoring system does not support the measurement of LNAM. There is no plans at this stage to ask our provider to facilitate this as we cannot make the data comparisons with other airports.

We will continue to monitor the progress of these trials at other UK airports.

Further information

This report uses information taken from CAP2032 on the Low noise arrivals metric study.