Slightly Steeper Approach Study Report 2021

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Introduction

At London Luton Airport (LLA), most arrivals use the international standard Instrument Landing System (ILS) 3.0° glide path at final approach. As part of our Responsible Business Strategy (2020-2025), LLAOL committed to assess if a Slightly Steeper Approach can be adopted and implement recommendations by 2023.

The aim of this study is to evaluate the feasibility of the 3.2° slightly steeper approach (SSA) procedure at LLA through engagement with operators and LLA's air navigation service provider (ANSP-NATS).

Based on successful slightly steeper approach trials at other airports, a small noise benefit is achieved to those communities underneath and around final approach.

At LLA, a proposal was presented to the operators and NATS then discussed at the Flight Operations Committee meeting. Feedback from operators and NATS were collected and collated to form this report and make a recommendation.

What is Slightly Steeper Approach?

A Slightly Steeper Approach (SSA) is a form of noise abatement procedure to minimise aircraft noise exposure to residential areas. Increasing the aircraft's glide path can reduce noise in two ways:

1. It increases the height of the aircraft over the ground, increasing the distance between the aircraft and the ground. This also means keeping the aircraft higher for longer during final approach.
2. It increases an aircraft's rate of descent, reducing the amount of engine power required, reducing the amount of noise emitted.

Stakeholders

Although it is expected that there would only be changes along the final approach centreline, it is likely that community stakeholders will be interested in this proposal. Other stakeholders also include operators at LLA and NATS.

Differences between 3.0° and 3.2° Slightly Steeper Approach

The international standard Instrument Landing System (ILS) glide path angle is 3.0°. On a 3.0° glide path, a reduction in height of 318ft is achieved for every nautical mile travelled. A slightly steeper approach at 3.2° can achieve 340ft. A graph below shows the difference in vertical

profile for each glide path. At 8nm from the runway, there is difference of 170ft (52m) in height between the two glide paths.

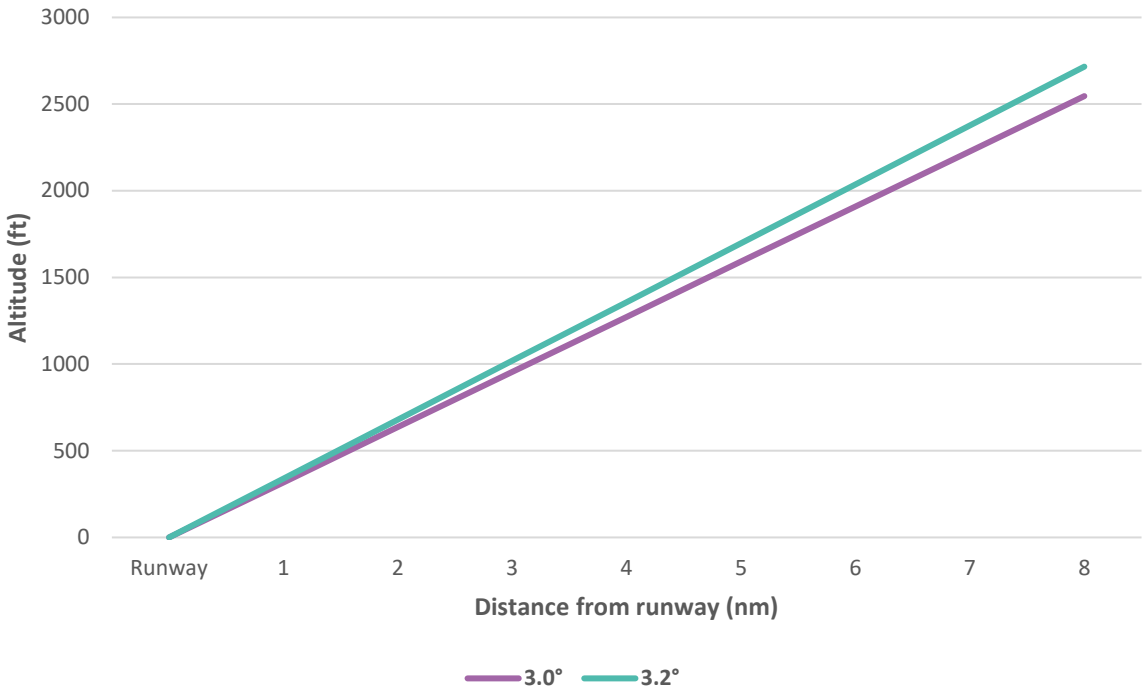

Figure 1: Graph showing the altitude[1] and distance from the runway for each glide path

As the aircraft descend on final approach and closer to the runway, the difference in height between the two glidepaths becomes smaller. It is expected that the noise benefit becomes smaller and then negligible as aircraft approach the runway. According to trials at another airport, it is estimated the average SEL[2] (sound exposure level) noise reduction is no more than 0.5dBA. At distance further from the runway, up to 1.4dBA noise reduction could be achieved, depending on aircraft performance and weather conditions.

London Luton Airport Surroundings

The table below shows the distance between town or point of interest and the arrival runway threshold. Its population is shown in bracket.[3]

Population in bracket	**0-3nm**	**3-5nm**	**5-6nm**	**6-7nm**	**7-8nm**	**8nm+**
Runway 07 Easterly	South Luton (10,400)	Caddington (3,700) Kensworth (1,500)	Whipsnade (400)			Pitstone (3,000)
Runway 25 Westerly	Breachwood Green (600) Bendish (<100)	St Paul's Walden (1,300) Langley (200)			Stevenage (94,100)	

[1] Altitude for reference only – Actual altitude of aircraft may be different
[2] Sound exposure level (SEL) is a measure of energy that takes into account both received level and duration of exposure.
[3] Source: Parish Council websites

Related case study and trial by other airports

London Heathrow Airport

In the UK, Heathrow trialled two RNAV 3.2° approach procedures in 2015 and 2016. The trials covered 1.9% of all arrivals. Around 65% of fleet mix were Airbus A320, one of the most popular aircraft type using Heathrow. The noise monitors recorded average SEL noise reductions of 0.5dBA in both trials. It was found that there was no adverse impact to safety or operational performance (go-arounds, vortex, runway throughput, separation). In 2021, Heathrow conducted an airspace change consultation as part of CAA's CAP1616 to retain the 3.2° RNAV approaches as a permanent feature. In October 2021, the CAA approved Heathrow to implement SSA permanently.

London City Airport

Some other airports may have a steeper glide slope for obstacles reason. London City Airport have a descent angle of up to 5.5°. This is used by the smaller passenger jet aircraft such as the E190 and A318. However, because of its shorter runway and surrounding terrain, specific avionics system, aircraft certification and crew training are required for this type of operation. This descent angle was given special permission from the CAA specifically to avoid obstacles (Canary Wharf).

Frankfurt Airport

At Frankfurt Airport, one of the runways installed a CAT I ILS at 3.2° specifically for noise abatement reason, in addition to the existing CAT III 3.0° ILS. Both systems operate simultaneously to enhance operational resilience. The CAT III 3.0° is used when in low visibility operations. Like Heathrow, the increased glide slope operation at Frankfurt could be easily integrated in regular standard operation. The airline acceptance of 3.2° glide slope turned out to be higher than expected, given that a major international airport hub has wide fleet mix and foreign carriers. It resulted a SEL noise reduction of between 0.5 and 1.5 dB (A).

The UK CAA is expected to publish a document providing guidance and recommendations on how the industry adopt steeper approaches. LLA will be given more guidance on this when the document is published. At the time of publishing this document, the guidance has not been published.

Limitations at LLA

There are several airport characteristics that may restrict certain aircraft from descending at a steeper angle on final approach at LLA. LLA's runway is shorter than other major international airports, at a length of 2,160m. This may restrict larger jet aircraft from using the 3.2° glideslope. Heathrow's Runway 27L and Frankfurt's Runway 07L/25R has a length of 3,658m and 2,800m respectively. The longer landing distance available allows larger aircraft to perform slightly steeper approach at safe speed. Due to the geographical characteristic and climate at LLA, there is higher frequency of low visibility operations in Luton than may be seen at other airfields. Also. The higher approach speed may increase ground noise due to the longer duration use of reverse thrust at landing.

Feedback from Airline Operators and NATS

Operators were requested to give feedback on the SSA proposal proposed by LLA. A total of five commercial operators responded to the proposal by means of email and telephone. They represented 94% of all airline transport movements at LLA and operate the Airbus and Boeing fleet. Due to commercial sensitivity, the respondents are anonymised in this report.

In summary, three operators do not support the proposal, one operator supports the proposal and one operator has no comment on this proposal.

Those who do not support the proposal gave the similar theme stating reasons the infeasibility of introducing SSA at LLA. The themes are safety, runway length and climate at LLA.

Safety

Steeper approaches show trend data of higher potential of high G or hard landing. This causes increased maintenance inspections and additional cost for operators. An operator commented there could be risks of a terrain alert warning at the cliff prior the Runway 07 threshold and this may increase chances of go-arounds.

LLA Runway

All operators who do not support the SSA procedure stated that the runway at LLA is too short to perform SSA. Luton's runway is significantly shorter than the runway at London Heathrow Airport and other airports in the case studies. For reference, the landing distance available (LDA) at LLA is 2,080m long whereas the Heathrow runway LDA is over 3,300 m long. The shorter LDA may not provide sufficient distance for the (heavier) aircraft to slow down as the aircraft travel faster at a steeper glideslope. The steeper angle approach requires longer flare and landing distances. This is a trend in an operator's own data. This may also require higher reverse settings which cause more noise and fuel burn.

Operators are concerned with later runway vacation point and longer taxi time. An extended taxiway linking the end of the runway and multiple rapid exit taxiways are proposed by operators to minimise runway occupancy time. Longer runway occupancy may reduce runway throughput and cause delays.

An operator commented the impact of landing distance is minimal but could be affected by pilot technique when flaring.

Due to the topography to the west of the airfield, the sudden rise in surface level may set off terrain alerts and cause more go-arounds.

Climate at LLA

Operators commented the wind condition at Luton is unstable due to the height of the airfield above sea level. The wind effects at both ends of the runway threshold is unusual. The increased approach angle may drive an increased number of go-arounds due to the approach becoming unstable in latter stages from these wind effects. The standard 3.0° approach angle provides flight crew with known power setting data and pitch angles for final approach with landing flap set. Adjusting the approach angle alters the datum settings which, in challenging weather conditions. This could result in an increased number of go-arounds due to unstable approaches that could be attributed to the amended approach angle.

Due to the climate at LLA and its geographic location, the low visibility operation activates regularly and sometimes it activates many times per day. As low visibility procedures must use

a 3.0° approach this may cause the approach angle to be changed multiple times per day, this is not possible with the current infrastructure at LLA.

Flight Operation

An operator commented that earlier landing gear deployment and full flaps setting are required for 3.2° glideslope operation. This drives a greater noise aspect on final approach than the offset of the steeper approach. These also increase fuel burn.

Another operator stated that the aircraft autoland function is limited to 3.15°. Test flights would be required to approve 3.2° autoland with additional pilot training

The operator which supports the SSA proposal already fly into other airports with steeper glide paths and do not see the proposed glide path causing a problem to their operation at LLA. This is in line with the operator's sustainability policy and safety strategy.

The operator that has no preference to this proposal did not give positive or negative feedback on this proposal.

NATS has also commented on this proposal and gave similar feedback as the operators, relating to runway occupancy time, aircraft speed, possibility of more go-arounds due to topography. Moreover, the Instrument Landing System (ILS) and Precision Approach Path Indicator (PAPI) would need to be modified and there would be a cost associated with this. Relating to operational, aircraft would be higher on approach and gaps between aircraft may be affected with different speeds being flown. NATS has also noted that some aircraft types are unable to fly CAT III approaches at 3.2°.

Conclusion

The feedback from operators and NATS were collated and evaluated. From the feedback, and the increased risk to safety specific to LLA, it is not recommended to implement Slightly Steeper Approach's of 3.2° at LLA. However, LLA will continue to review with operators and NATS should it be possible to implement at LLA in the future. LLA will also continue to explore other ways to reduce the noise impacts to communities with operators, NATS, aircraft manufacturer, and the local community, as part of the LLA's Responsible Business Strategy and Noise Action Plan.