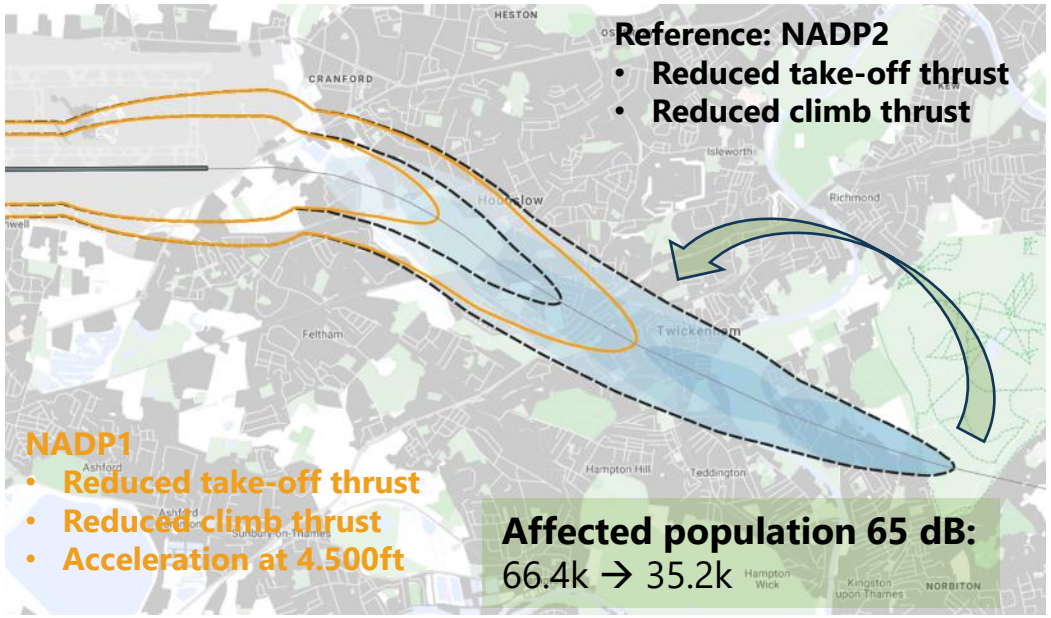
Reducing Annoyance from Departure Noise – Next Steps

- Objective and evidence based approach has led to a clear recommendation how to reduce annoyance from departure noise at Heathrow;

Heathrow to advise all pilots to use NADP1 to 4500ft



History & Present Status

- From the start of HCNF in 2015 (6+ years) communities have asked for reductions in departure noise, citing departure climb profiles as a major issue
- Heathrow is required to minimise noise disturbance and ensure "that aircraft shall at all times be operated in a manner which is calculated to cause the least disturbance practicable in areas surrounding the aerodrome" **(AIP)**
- Many studies from CAA/ERCD - but 'objectives' not sufficiently detailed for departures
- Clear study from To70 covering both short & long haul planes (technical results similar to CAA studies). This shows that potentially the numbers impacted at N>65 could be almost halved
- Communities believe any issues with this approach have been addressed in the previous HCNF meeting – no further letter or list of issues from Heathrow
- Next Step – Heathrow to advise pilots to use NADP1 to 45000ft

Previous ‘issues’ – all addressed

- ‘Need a clear Objective’ – objective based on reducing annoyance using SoNA annoyed results for L_{Amax} and L_{Aeq} (see Slide 3 & 4)
- ‘Only presented for short haul planes’ – similar results for 787 & 777 (see Slide 10)
- ‘Increased cost to Airlines’ – the £10 per flight extra cost (e.g. <10p per pasenger) is minor in the context of the £1000 landing charge. It is to be expected that airlines would have to alter operation procedures to reduce noise given Heathrows location next to high density population centres
- ‘Slight disadvantage for those 20km+ from SoR’ – According to Government the Lowest Observable Adverse Effect Level (LOAEL) will be before this point (see Slide 11). It can be agrued that LOAEL is incorrectly set and Heathrow badly affects many more people so flight numbers should be reduced but an ongoing debate beyond this departure noise reduction improvement discussion.
- ‘0.5% increase in carbon dioxide’ – Government policy says below 4000ft Noise Issues take priority. This procedure is about planes below this level. Heathrow is also trying to lead the world in the introduction of SAF fuels.
- ‘Which other airports apply this procedure’ – Paris, Brussels and Tokyo are examples of airports with high density population nearby and all have instructions to fly higher, quicker.....

And by using NADP1 to 4500ft NOX and particulate pollution entering the pollution mixing layer will be reduced (see Slide 9)

Objective (from Heathrow Community Noise Group)

Objective

Reduce departure noise based on LAmax as much as possible for the largest population (and SELs where possible), while minimising negative effects including increased noise (e.g. sideways or close in), NO_X and fuel burn.

Rational for Objective – based on annoyance relationships

Figure 1: Plot of mean annoyance scores in SoNA 2014 survey as a function of average summer day $L_{Aeq,16h}$ noise exposure

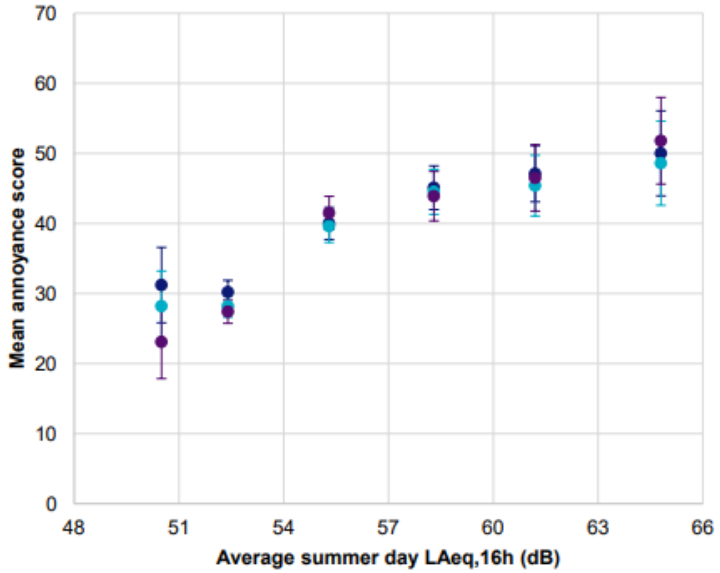


Figure 3: Plot of mean annoyance scores in SoNA 2014 survey as a functio 16-hour N70 noise exposure

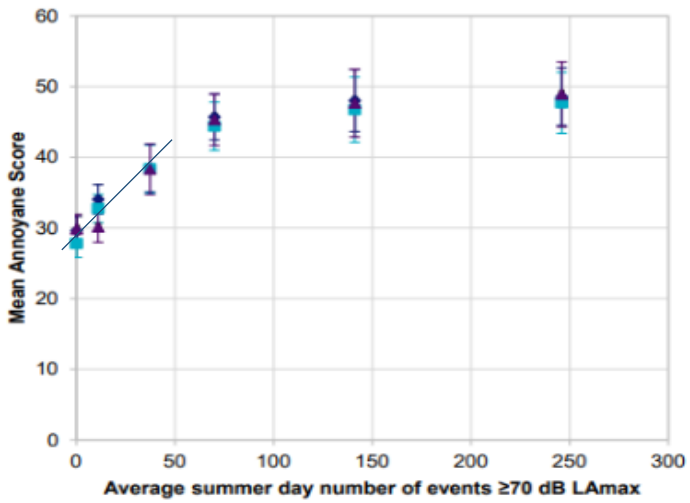
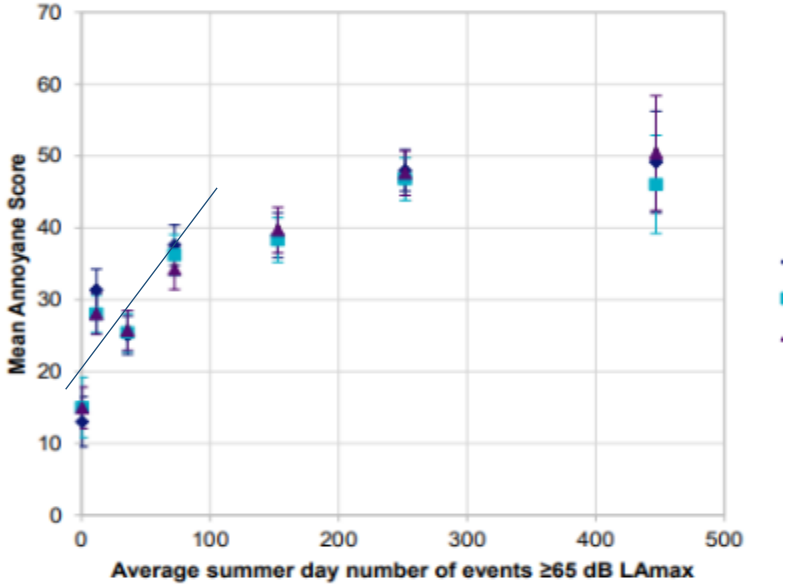


Figure 4: Plot of mean annoyance scores in SoNA 2014 survey as a function 16-hour N65 noise exposure

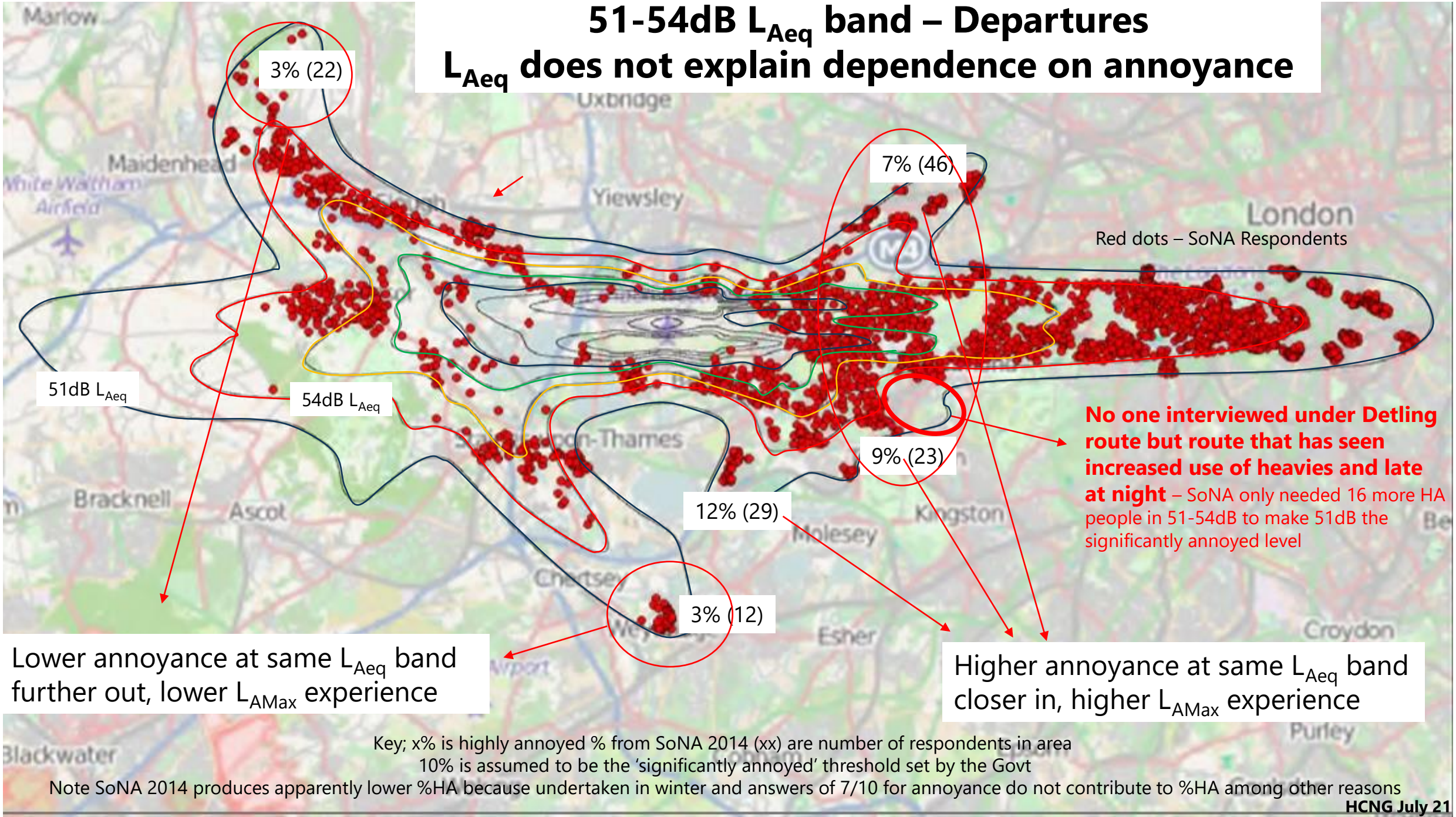


Flat relationship <54dB LAeq (<54dB includes more departures)

Annoyance can be reduced with lower noise events (departures are at lower event numbers)

In addition important to understand i) airline considerations – fuel burn and engine wear and ii) environmental concerns NO_X and CO_2 to hold a balanced discussion

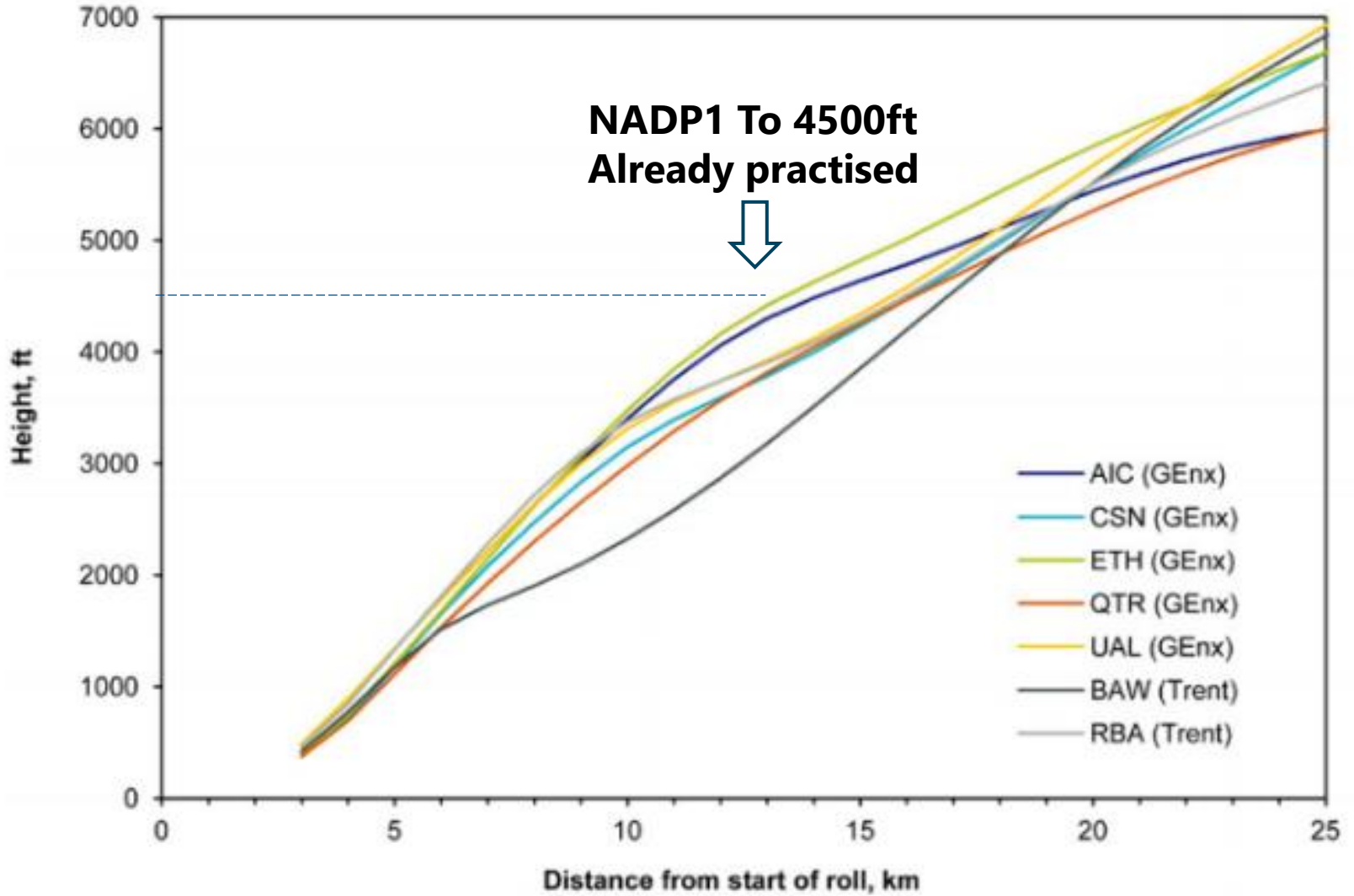
51-54dB L_{Aeq} band – Departures
L_{Aeq} does not explain dependence on annoyance



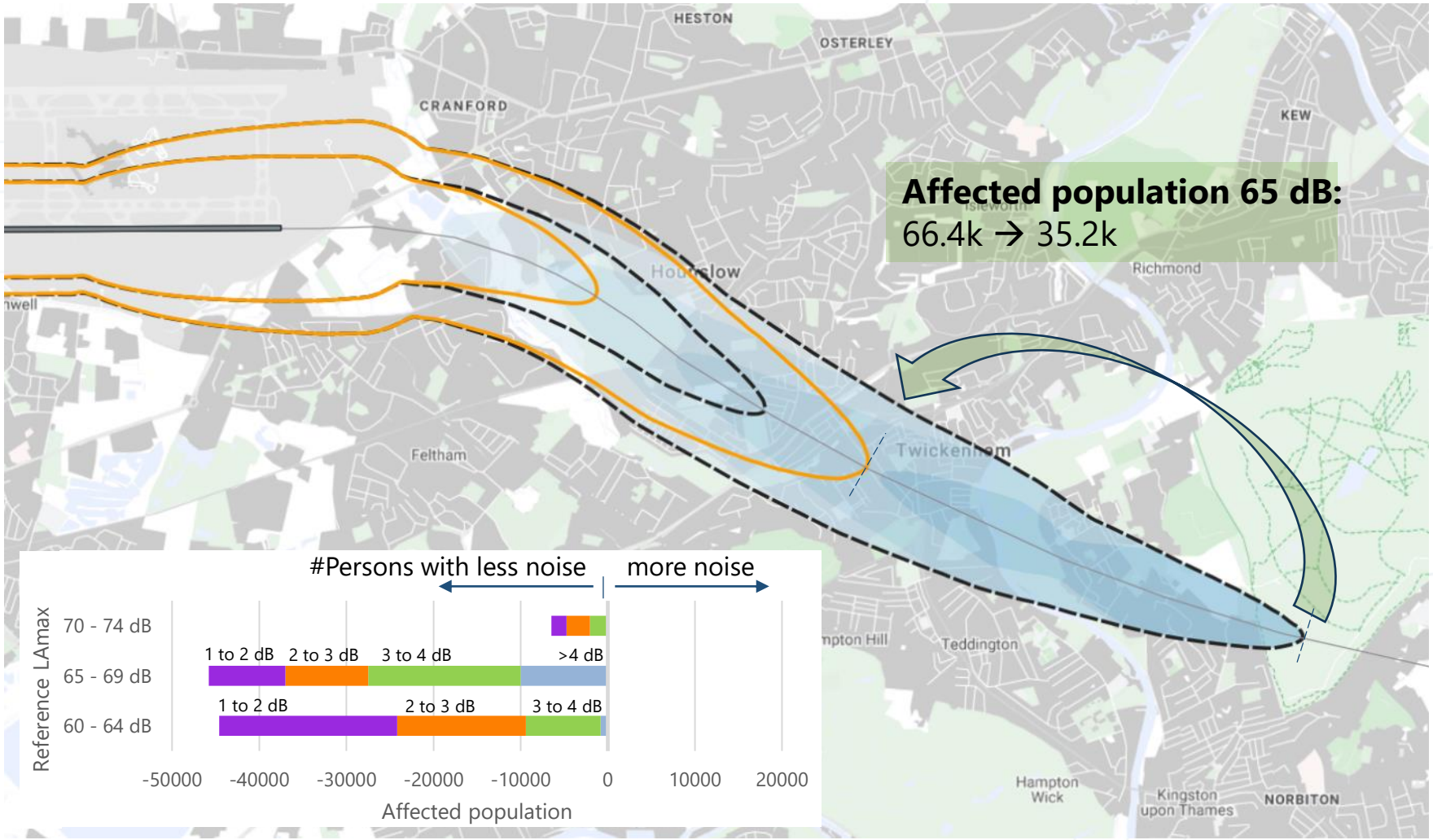
Key; x% is highly annoyed % from SoNA 2014 (xx) are number of respondents in area
10% is assumed to be the 'significantly annoyed' threshold set by the Govt
Note SoNA 2014 produces apparently lower %HA because undertaken in winter and answers of 7/10 for annoyance do not contribute to %HA among other reasons

Profiles from CAA/ERCD report CAP1911 July 2014

Figure 9 Comparison of average 787 departure height profiles by airline



Airbus A320 – 65 and 70 dB LAmax contours



Reference: NADP2
- **Reduced take-off thrust**
- **Reduced climb thrust**

NADP1
- **Reduced take-off thrust**
- **Reduced climb thrust**
- **Acceleration at 4.500ft**

No area sees higher loudness

noise decrease (>1 dB)

noise increase (>1 dB)

Airbus 320 Affected population, compared to NADP2

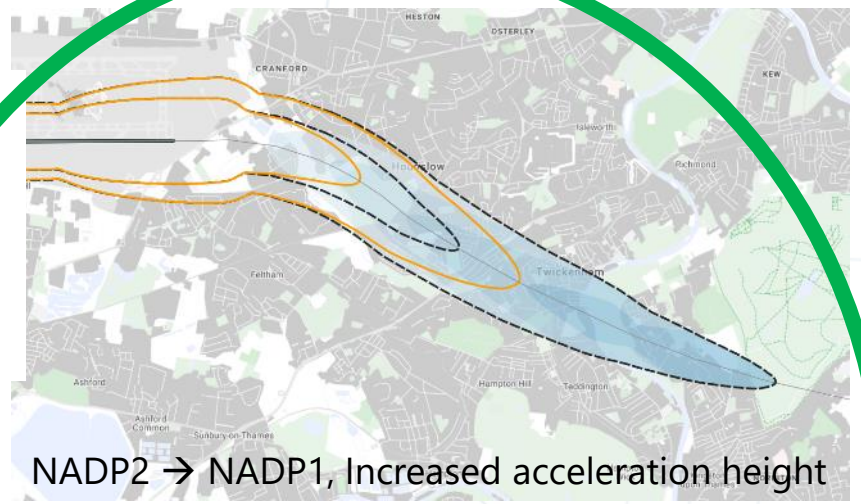
Changes in LA max: loudness

Clear Recommendation for Heathrow

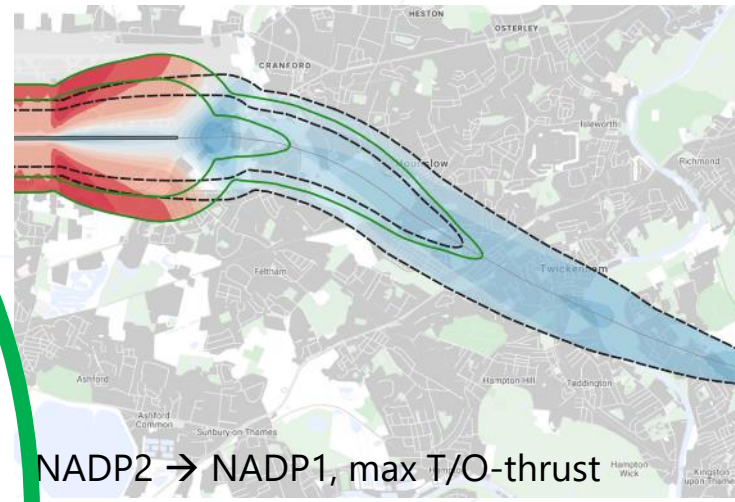
- NADP1 to 4500ft

- Already practised

NADP2 → NADP1

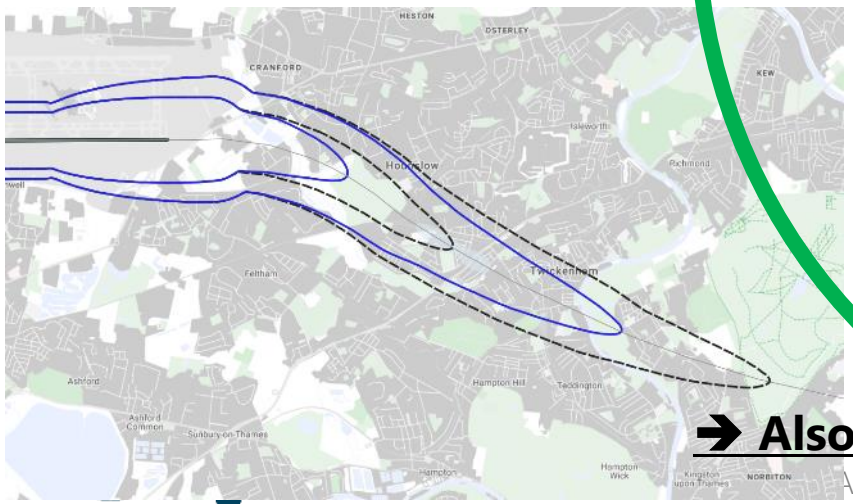


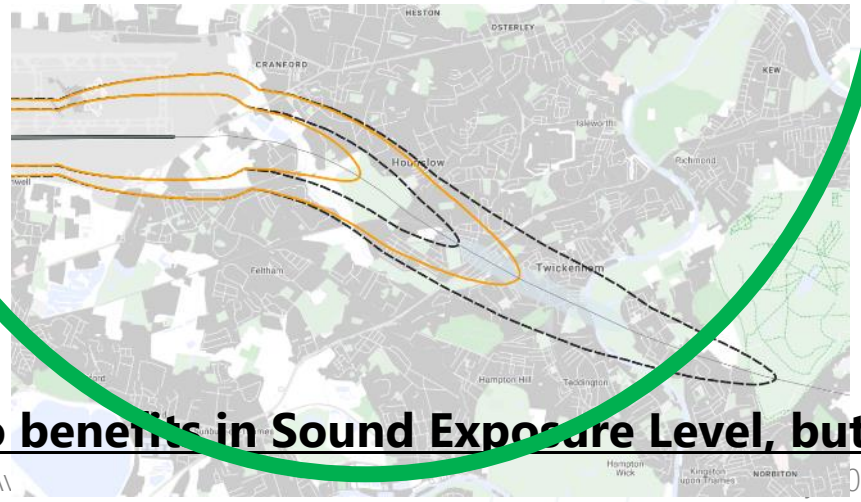
NADP2 → NADP1, Increased acceleration height

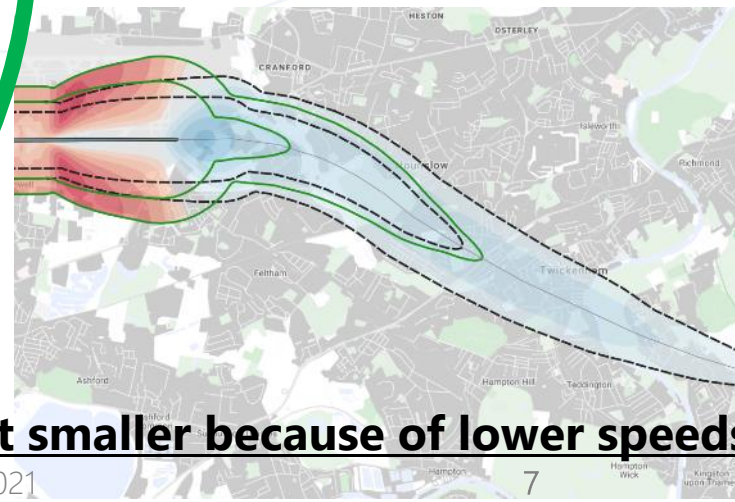


NADP2 → NADP1, max T/O-thrust

Changes in SEL (within 65 LAmax area) – includes duration of noise event







➔ Also benefits in Sound Exposure Level, but smaller because of lower speeds

Recommendation

- **To comply with AIP at London Heathrow**

'Aircraft to be operated in a manner calculated to cause the least disturbance practicable in areas surrounding the airport'

- **Heathrow to advise all pilots to use NADP1 to 4500ft**

- Monitor performance of pilots using this procedure

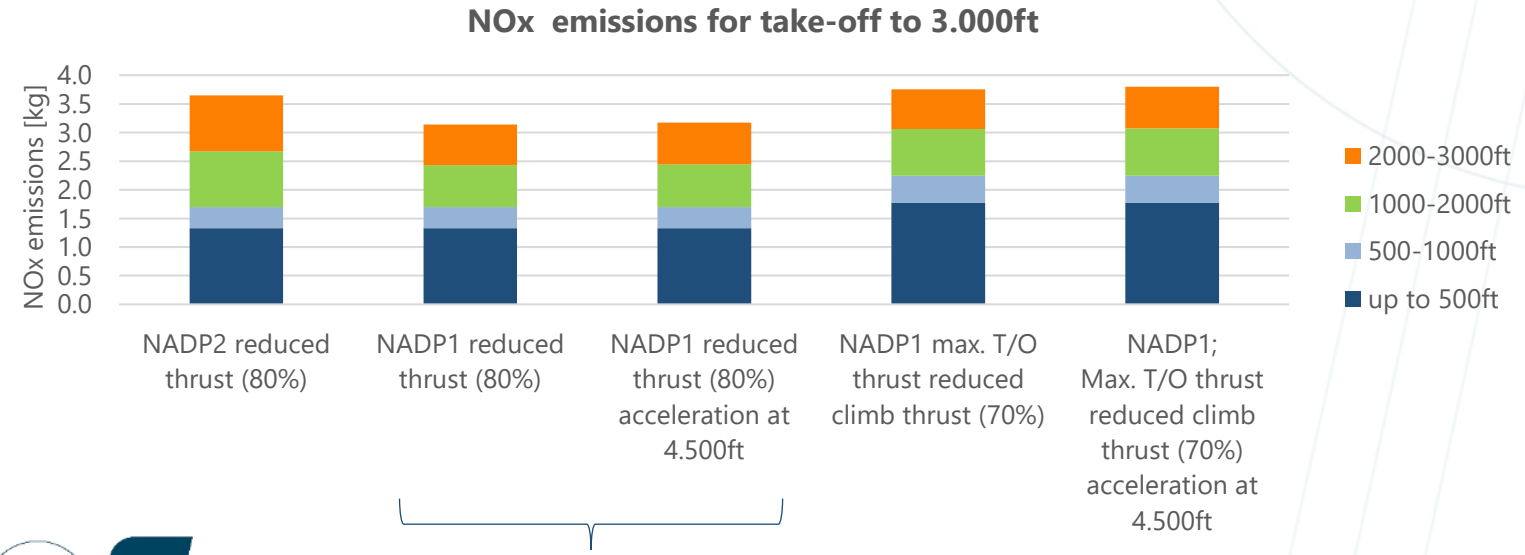
Note it is standard practise to use NADP1 at airports with dense populations close by

Fuel burn and NOx

Additional fuel burn and NOx increase per flight with NADP1 and reduced thrust settings.

Fuel burn	NADP2 reduced thrust (80%)	NADP1 reduced thrust (80%)	NADP1 reduced thrust (80%) acceleration at 4.500ft	NADP1 max. T/O thrust reduced climb thrust (70%)	NADP1 max. T/O thrust reduced climb thrust (70%) acceleration at 4.500ft
Additional fuel burn [kg] (% total flight, 4.750 kg)	-	25 (0,5%)	25 (0,5%)	46 (1,0%)	103 (2,2%)
Additional cost of fuel	-	€ 14	€ 14	€ 25	€ 57

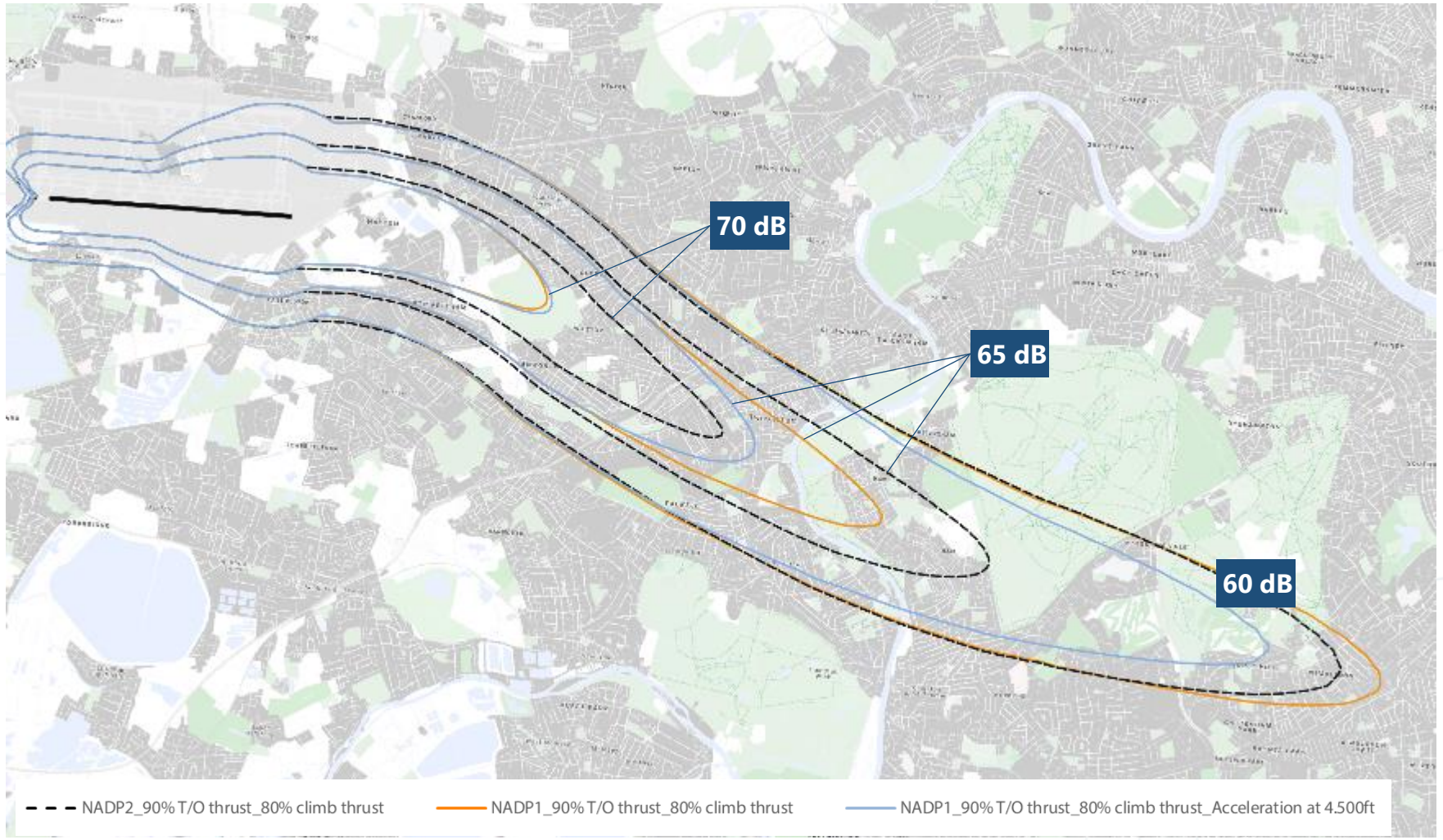
Increased thrusts also means increased engine wear



Pollution reduced in mixing zone to 3000ft

Boeing 787-8 – 60, 65 and 70 dB LAmax contours

Distance Class 5 (2500-3000nm)



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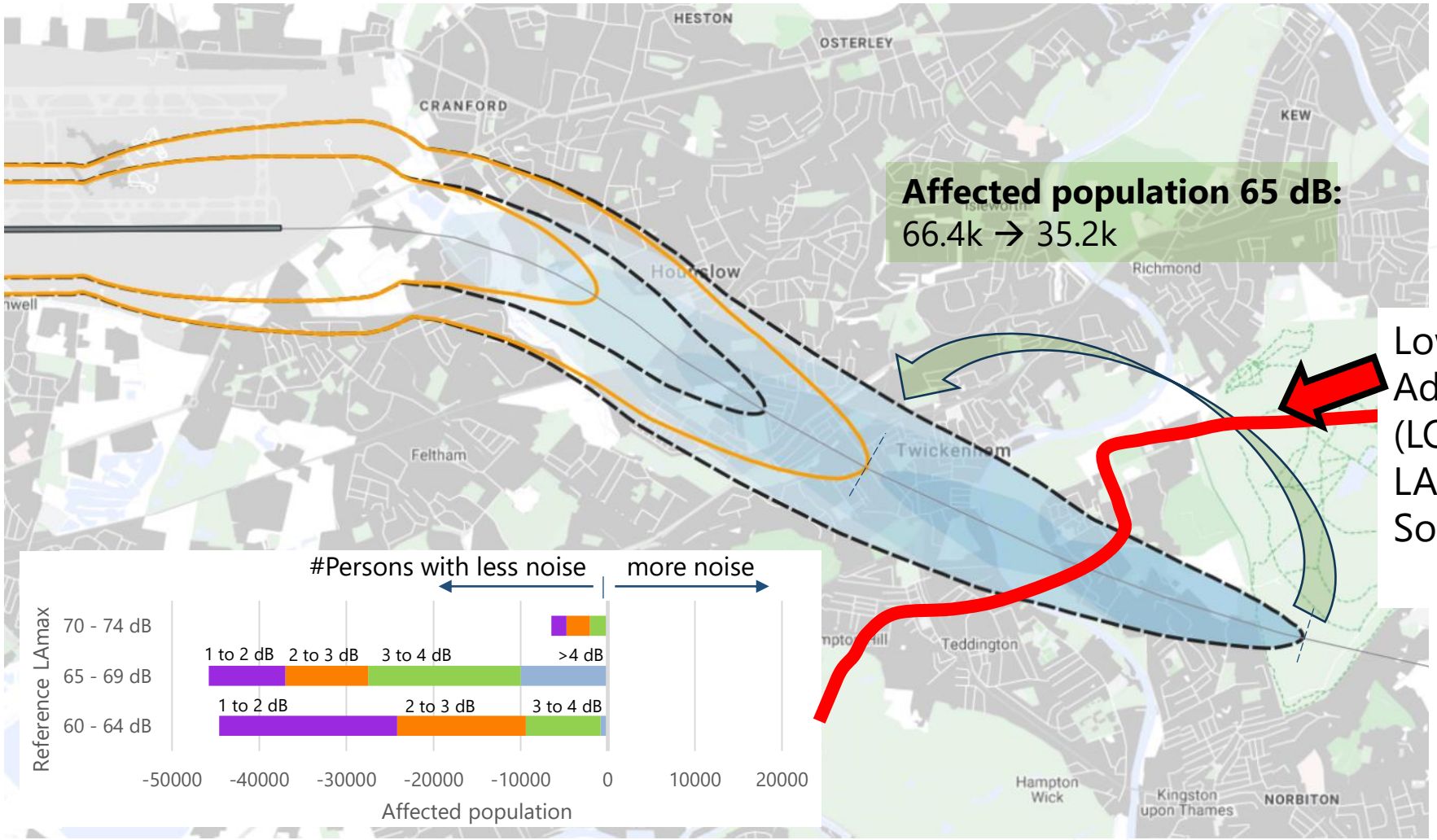

Affected population 65 dB:
66.4k → 35.2k

Reference: NADP2
- **Reduced take-off thrust**
- **Reduced climb thrust**

NADP1
- **Reduced take-off thrust**
- **Reduced climb thrust**
- **Acceleration at 4.500ft**

Lowest Observable Adverse Effect (LOAEL) Contour – 51dB LAeq (using data from SoNA 2014 work)

noise decrease (>1 dB)

noise increase (>1 dB)