

Reducing Noise by Flying Higher using standard Operating Procedures

Heathrow Noise Forum

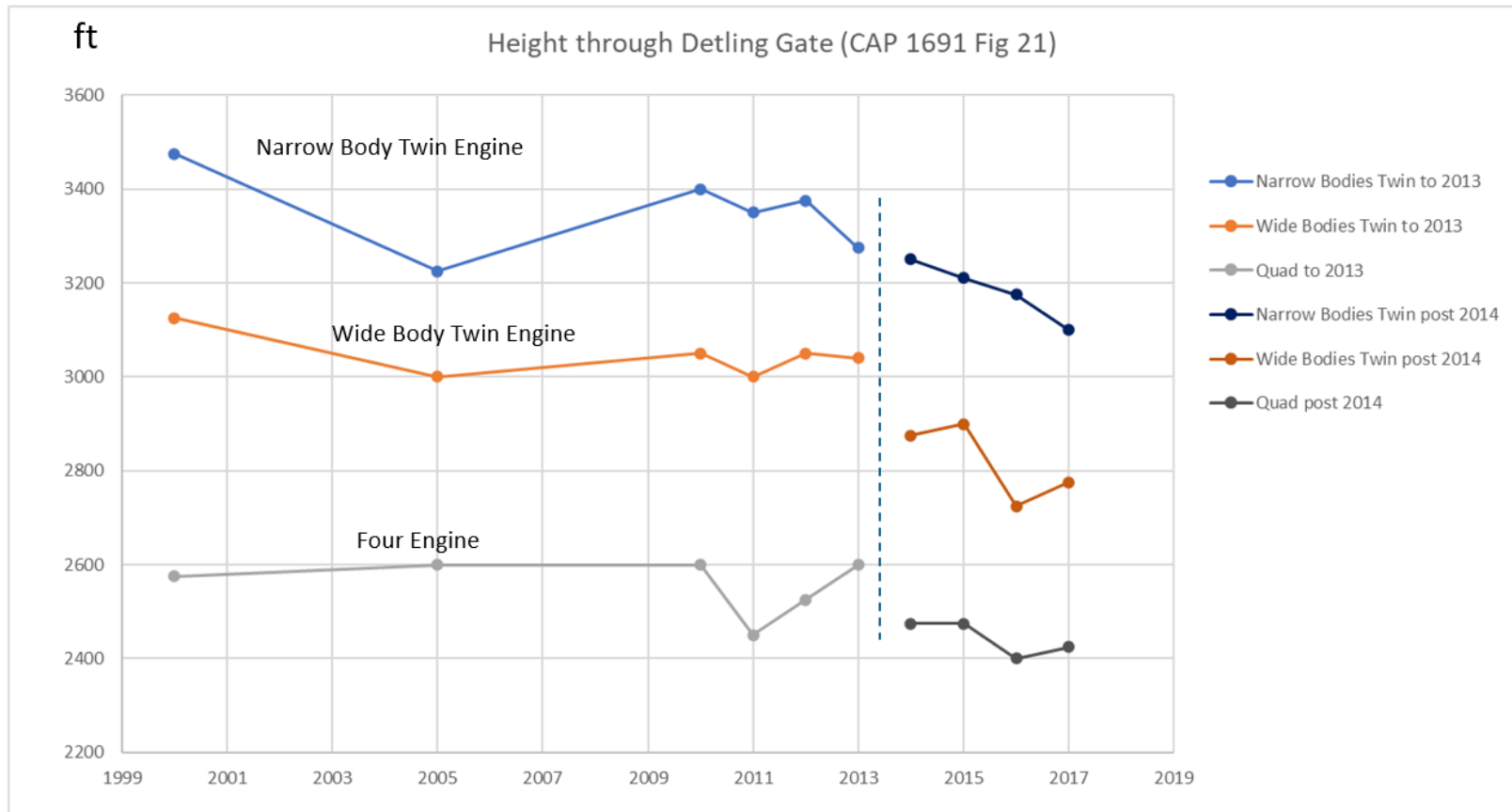
May 2024

Dave Gilbert

Note slides not to be circulated outside Departure study group
until CAA/ERCD confirm quality check of some graphics

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Recap - Since 2000 planes have been flying lower - a step change happened post 2014



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Recap & Key Points – Fly higher, using NADP1*, reduces loudness and has other benefits

- ICAO recommend using NADP1 where there are communities ‘close-in’
- ECAC/SAE recognises present noise modelling is only valid for acoustically soft sound / absorbent ground conditions (unlike those surrounding Heathrow)
- Many airports around the world require NADP1 variants (Paris, Brussels, Madrid, Tokyo, various US airports)
- Heathrow does not require NADP1 even though it has communities close in
- Since the creation of the Heathrow Noise forum in 2015 communities have requested Heathrow use NADP1 for all planes

*NADP1 is a standard operational procedure where planes keep flaps out after the take off phase. This gains more height, while take off speed is roughly maintained. Flaps are then drawn in once a certain height is reached e.g. at 1.5km / 4500ft. It does not change thrust/engine wear, thrust levels are chosen by the pilots/airline as required always with a minimum 75% take off thrust for safety.

Recap on Progress – Fly higher, using NADP1*, reduces loudness and has other benefits

- 2015 -2019 - various CAA/ERCD inconclusive studies ‘noise (sound energy) is moved to side’, while loudness reduced
- Finally Noise Forum chair asked for independent study
- Clear ToR written
- To70 showed clear benefits for A320 narrow bodied twin engine type (~60% of Heathrow fleet) for both loudness and sound energy (undertaken in 6 months)

- After Covid Heathrow wanted to look at whole fleet & actual flight paths but used CAA/ERCD (latest study now running for 2 ½ years since inception...)

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ERCD – Research Arm of CAA

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Limits to latest CAA/ERCD Analysis

- CAA/ERCD have applied existing models & financial analysis
- Presently do not account for harder surface urban areas requiring different sideways attenuation – need to interpret potential corrections
 - See Noise Forum presentation Feb 2024
- Monetisation of slight differences in arrivals far away from departure routes
- Results are averages not single mode so do not reflect ‘single mode’ experience

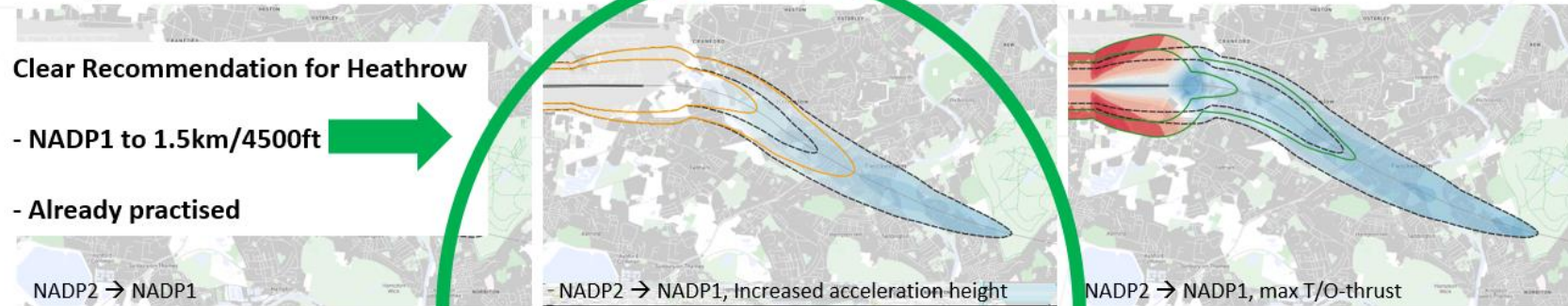
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Recap - To70 Work found simple clear conclusion

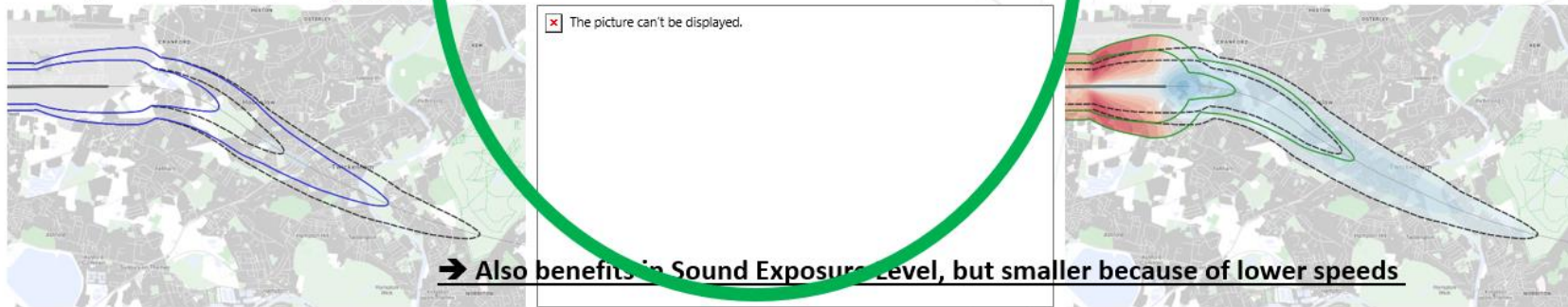
- Reduced affected population, with NADP1 to 1.5km/4500ft

Key: Blue – positive Red - Negative

Changes in LA max: loudness



Changes in SEL (within 65 L_{Amax} area) – includes duration of noise event



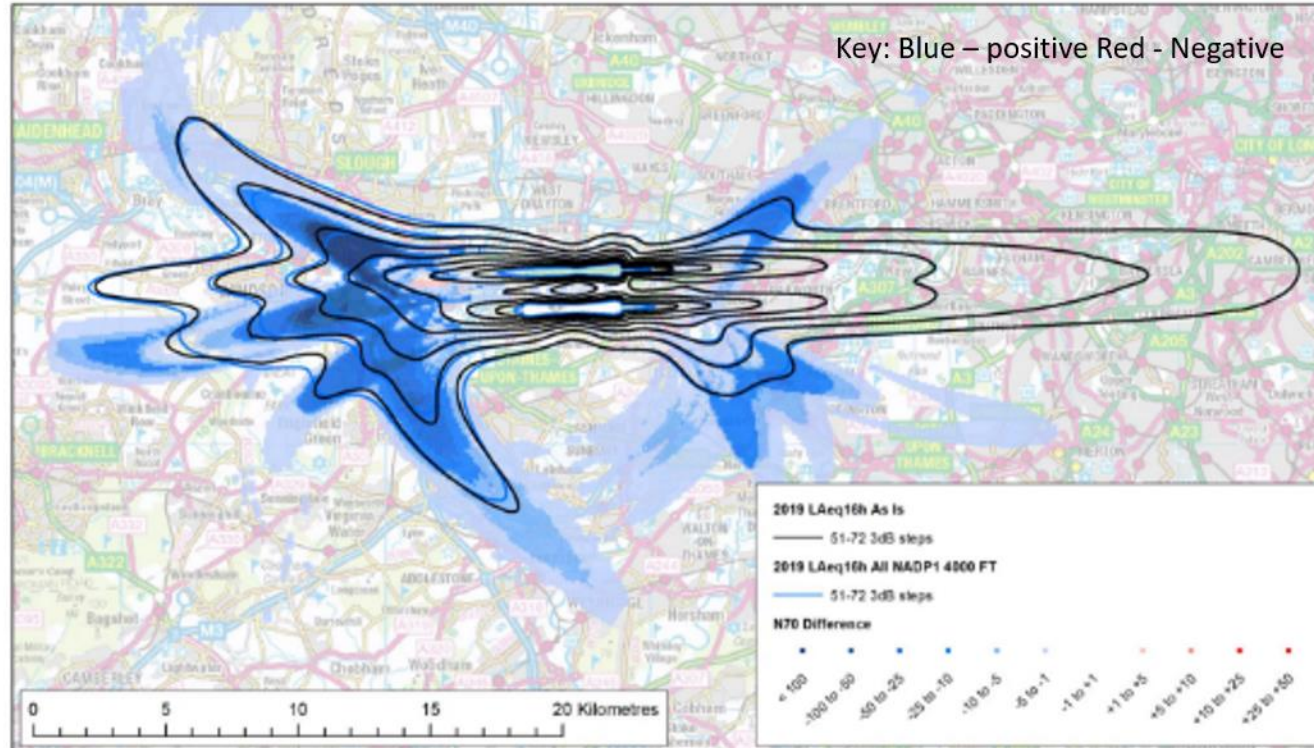
HCNG July 21

Notes - this work used a single flightpath and still showed positive SEL effects
Also showed low cost ~10p a passenger - minor & in line with ANG 2017 Noise is priority to 7000ft

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Latest Study - NADP1 reduces loudness events

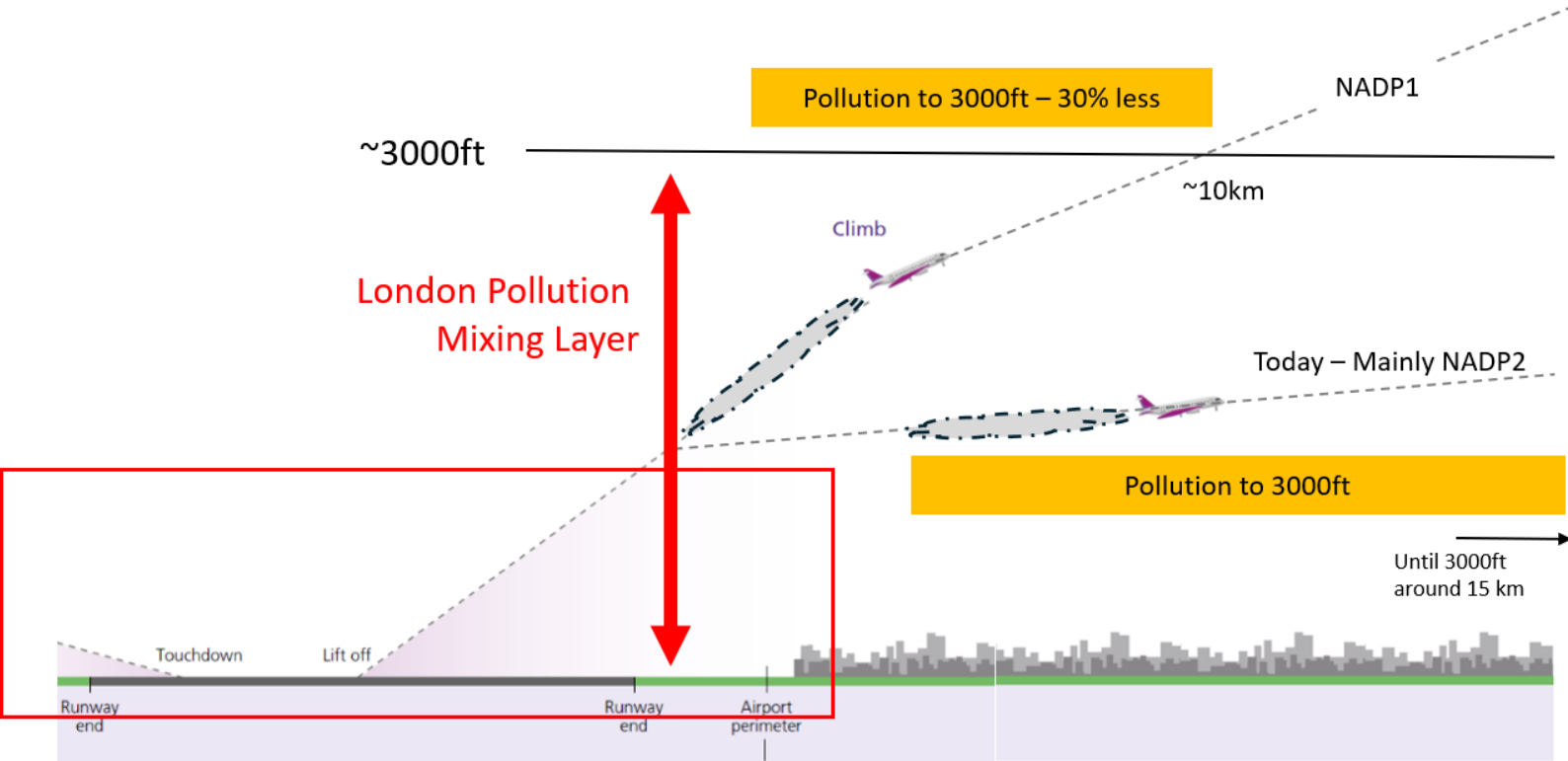
N70 All NADP 1 4000ft vs As Is absolute and difference contours



- **Clear benefit**, large areas will see a reduction of 25-100 high noise events (N70) events
- Important to note how far out and how many N70 events occur outside 51dB LAeq LOAEL – in line with complaint data

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NADP1 reduces pollution created in the mixing layer by 30% - NoX & Particulate Pollution



TAG Feb 18

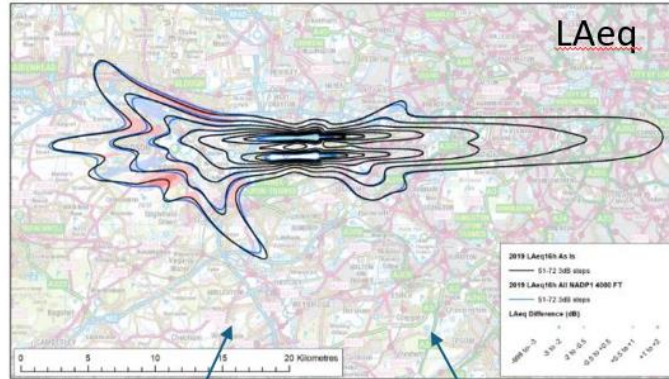
Pollution Levels < 1000ft Same 'Local Airport Environment'

Picture is Indicative and not to scale

Lower speeds & higher height with NADP1 also reduce risk of catastrophic bird impact at lower altitudes

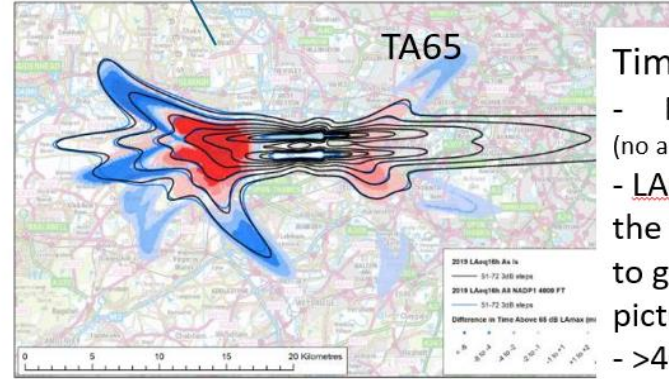
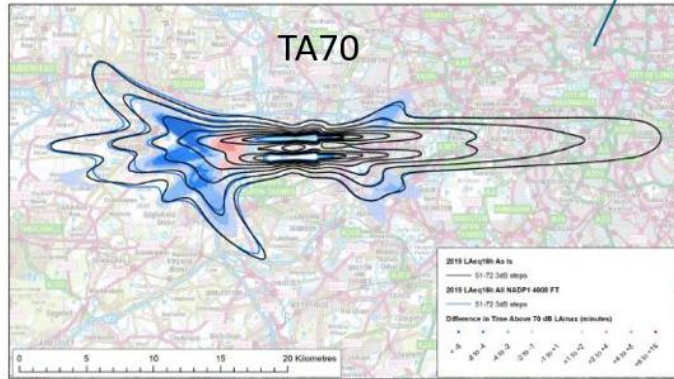
Summary of NADP 1 to 4000ft

Key: Blue – positive Red - Negative

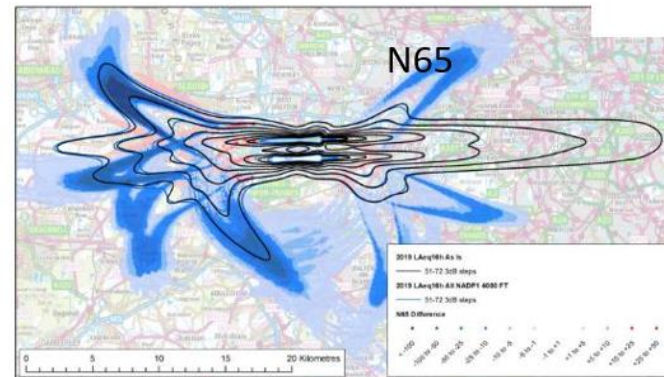
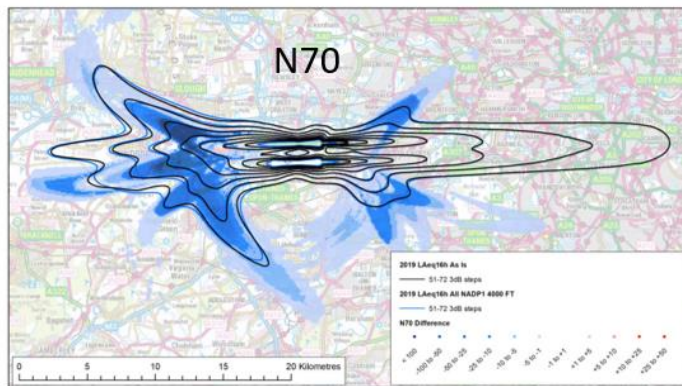


Expected large shift of 'noise' to side is not shown (dispersion effect/log scales)

Slight 1-2dB shifts in e.g. Slough Likely to be a modelling effect due to incorrect modelling of sideways attenuation



Time above
 - Not normally used (no annoyance relationship)
 - LAeq 'sums' all the noise levels to get overall picture (above)
 - >4000ft option



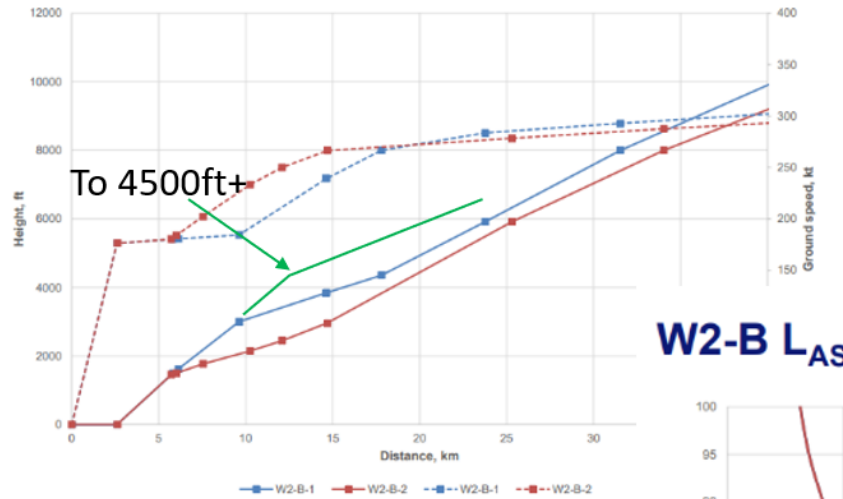
Events Data - Positive

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Use Higher acceleration attitude to reduce TA65

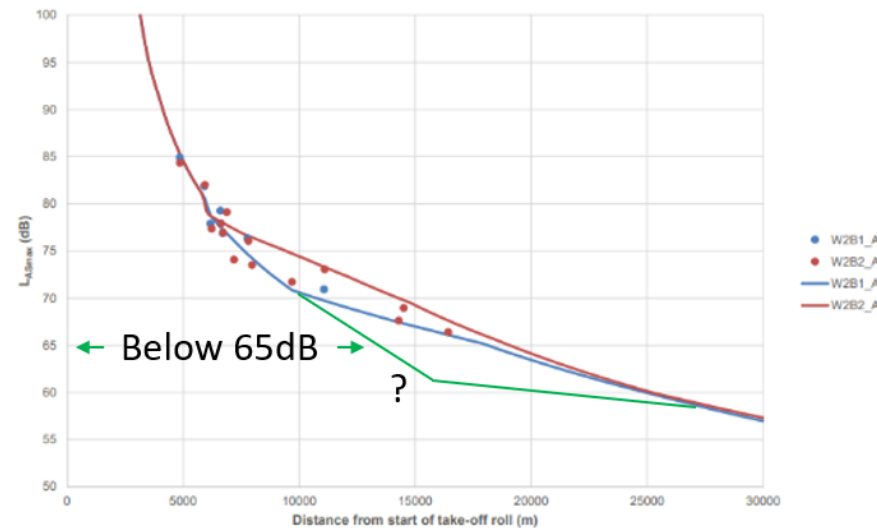
- initial proposal was 1.5km/4500ft but could be higher

W2-B



Aside - As 65dB is a key metric should we adapt regulations so that planes keep using NADP1 to the point when noise is below 65dB L_{Amax}?

W2-B L_{Amax}



Green Lines

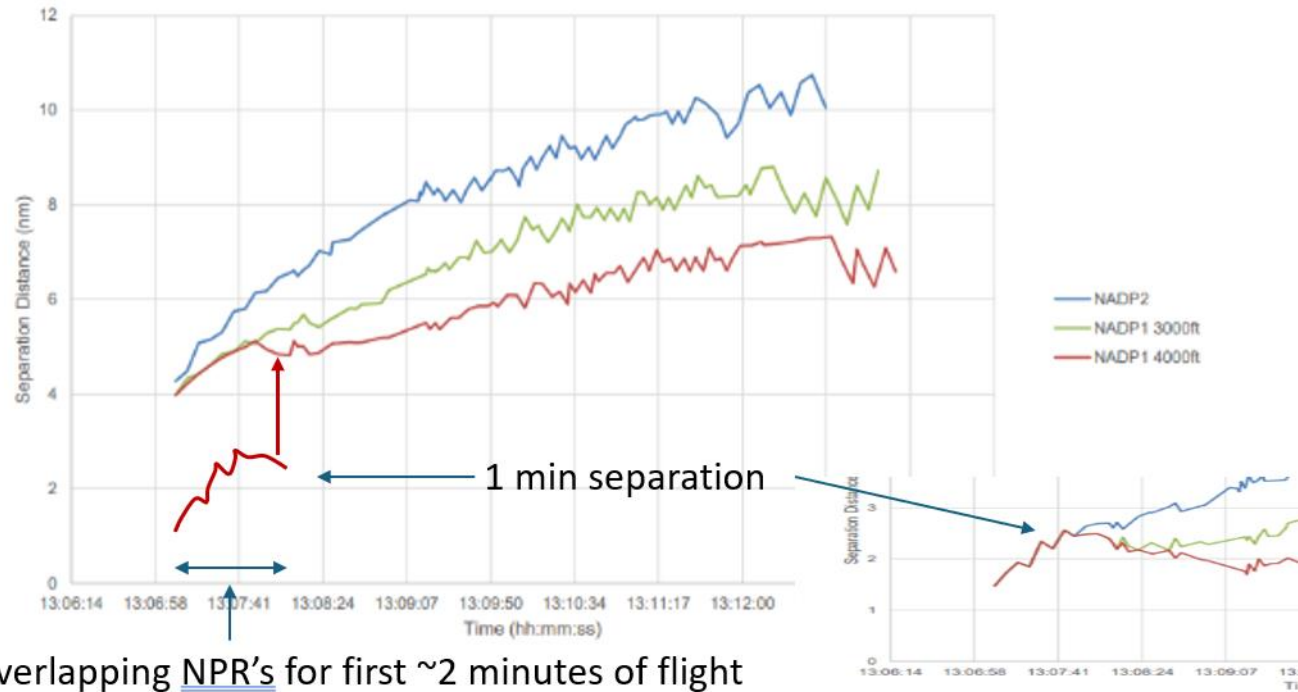
- Profile to ~4500ft & possible noise profile getting below 65dB sooner
- What are the other compromises?

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Catch-up

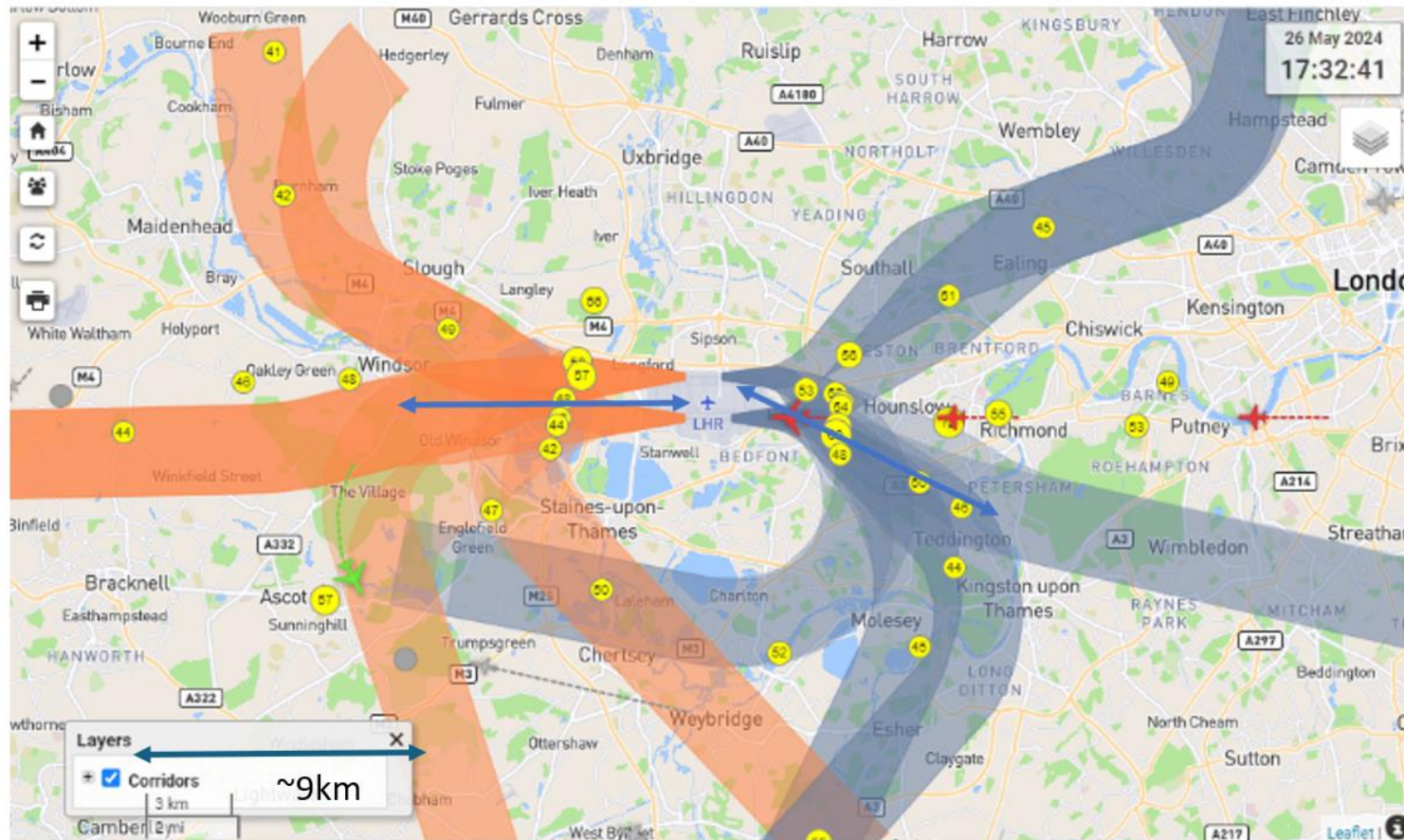
- Planes only follow same NPR every 2 minutes
- Planes can take off every minute but with different NPR plans

Effect of catch-up with same NADP: 787-9 (187kt) vs A320 (150kt) 2 min split



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NPR's separate from 4-8kms
- @150kts (278km/hr) 2 mins in air distance
~9km

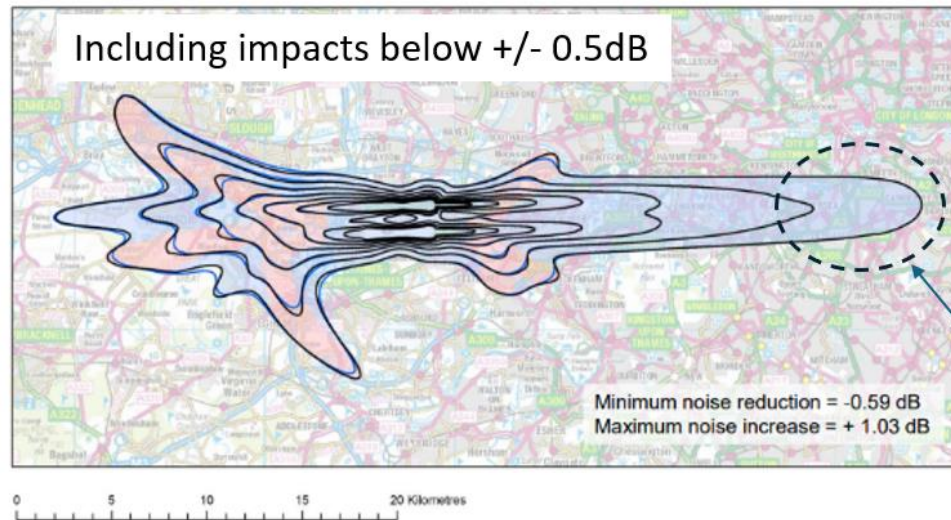


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Implications for PBN / Concentrated Routes

- Centreline L_{Aeq} is reduced with NADP1 - although small. This is in addition to reduced loudness.
- So even based on existing modelling introduction of concentrated PBN routes, which reduce sideline noise but increase centreline impacts, should be accompanied by NADP1 to >4000ft around Heathrow

L_{Aeq}16h All NADP 1 vs As Is absolute and difference contours



*Note Reversed Notation
Red Positive
Blue Negative

Apparently arrivals impacted many miles from Departure routes

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Summary

	As Is	NADP1 to 4000ft	NADP1 to 4500-5500ft	Comments
LAeq				Surprisingly Minor Changes - pos positive overall if urban env modelled
Monetisation, LAeq				Minor if arrivals removed, pos positive with urban corrections
Centre line LAeq & LAmx				Important for PBN introduction
TA65				Link to annoyance unclear, higher NADP1 option can reduce area
TA70				
N65				Beneficial - reduced annoyance
N70				Beneficial - reduced annoyance
Monetisation N70				
Monetisation N65				
LAQ (1000ft)				No change
Pollution to 3000ft				
Catch Up				Must be managed as today
CO2/Fuel Cost	Minor changes (0.34%) vs Beneficial Noise reduction to 7000ft, not to be considered unless disproportionate - Air Navigation Guidance 2017			

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Conclusions & Next Steps

- NADP1 improves noise environment for communities
- NADP1 has to be used for ASM/PBN changes
- Noise modelling around Heathrow's urban areas has to include surface effects
- Heathrow to require NADP1 to 4000-4500ft (to check if higher e.g. 5000-5500ft would be beneficial)

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