



Aircraft Noise Mitigation Through Operational Measures

Dr Darren Rhodes
Environmental Research & Consultancy Department
Civil Aviation Authority

The ICAO Balanced Approach



- Reduction of noise:
 - At source
 - Noise certification: Chapters 2, 3 & 4
 - Through operational measures
 - E.g. noise abatement procedures, preferential runway use etc.
 - Through land-use planning
 - E.g. framework laid out in PPG24
 - Through operating restrictions
 - Implemented in EU via Directive 2002/30/EC

ICAO guidance on operational measures



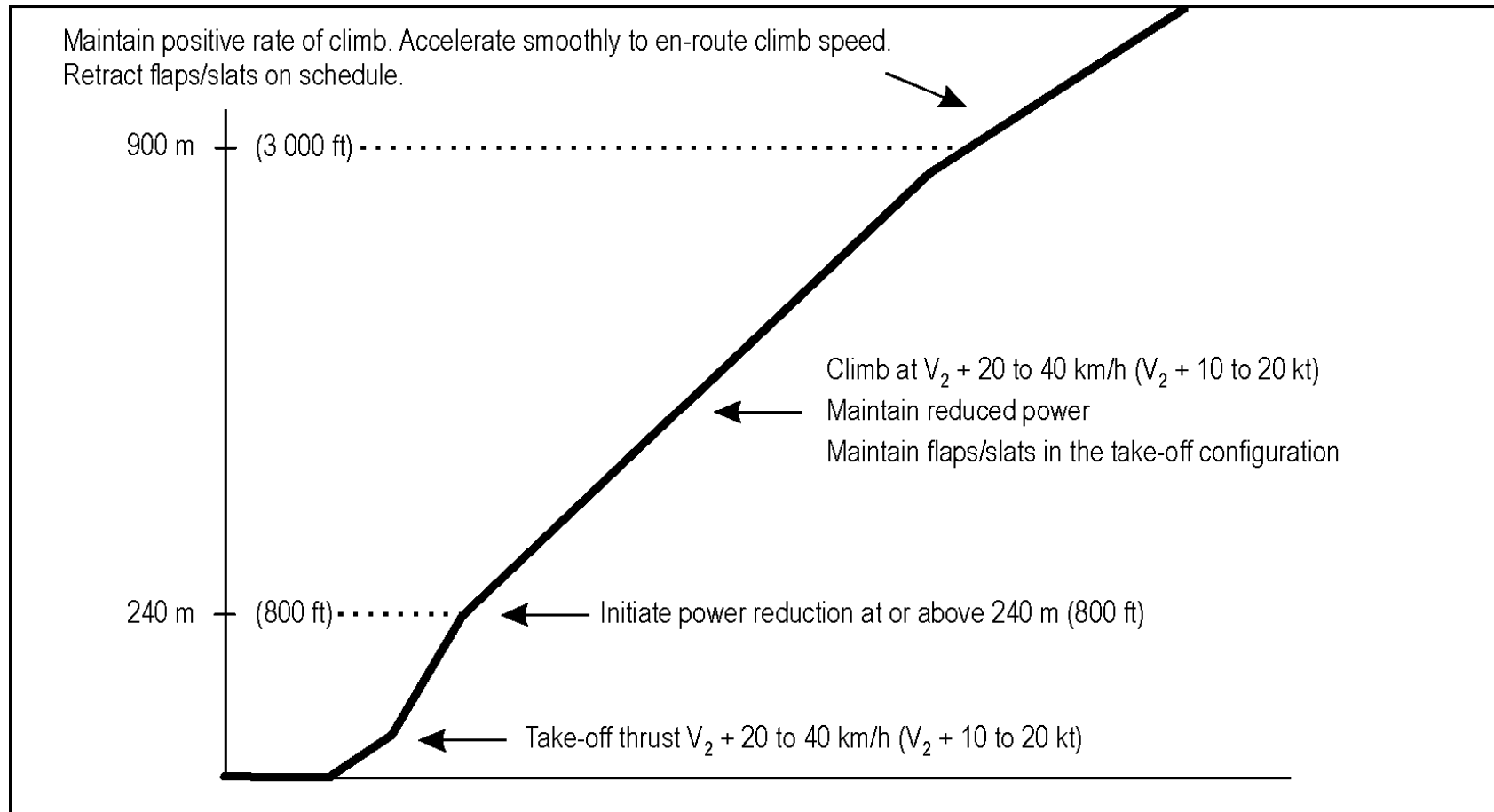
- ICAO Doc. 8168: Procedures for Air Navigation Services (PANS-OPS) Vol.1
 - Guidance on noise abatement departure and arrival procedures
 - Preferential runway use, displaced runway thresholds
- ICAO Doc. 9184: Airport Planning Manual
 - Preferential runway use, displaced runway thresholds
- In Europe ICAO PANS-OPS historically implemented via JAR-OPS, now via EU-OPS
- EU-OPS now legally binding on air carriers

Noise Abatement Departure Procedures (NADPs)

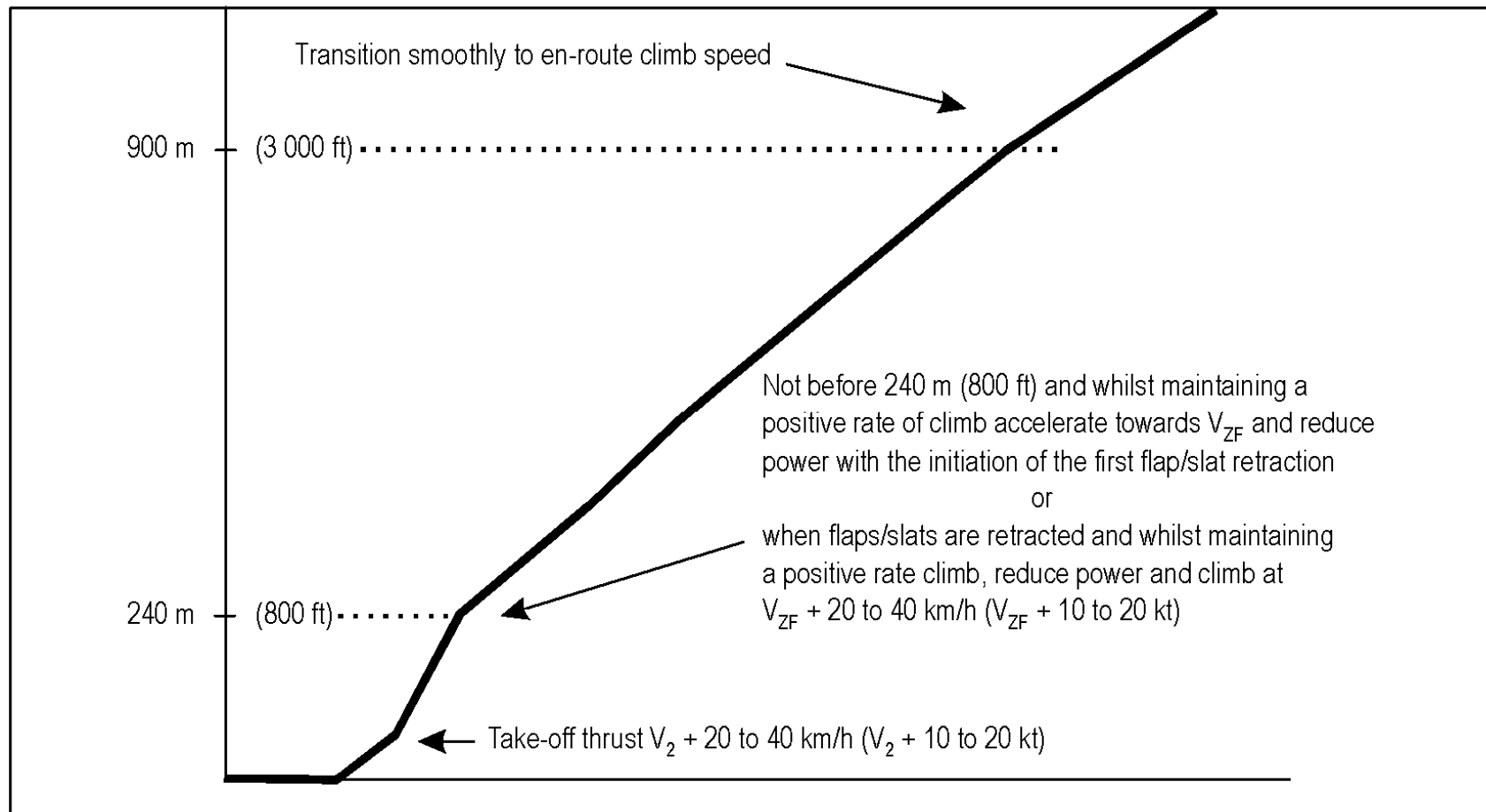


- PAN-OPS specifies:
 - No more than two NADPs per aeroplane type
 - No action initiated below 800ft aal
 - Procedure complete by 3,000ft aal
 - Two main actions defined are:
 - Thrust reduction altitude from take-off power to climb power
 - Initial flap retraction altitude
 - Two procedures recommended:
 - One where thrust is reduced first, followed by flap retraction
 - One where flap retraction is initiated first, followed by thrust reduction
- NADPs don't reduce noise in total they simply redistribute noise

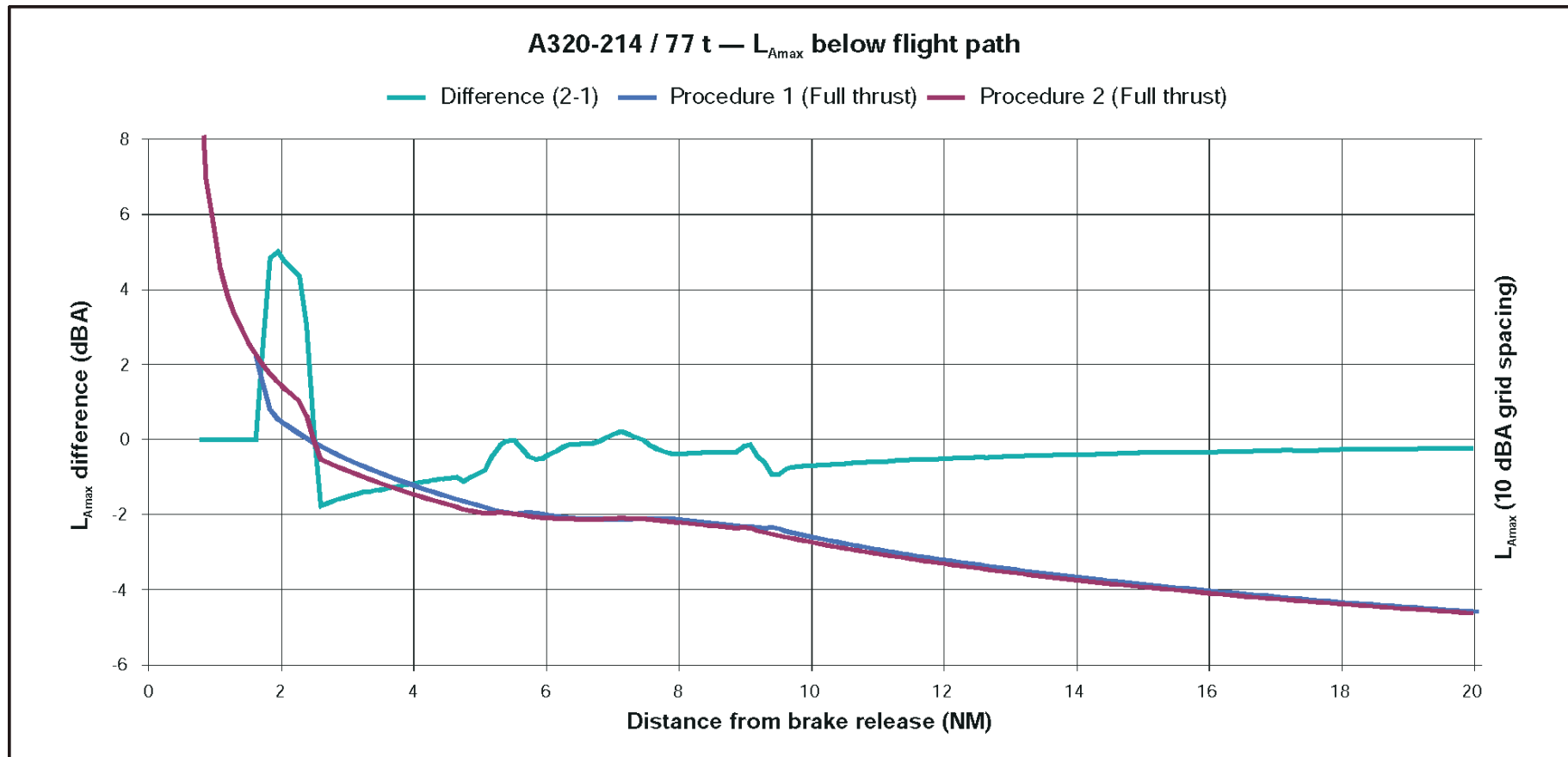
NADP 1



NADP 2

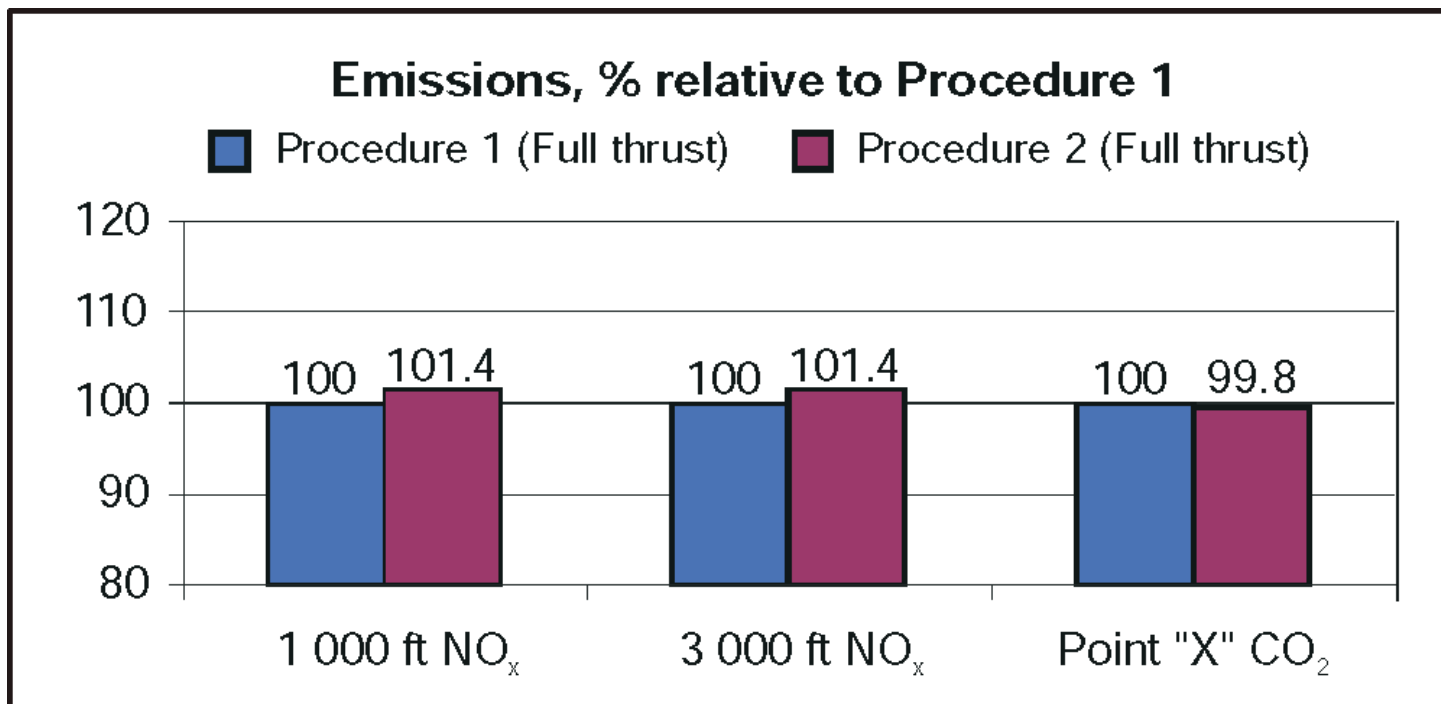


A320: Effects of thrust reduction height (NADP 1)



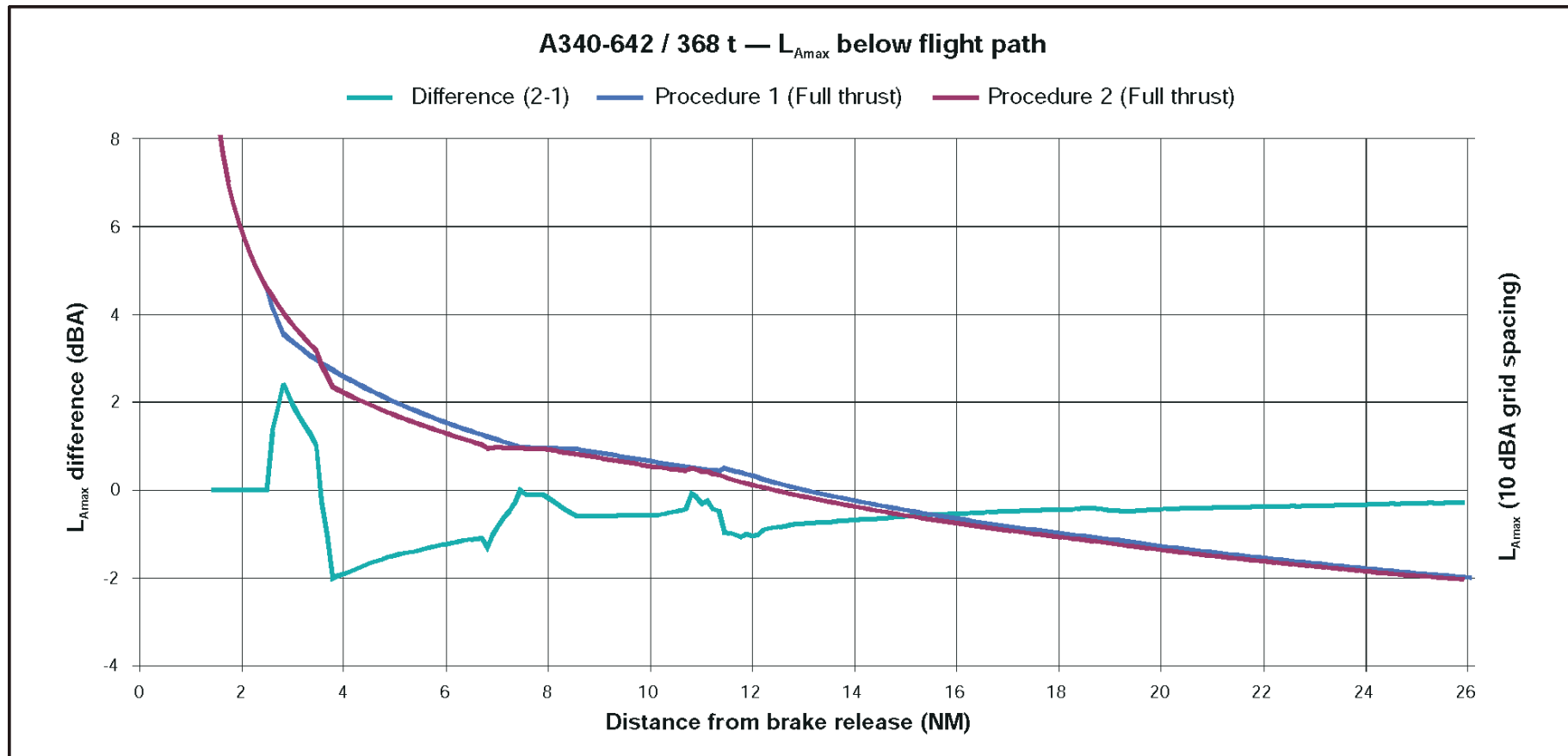
Source: ICAO Circular 317 (2008)

A320: Effects of thrust reduction height (NADP 1)



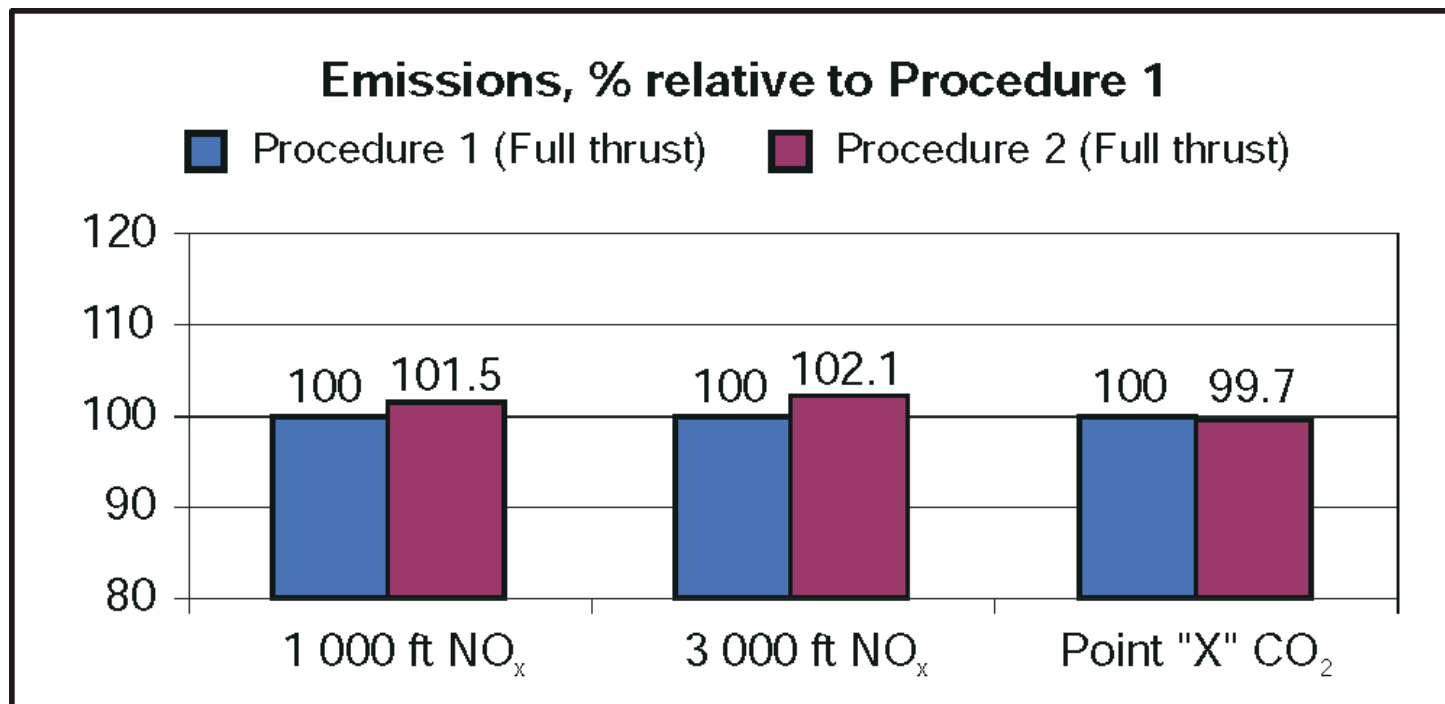
Source: ICAO Circular 317 (2008)

A340: Effect of thrust reduction height (NADP 1)



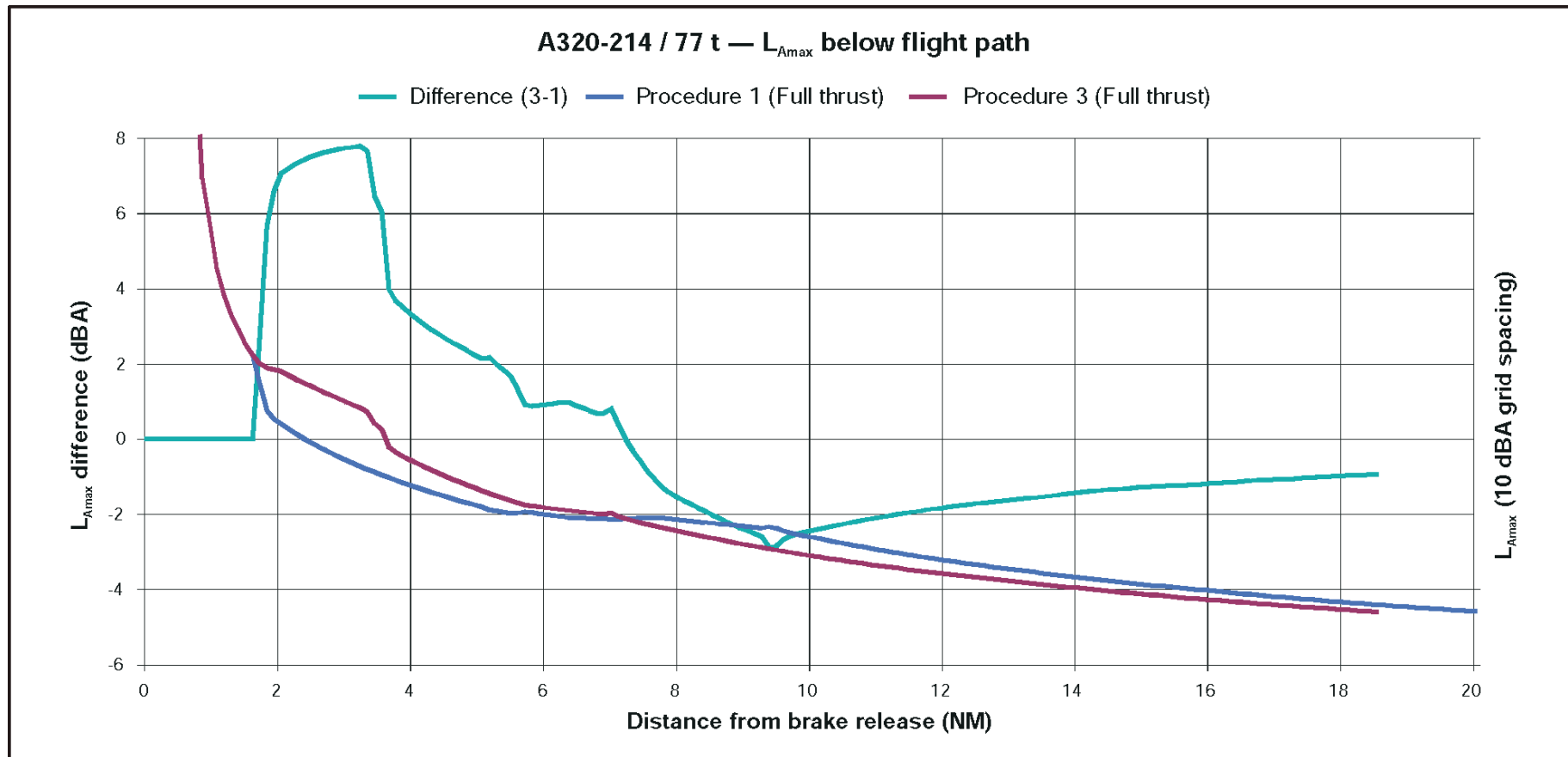
Source: ICAO Circular 317 (2008)

A340: Effect of thrust reduction height (NADP 1)



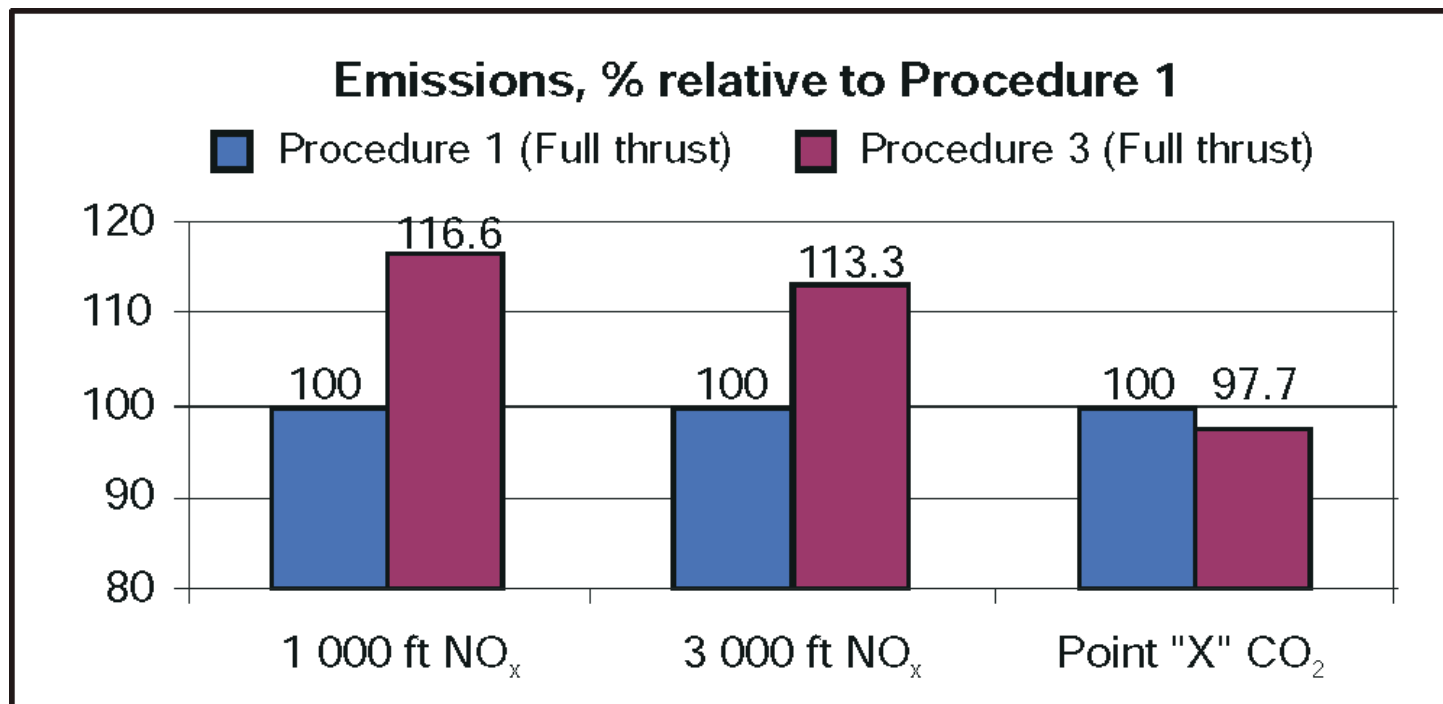
Source: ICAO Circular 317 (2008)

A320: NADP1 vs NADP2



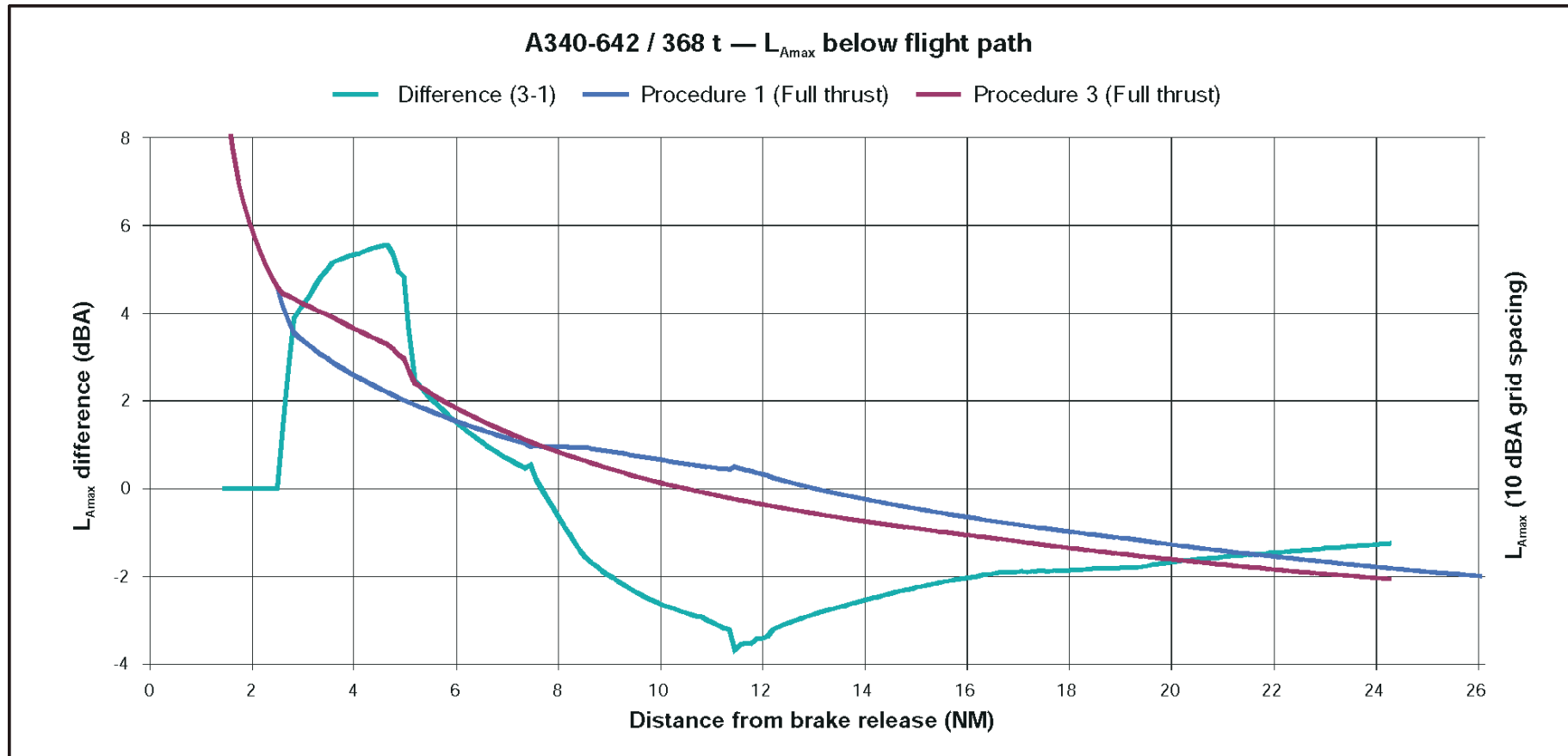
Source: ICAO Circular 317 (2008)

A320:NADP1 vs NADP2



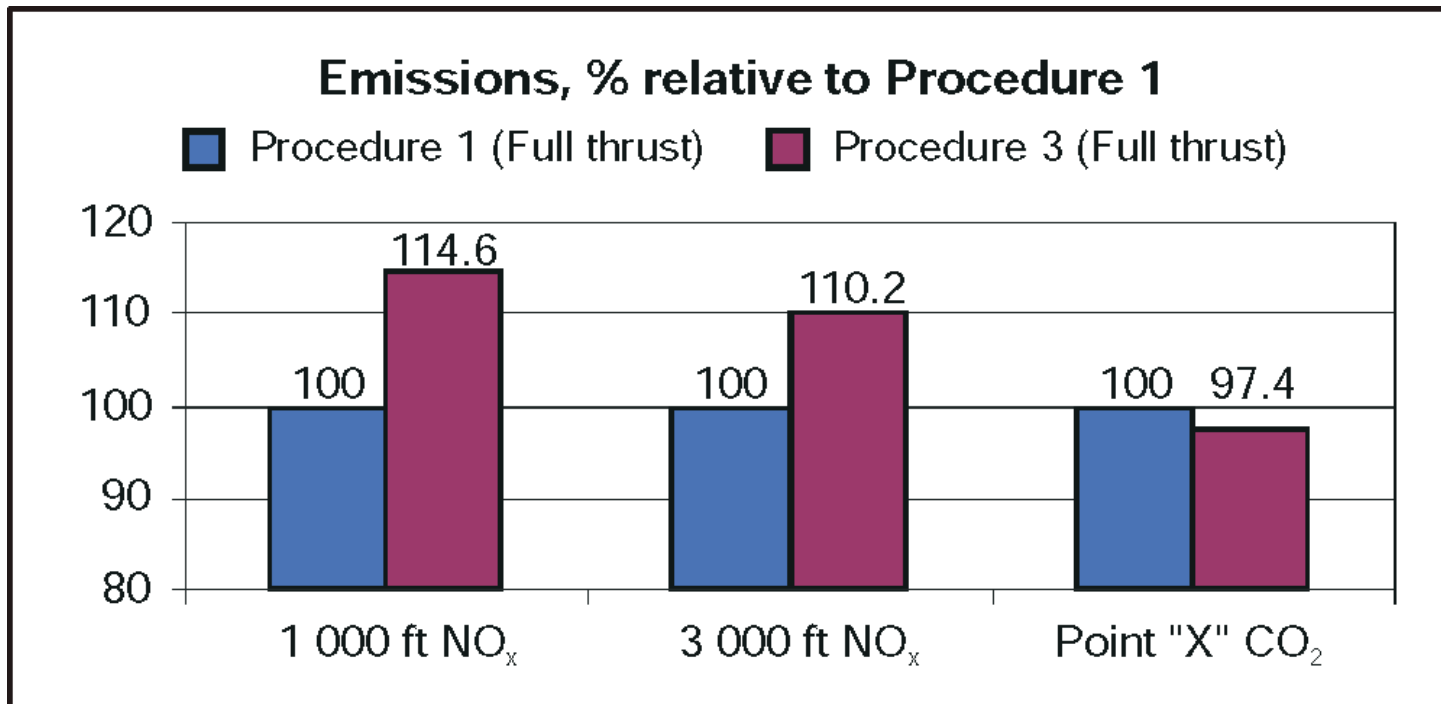
Source: ICAO Circular 317 (2008)

A340-600: NADP1 vs NADP2



Source: ICAO Circular 317 (2008)

A340-600: NADP1 vs NADP2



Source: ICAO Circular 317 (2008)

NADPs and ATM

- NADP 1 procedures typically hold takeoff speed to around 3,000ft
- NADP 2 procedures typically initiate acceleration to 250kt at 1,000ft
- Even for the same aircraft type speed differences can lead to impact on departure separation and departure time 'splits'
- No single NADP minimises noise, air quality (LTO NOx) and gate to gate fuel/emissions
- Who decides best choice?

Future NADPs

- Automation to remove limitation of two distinct procedures
 - Airbus A380 FMS provides two procedures but with variable initiation heights
- Enhanced thrust management
 - Use of onboard systems to avoid sharp changes in thrust setting

Noise Abatement Arrival Procedures



- 1976: First CAA Paper (76032) on low power/low drag approach procedures
 - Favourable ATC speed control to keep the aircraft in a low power/low drag configuration for as long as possible
 - Continuous descent with ILS intercept at 3,000ft
- 1978: CAA Papers 78002 & 78006: first trials at Heathrow of LP/LD and CDA procedures
 - Distance from landing at initial descent clearance
 - ATC providing accurate distance to run “messages”
 - Fuel savings of 30-200kg per arrival depending on type

CDA in the 21st century



- UK Industry code of practice published in September 2001. Second edition published November 2006
- Promotes continued implementation of CDA and LP/LD flying techniques
- CDA achievement rates regularly above 80 percent

CDA ü ?

CDA in the 21st century



- CDA only reduces noise beyond 10nm
- LP/LD can reduce noise <10nm but
 - constrained by ATC speed control
 - PANS-OPS requires final landing configuration at 5nm
- Heathrow
 - arrivals noise (above 57dBA Leq) covers 33% of total exposed area, but encompasses 60% of exposed population
 - area is almost entirely within the final 10nm of the approach
- Where are the next operational arrival noise reductions going to come from?

Future arrival mitigation options



- Displaced landing thresholds
 - Recently introduced at Stansted runway 05, already implemented at Heathrow runway 09 & Gatwick (08 and 26)
- Steeper glide path
 - Prohibited solely for noise reasons in ICAO PANS-OPS
 - Numerous operational factors including loss of low-visibility landing capability
 - Significant dislike amongst pilot community
- If there are no further operational benefits, we need to acknowledge this...