

COMMUNITY-CENTRED FLIGHT PATH OPTIMISATION FOR URBAN AIR DELIVERY

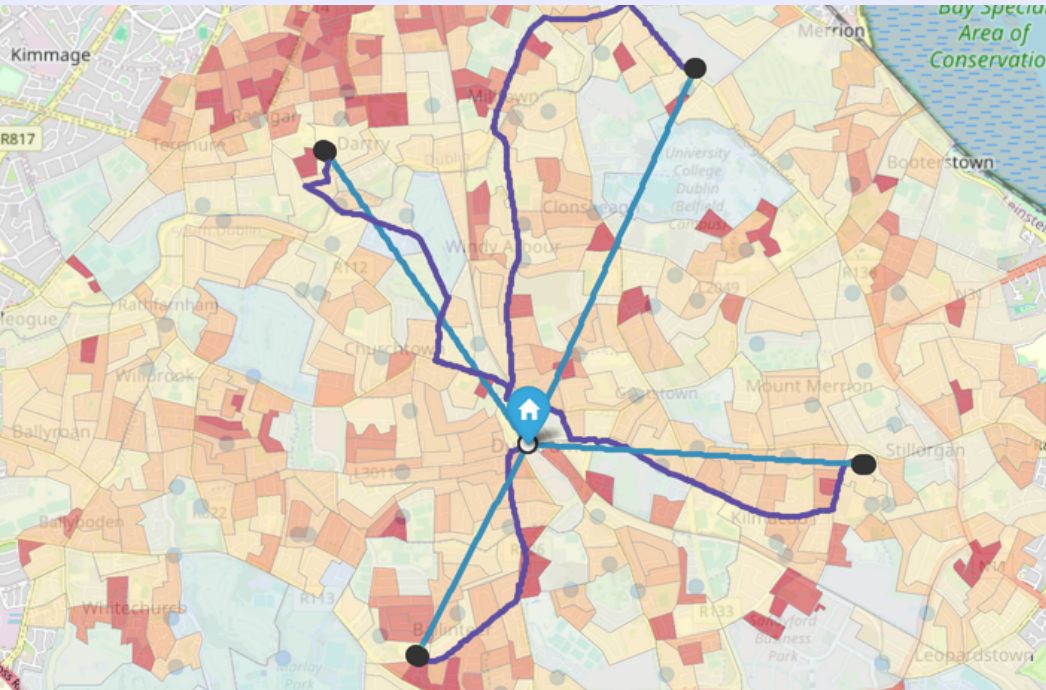
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INTRODUCTION

Urban Air Delivery (UAD) promises lower emissions, less road congestion and near instant delivery times. Dublin-founded Manna has completed over 300,000 drone deliveries. However, three hub planning applications have been refused since 2025 despite independent noise impact assessments showing only a 0-2 dB increase in sound exposure, rated not significant. The standard noise assessment tools used failed to capture the drones’ intermittent and repetitive character, since Ireland has no noise standards for drones. Due to the lack of appropriate regulations, Manna has paused its Irish operations and UAD is now at a standstill.

Figure 1. Map with routes in Dublin’s Dundrum



RESULTS

- Noise-aware cuts noise substantially
 - SEL down by 5.1 dB
 - SPL down by 7.2 dB
- 69% less noise energy received by the population
- 41% longer distance and higher cost
- 1,113 people moved from 60-70 dB band to quieter 40-60 dB band
- Improvement is not universal
 - Lower community average SEL and SPL
 - No cap, exposure can get worse for very few people
- Microhubs improve overall average but significantly worsen SEL and SPL for building closest to them

OBJECTIVE

Develop a routing algorithm that reduces the noise exposure on communities and quantify the trade-offs.

METHODOLOGY

- Two routing algorithms developed:
 - Fuel-aware - shortest path, lower altitude and more noise exposure (teal)
 - Noise-aware - higher altitude (up to 80m), follows roads and adjusts route based on population density (purple)
- Microhubs as an alternative to garden delivery, concentrate noise further from quiet private areas
- Noise exposure modelled using ISO 9613-2, tested on Dublin
- Sound levels calculated as Daily Sound Exposure Level (SEL) and Peak Sound Pressure Level (SPL)

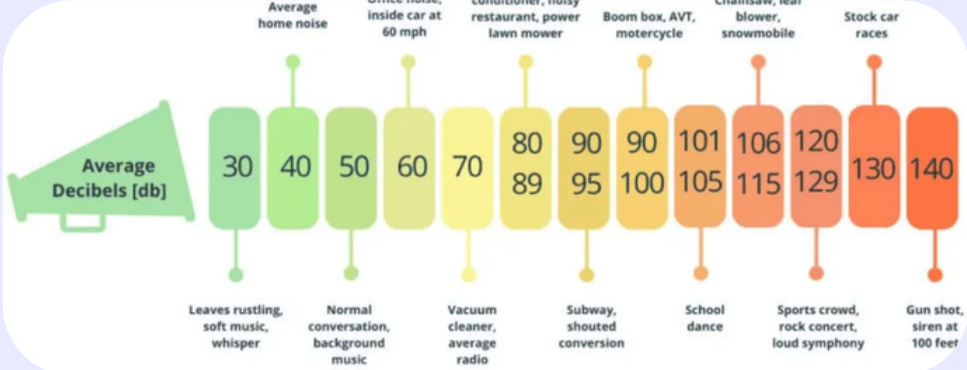
Table 1. Comparison of fuel-aware, noise-aware and microhub routes (1 Dundrum route)

Metric	Fuel-aware	Noise-aware	Microhub (noise-aware)
Distance [m]	2,490	3,516	4,449
Energy [Wh]	123.2	178.8	213.8
Cost [€]	0.191	0.277	0.331
Daily SEL [dB]	133	127.9	125.2
Peak SPL [dB]	79.2	72	74.7

CONCLUSION

Smarter routing alone can reduce the noise exposure by up to 69 % for about 41 % longer distance and higher cost. However, it redistributes the noise rather than removes it, which can make matters even worse in some cases, as seen with microhubs. With careful siting, they offer an immediate improvement without undercutting garden delivery’s main advantage. A better algorithm helps, but cannot replace the need for better regulations and noise assessment tools in Ireland. Without them drones cannot fly over urban Irish skies without decreasing the quality of life of the communities.

Figure 2: Decibel Scale



Routing algorithms can decrease the noise exposure by UP TO 69%