Institute of Acoustics

Briefing Note

Noise from Drones

It is predicted that there could be 76,000 drones operating in the UK by 2030, with around 628,000 jobs in the drone economy[1]. The Institute of Acoustics (IOA) has been considering the potential noise impact that might arise from increasing numbers of drones in our skies.

Use of Drones

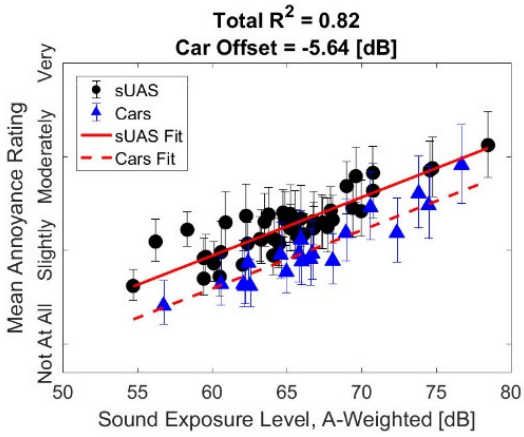
Drones or Unmanned Aerial Vehicles (UAVs) can be employed for a range of inspection, monitoring, and security applications. They can capture images and video; access places difficult to reach by people and carry items including consumer goods, post and medical supplies. Small camera-laden drones are generally remotely piloted by someone on the ground, though they can also be programmed for autonomous flight. Both drones and their operators must adhere to relevant UK regulations and follow a series of protocols in order to avoid topography, buildings, and other drones.

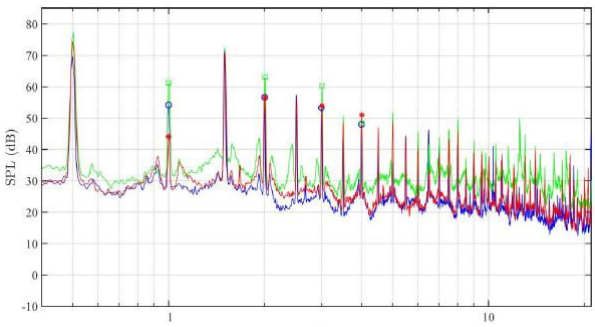
While offering a host of benefits, drones can be noisy and protocols for use should also take account of the potential impact of noise arising from their use. Safety has remained at the forefront of existing regulation and debate, but the environmental pollution resulting from the noise does not yet appear to have been thoroughly considered.

For example, electric vertical take-off and landing (eVTOL) air taxis carrying people will likely be piloted at first, but eventually fly autonomously. The principle is the same as the personal transport pods now used at Heathrow airport for ground transport from car parks. Operating in three dimensions, air taxis could use Unmanned Traffic Management routing protocols, rather than physical guides. As regulation is developed to manage new drone applications, the approach taken to routing protocols is crucial to both the safe and secure operation and in providing an opportunity to effectively manage noise impacts of drones.

Drone noise

Drone noise is arguably more annoying than other transportation noise. This can be seen on the graph[2]. Here, the black dots represent drones and the blue triangles cars. The noise level from drones can be 6 dB lower to cause the same annoyance as cars.





Frequency (Multiple of Blade Pass Frequency)

One reason for this difference can be seen in this graph[3] plotting the sound level against the frequency of the sound. Drone sound is very tonal, with a mixture of hums and whistles caused by the rotating blades and motors.

Potential measures for managing drone noise:

- **The extent of the potential adverse noise impact from drones needs to be determined.** This is likely to involve a combination of the noise generated by the drones, how often they will be flying, the time of day and day of week the flights occur, and the other sound that already exists in the area likely to be affected. Noise policy also requires that a balance must be found between the benefit of drones and their resulting noise impact. To achieve this goal, we need a better understanding of the impact of drone noise on people. This is likely to require more research.

- **Controlling noise at source** can be achieved by setting maximum sound levels that can be generated by drones in flight and is an important noise management tool.

- **Controlling the number of flights,** whilst an important mitigation measure, is probably impracticable if the full benefits of drones are to be achieved. Drone use is arguably much more like car use than aircraft use, with the number and routing of drones being in the hands of individuals. Nevertheless, this measure should be considered in greater depth, for example in densely populated urban areas in which drone delivery is under discussion.

- **The control of drone flightpaths** is likely to be an important consideration. This is necessary for reasons of privacy and security. There is also a need for further consideration of the drone's potential impact on wildlife, as studies have shown that drones can be harmful by being disruptive and stressful to a range of wildlife.[4] Preferred routes may be adopted, based on criteria to be developed, where there are fewer people and less wildlife, or where the existing sound level is already high.

- **The purpose of the flight can contribute to the noise impact.** A drone delivering pizza to a private house is less likely to be tolerated by those affected than a drone generating the same noise impact but which is carrying donor organs for transplant.

To find out more: email: briefings@ioa.org.uk http://www.ioa.org.uk

With thanks to Dick Bowdler FIOA and Anna Jackman, University of Reading for preparing this briefing.

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[1] Skies Without Limits. www.pwc.co.uk/dronesreport

[2] A. Christian (2018) Psychoacoustic Considerations for UAS/UAV and UAM, NASA

[3] Noise reduction methods for a fixed wing UAV. Young-Min Shim et al. Conference Paper, Quiet Drones 2020

[4] M Mulero-Pázmány, S Jenni-Eiermann, N Strebel, T Sattler, J José Negro, and Z Tablado (2017) Unmanned aircraft systems as a new source of disturbance for wildlife: A systematic review. PLoS ONE https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0178448