Abstract
UAS - a new noise source from a noise protection perspective

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Current developments in the field of UAS (Unmanned Aircraft Systems) and the associated European legislation show that UAS will be increasingly used in the future. The UAS industry also has a great interest in starting regular operations, as ever longer flight times and larger payloads are possible. At present, they are mainly used in the service sector, e.g. for maintenance tasks or the transportation of medical goods, as well as in crisis management, e.g. for rescue missions. In the future, there will be so-called U-space airspaces in urban areas. The associated increase in UAS traffic raises the question of future noise pollution. This question needs to be investigated in more detail. UAS have their own, new noise characteristics, which are in addition to the conventional environmental noise in urban areas and also differ significantly from the known noise sources of general aviation. This special characteristic has not yet been sufficiently taken into account in the known noise metrics. It is therefore foreseeable that in future more and more people will feel disturbed by the noise of UAS flights or will at least be concerned about the expected noise pollution. This noise is often perceived as more disturbing than noise from other sources. This can affect public acceptance of the use of these aircraft in urban areas.

The presentation will show what the current legal noise assessment in Germany looks like for the open and special category over inhabited areas and what other questions are raised as a result. There are currently some unresolved issues in the application of § 21h (3) of the German Air Traffic Regulations (LuftVO) from a noise protection perspective, e.g. in the application of the Technical Instructions on Noise Abatement (TA Lärm). In addition, it has not yet been clarified how a noise assessment should be carried out when introducing a U-space. If TA Lärm is still to be applied, the following must be taken into account: The immission guide values of the TA Lärm represent a 16-hour level for the daytime period, i.e. all noise sources in this 16-hour period must be determined for an immission location and summarized to form a rating level. The U-space coordinator must carry out extremely forward-looking planning here, as the type and number of UAS will usually not be known when the application for a U-space is submitted. In addition, the prior exposure at the respective immission location must be known.

Furthermore, it will be shown how psychoacoustic parameters such as loudness, tonality and sharpness can at least provide an attempt at an effect-oriented consideration. Psychoacoustic parameters can help to better describe the actual perceived auditory impression and should be considered in addition to the purely

physical parameter of sound pressure level. To this end, various measurement campaigns with different UAS models between 500 g and 10 kg were evaluated [1].

The results provide insights into the potential level of public annoyance and allow conclusions to be drawn for the assessment of UAS noise, which can be used for future regulations or standardization. In particular, the models that will be used for transportation in the future due to their payload or are already used for inspection purposes have higher values for loudness and sharpness. However, these are not taken into account by the current noise indices. As a result, the characteristic UAS noise can only be inadequately assessed. Official noise assessment procedures must therefore be developed that take psychoacoustic effects into account, e.g. as a supplement. For example, it is conceivable that particularly conspicuous characteristics could be integrated into the usual noise assessment by means of a surcharge. This would certainly be possible via the TA Lärm and already exists in some cases, e.g. for tonality. The analyses also show that the psychoacoustic parameters investigated are dependent on the operating mode. Loudness and sharpness show a pronounced dependence on temporary load changes (e.g. during deceleration). In addition, fast overflights at high altitudes have a lower noise potential. It is therefore essential to adhere to the previous minimum flight altitude and possibly set minimum speeds for overflights.

With the current state of knowledge, it is quite possible to derive pragmatic solutions for noise protection that can be included in the official approval procedure for flight operations and thus mitigate the level of nuisance as a precautionary measure.

[1] Treichel, J., Lieb, T. J., Volkert, A., & Uijt de Haag, M. (2024). Psychoacoustic analysis of UAS depending on different operating modes.

Biography

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Degree in media technology. Since 2011 working at the German Environment Agency in the field of noise abatement, noise impact. Thematically responsible for noise from UAS in the open and specific category. Further thematic focus on the Environmental Noise Directive and noise from leisure activities.