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Noise measurement and aircraft tracking for purposes of noise zoning

The necessity for combined noise measurements and aircraft tracking is demonstrated on test cases from the practical experience of noise zoning. Two cases were analysed in more detail: the impact of real traffic routes on the boundaries of development restriction zones, and the need of ADS-B data usage to correctly determine noise contours for the maximum sound level criterion was shown.

Introduction

The task of noise zoning in the airport vicinity could be fulfilled at different stages of airport noise measurements. In accordance with Aviation Rules of Ukraine "Requirements for operators related to noise zoning of the airport vicinity" (ARU-381, 2019) [1] it is important to organize instrumental noise measurements (or continuously noise monitoring) for verification of airport noise models. The measured and modelled results must be provided by aerodrome operator and shared by Aviation State Service of Ukraine (ASSU). ASSU developed special web-site named NOMOS (Noise Monitoring) [2] for the listed purposes. However, there are results of noise zoning on the basis of modelling only. You can't find there the results of noise monitoring or measurement data. The provision concerning noise monitoring is not obligatory in Ukraine according to the current national rules and legislation at all.

At the same time, there are two criteria for nose zoning in Ukraine as defined by SSR-173 [3]: equivalent sound level and maximum sound level. The results of current research have shown that the total area and shape of the zones (zones «А», «Б», «В» and «Г») are usually defined with L_{Amax} criterion (preferably during night-time). Within conditions of the crucial levels of L_{Amax} it should be noticed that ARU-381 methodology of the data preparation [1] is extremely different from basics of assessment approach of the EU Directive 49/2002 [4]: started from the time of data analysis up to number of aircraft movements. The other issue is that ICAO DOC 9911 methodology [5] is not applicable for noise modelling of a single event. In the absence of real horizontal aircraft trajectories in the airport vicinities it is hard to create effective noise model that meets the local requirements and the international recommended methodology and that has a good convergence with the results of measurements.

Flight Profile and Aircraft Trajectory

In everyday operational conditions vertical flight profile and horizontal tracks differ significantly from the modelled during implementation of case-study approach as it was defined by ARU-385. The difference in operation and balanced noise modelling results has been shown in studies [6] at least in 2-3 dBA at arrival stage and 2 dBA at 1000 m distance from the runway end, that could deform shape of the noise contours significantly.

The measurements of aviation noise in the vicinity of airports in Ukraine was conducted with aircraft tracking data (ADS-B data). The differences between nominal

routs and real operation tracks in horizontal and vertical projections are demonstrated on fig. 1 and 2.

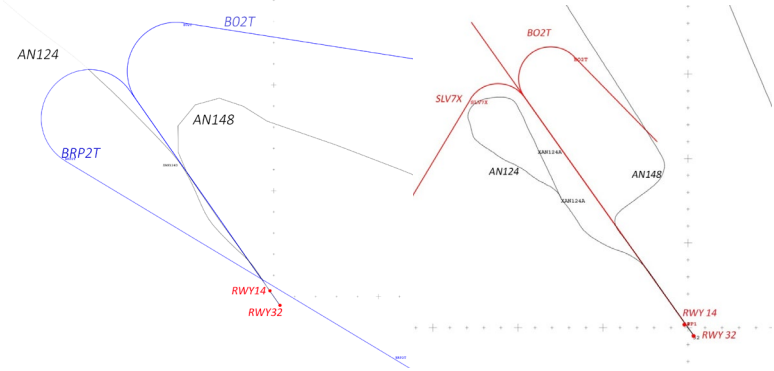

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Fig. 1. The differences between nominal routs and real operation tracks in the vicinity of Gostomel' airport: a) departure nominal tracks BO2T та BRP2T (blue) vs real operation tracks for AN124 and AN148 (black); b) arrival nominal tracks BO2T and SLV7X (red) vs real operation tracks for AN124 and AN148 (black)

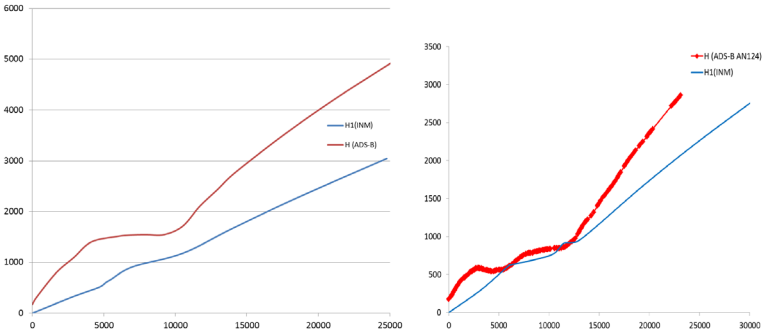

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Fig. 2. Comparison of flight profiles AN148 (a) and AN124 (b): real operational ADS-B recorded data (red) vs default profile from INM 7.0

On fig. 3 shows a comparison of the simulation results for aircraft operated on the nominal route (Bo2T) and taking into account only the trajectory along the route fixed using ADS-B data (TrackAN148). The flight height above the calculation points (Track.H.V-AN148) was also corrected. With the distance from the runway (points D7, D12, D13), the simulation results on the nominal routes differ significantly from the real flight trajectories.

Noise contours modelled on nominal routes and standard take-off profiles laid down in INM, in comparison with noise contours on aircraft trajectories obtained from the results of ADS-B observations may differ significantly in area and shape both near the airfield (for levels L_{Amax}= 85 dBA), as well as for larger distances from the ends of the runway (for levels L_{Amax}=60-65 dBA).

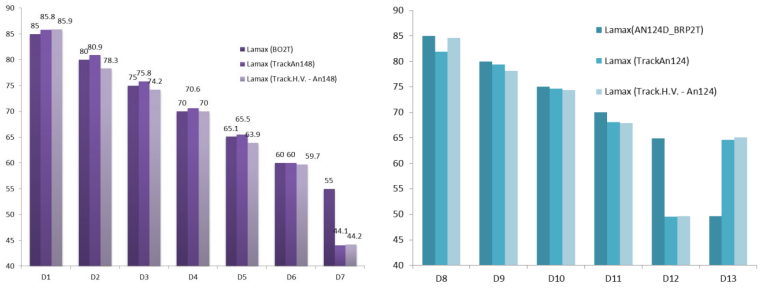

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Fig. 2. Noise level L_{Amax} in control points D1-D13 a) modelled results for AN148 during approach and b) AN124 during departure stage on nominal tracks and profiles and real ADS-B data (Track and Track.H.V-AN148)

Conclusions

Thus, in accordance with the current noise modelling methodology (ICAO DOC 9911) and the latest provisions of the Ukrainian legislation in the field of aviation noise management is integral part of noise zoning is tracking of aircraft during noise measurement.

References

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4. Directive 2002/49/EC relating to the assessment and management of environmental noise. European Parliament, European Council, 25 of June 20022002. https://eur-lex.europa.eu/
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