

# INVESTIGATION OF THE HELICOPTER NOISE

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## Abstract

*In Hungary about 40% of people live in regions where environmental noise is more than desirable one. Nevertheless the last 15 years the significant improvement of noise protection has not been. The designers and operators of the aircraft have experienced unsolved problem of aircraft-noise that is one of challenges of next century's aviation. To adapt results of the noise-protection investigation, the recognition of noise-sources and resulting influences of factors cause sound-field's deviation is very important one. Therefore, in addition to measuring of noise level and frequencies, the factor influence disturbing effects of the noise should be investigated. One of them is the connection between movement of noise-source and features of the sound field. The authors measured noise excited by helicopter — as a noise-source — at ground observing points. This paper shows influences of engine power on the noise level.*

## 1. Airbase and Noise Protection

In Hungary, expansion of the cities has an effect on the noise protection problem. Around airports and airbases, which were built on acceptable sites originally, houses have been built within their noise protection belts. Therefore measure of noise-loaded living space and people has grown up. At the same time, demand of both military and civil aviation has been grown too, which has increased the noise protection too.

The noise levels depending on flying procedures have significant differences and they can exceed the limits mentioned above. In the investigated airbase, the night-time flights have less ratio than day-time ones, but they have fundamentally same flight and noise characteristic signs, except for discretion of

inhabitants. The essential character of flights studied by us, which can be reference station, are the followings:

- considerable training flight is three times a week, on weekdays basically;
- duration of night-time training flights are less the day-time ones';
- the applied AGL-s are changed depending on training tasks.

## 2. Measuring of the Helicopter Noise

Level, spectrum and directness of arising noise depend on the helicopter construction — basically in consequence of main and tail rotors. In the front direction, the noise-radiation is more intensive than in case of fixed-wing aircraft. Therefore the theoretical angle of the sonic-cone is deformed which influences the features of the sound field.

The measuring in the free sound field above sound reflecting plane surface is one of the most generally used practical methods. This is able to investigate noise-sources and connection between features of noise-sources and the sound field and character of the background noise can be deduced from result of this method.

The helicopter noise should be measured at some points. These measuring points should be placed at surface equally-spaced from the significant radiating surfaces of the investigated noise source — in our case of the helicopter. During determination of the measuring surface the rotary parts have to be taken into consideration very strictly. Therefore to measure near-field zone noise of helicopter the following dominant noise-sources had been defined: engine and transmission; main and tail rotor.

After appraisal of several measured data and comparing them to theoretical conclusion,

five measuring point had been determined (see Figure 1), considering the followings:

- near-field zone measuring happened not only near the investigated equipment but near other ones too, therefore part noise sources should be separated;
- directions should be determined depend on direction and intensity of the noise radiation, in the interests of comparison;
- prompt and correct measuring method should be worked out for a future practical investigation.

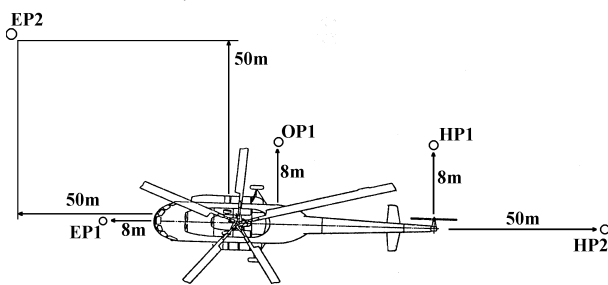


Figure 1.  
Noise-Measuring Points

To show the question mentioned above and to disclose the relations, the manoeuvre so called "jumping" (Figure 2.) was measured in three cases. In the first one the maximum above ground level of the helicopter was accurately above the measuring point. In second case it was in front of, and in third one behind measuring point by 50 m. In every case the helicopter Mi-24 was flying at a speed of 200 kilometres an hour and its above ground level was 15 meters. Noise—time function of the investigation can be seen in Figure 3.

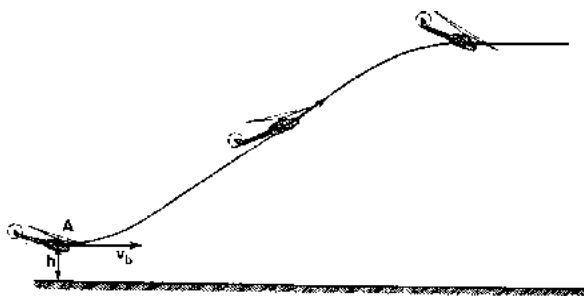


Figure 2.  
The Maneuver "Jumping"

The increasing and then decreasing of

noise-level are influenced significantly by engine power according to the theoretical connection. But, changes of the power differ in time and in the envelope cause deviation of "increasing—decreasing" process of the noise and occurrence of its maximum levels.

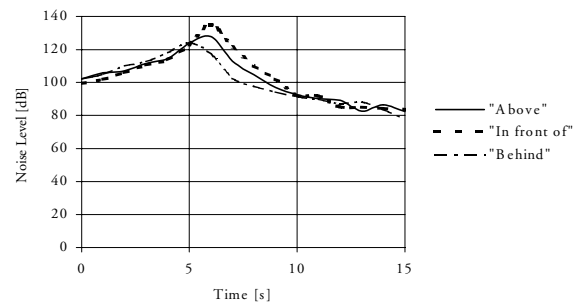


Figure 3.  
Connection between Noise-Level and Engine Power

### Conclusion

The connection between environmental noise, sound field influences of external factors and operational conditions can be characterised by investigation of noise source moving in the space. Analysis of operational conditions and flight modes is one of the most important noise protection tasks.

The result of our investigation shows that in addition to engine noise, the noise radiated from airframe and generated by aerodynamic effects and rotary elements are determinant ones.

The main aims of our future work that the noise protection will be not only to edict limited noise levels, but determination of requirements and their keeping too.

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