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NOISE ASPECTS OF ULTRALIGHTS AND MODEL AIRPLANES

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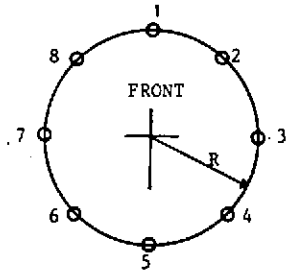
Two types of rather noisy recreational airplanes are treated in this paper, Ultralights and model airplanes. For both types noise regulation exists in the Netherlands.

ULTRALIGHTS

Ultralights, also called microlights or minimum aircraft, are simple, low weight (70-110 kg empty) low speed (40-90 km/h) tube-and-bag aircraft, powered by small (100-450 cc) low power (15-30 hp) engines. They are usually single seat aircraft, the pilot sits in the open air. Some two seat types are available, used for training purposes. Ultralights are mainly advertised and used for recreational purposes, although some non-recreational use is foreseen. They were introduced in the Netherlands in 1981, their price is comparable with that of a medium sized car.

Noise levels

It became clear that Ultralights can be very noisy, probably because of their often rather crude engine intake and exhaust systems and their fast turning propellers.
In the summer of 1981 and 1982 the Dutch Department of Civil Aviation (RLD) performed a large number of static full power noise measurements. Emission levels, defined as the arithmical mean of eight noiselevels on a 10 m radius circle around the engine exhaust (figure 1), of 85-94 dBA were measured.
Some results of fly-over tests are available. At full throttle 150 m (500 ') fly-overs, maximum noise levels of around 70 dBA and more were recorded. Figure 2 shows an example of recent test-data obtained by the Department of Aerospace Engineering of Delft University of Technology.
To put these data into perspective, let us compare them with noise levels of other aircraft.



$$\text{Emissionlevel} = 1/8 \sum_{i=1}^{8} LA_i$$

R=10 m - Ultralights
7 m - Model Airplanes

Power=Full throttle

Circle centre=end of engine exhaust

Fig.1.Lay-out for static "round-about" noise measurements

Typically, 45-50 hp motorgliders produce about 65 dBA during 150 m full-throttle fly-overs, a popular 700 kg 110 hp two seat U.S. "normal" airplane about 73 dBA. Moreover, there is a distinct difference in noise duration between the "normal" airplanes and Ultralights. At very low to moderate windspeeds, the 10 dB-down time of Ultralight noise during the 150 m full throttle runs was typically 30-45 seconds, compared with about 12-15 seconds for the "normal" airplane. When flying Ultralights at low power, and hence very low airspeed, into some wind, 10 dB-down times of 1-1½ minute can be expected. Of course at those power settings, the noise levels are lower than the numbers quoted above. At a typical cruise power, the levels of the Eagle are some 5 dBA below the full-throttle values of figure 2.

Noise regulation

To obtain experience with Ultralights, concerning both airworthiness-operational and noise aspects, they were allowed to operate during a trial period that ended December 31, 1982. During this period, a permit to fly could be issued to a maximum of 40 Ultralights. It was only granted if, amongst other things, the emission level during the static noise test described above did not exceed 91 dBA. They had to remain within 5 km from the field of departure and could operate between 50 and 100 m above the ground. Flight over populated areas was prohibited. In fact, only 30 permits were actually issued.

On January 1, 1983 a so-called interim-period started. Some airworthiness requirements were formulated, furthermore the pilots will have to pass a flight-test and a written exam to obtain a licence. If these requirements are met, cross-country flights at altitudes between 150 and 300 m above the ground are permitted during the interim-period. During this period, the maximum number of Ultralights to be registered is increased to 80.

New noise limits are defined. For single seat Ultralights, the maximum noiselevel during a full-throttle fly-over at 150 m altitude

shall not exceed 60 dBA. This is the same value allowed in the Federal Republic of Germany. In the Netherlands, noise certification can also be performed according to the static "round-about" method of figure 1. In this case, the limit is 80 dBA. For two-seat Ultralights the noise limits are 3 dBA higher, provided they are used for training purposes only. Ultralights are not allowed to fly within a horizontal distance of 500 m from built-up areas, campings, etc. For so-called "official quiet areas", areas with a low ambient noiselevel that are as yet not disturbed by external noise sources, the minimum horizontal distance is 1500 m. The number of airstrips exclusively for Ultralights will be limited to about 25. The location of these strips will be such that the pilots, while using the strips, can comply with the requirements concerning the minimum distances described above.
A definite regulation concerning Ultralights will be in force as soon as possible, but not before 1984.

MODEL AIRPLANES

Model airplanes, and their noise problems, are with us quite a while longer than Ultralights. There are about 150 model airplane clubs in the Netherlands, totalling more than 5000 members. Radio-controlled powered models are by far the most popular. By definition a model airplane weighs less than 20 kg and is, of course, unmanned.

Noise levels

Noise research was performed by Eindhoven University of Technology in 1976. Based on this research, a number of articles on model airplane noise reduction was published in a widely read model airplane technical information magazine. They informed the model airplane builders on how to construct their models, select suitable engines, engine-exhaust combinations, etc. to obtain low noise models, without unduly

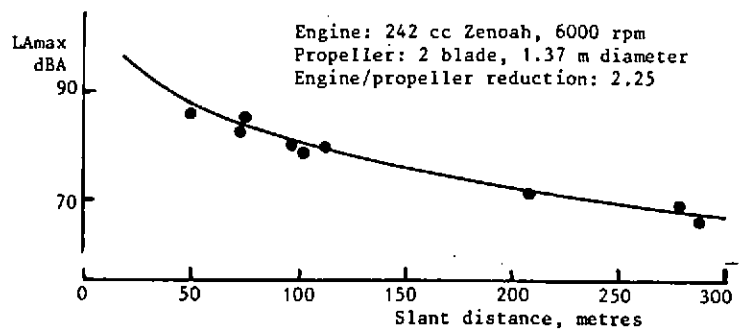


Fig.2.Fly-over noiselevels Aerolights Eagle at full throttle

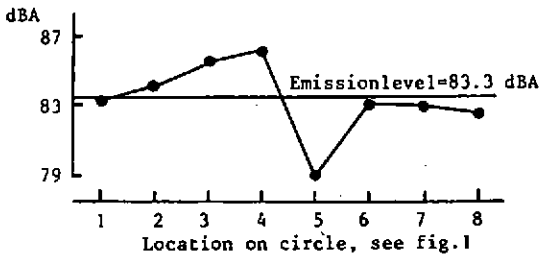


Fig.3. Averaged noiselevels of 16 model airplanes

affecting their performance and outward appearance. Part of this research consisted of noise measurements according to the "round-about" method of figure 1, the radius of the circle being 7 m in this case. Figure 3 shows averaged results of 16 models.

Noise regulation

In May 1981 a Model Airplane Regulation, dealing with safety and noise aspects was published. According to this regulation, the emission level obtained from the 7 metre "round-about" method must be 84 dBA or less at full throttle. The minimum distance between mini-airports and built-up areas is 1500 m. Preliminary computations, based on the 84 dBA emission level, typical flying patterns, average use of the mini-airports and including a 5 dB correction for audible tone components and a 5 dB correction for operations during evening hours, showed that at this distance a Leq-level of 50 dBA can be expected.
In 1984 the maximum permitted emission level will be reduced to 80 dBA, in 1989 to 75 dBA. If clubs exclusively use models that already comply with these future requirements, a shorter minimum distance between mini-airports and populated areas is allowed. At an emission level of 80 dBA this distance may be 1200 m or more, at 75 dBA the minimum distance is 900 m, at 70 dBA 700 m.