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## **ROZPRAWA DOKTORSKA**

**„Budowa systemu bezpieczeństwa związanego  
z procesem holowania szybowca”**

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## Abstract

This doctoral dissertation concerns the problem of improving safety in sailplane aviation by measuring the critical flight parameters of the sailplane during take-off with the use of an aerial winch. During the observation and analysis of the available materials related to the piloting of gliders as well as the instructions for the use of air winches, deficiencies in the objective measurement of critical flight parameters (take-off after the winch), i.e. the towing line tension force and the glider's angle of attack, were noticed. Based on own observations and analysis of the state of the art in this area, it was concluded that it is currently possible to increase the level of aviation safety by measuring the above-mentioned parameters and then presenting them to the pilot in the cockpit for information purposes. It should be noted that the current level of technology has significantly evolved, however, both the solutions currently used and the current legal regulations regarding the subject of gliding, and especially glider take-off, come from the 1980s. Taking into account the above facts, it was decided to try to improve the safety level during glider take-off using the tow behind the aerial winch by building a system designed to measure the previously mentioned critical flight parameters, and then presenting information to the pilot in the form of lighting up warning lights about exceeding the set threshold value. towing rope tension force and approaching the limit value of the angle of attack.

For this purpose, a dedicated system was designed to function as the target system, and after the software was changed, it performed the measurement function used during the practical tests. The system was pre-tested and calibrated in laboratory conditions, and then tests were carried out in real conditions, which showed that the acceptable critical angle of attack was exceeded during the take-off of the sailplane while towing behind the winch. In the second series of tests, after the activation of the information controls, the pilot was able to respond properly to the signal of the warning light illuminating before approaching the critical angle of attack after about 10 flights. In this case, the pilot was able to effectively limit the angle of attack of the sailplane in order to keep it within the proper range indicated in the manual for the sailplane used.

In connection with the obtained test results, it can be stated that the thesis is correct that it is possible to build a safety system related to the glider towing process during take-off with the use of an aerial winch with the use of electronic sensors.

**Keywords:** glider, aerial winch, flight safety, glider take-off, glider towing.