Public summary

Clear Flight Solutions is a company that is specialized in Bird Control. They use so-called *Robirds*. This is a flapping wing robotic Falcon that not only looks like a bird of prey but also flies like one. The Robird cannot take-off autonomous as of now. A specialized pilot is needed to throw the bird into the air. Because this method is not consistent, the launch sometimes fails, resulting in the Robird getting damaged.

Therefore the main goal of this assignment was to design and construct an autonomous launching system that launches the Robird in a safe and consistent way. This will help the pilots that control the robotic bird to predict how the Robird is going to react to every launch. It will also help in making the Robird fully autonomous, so that no people have to be involved in the future.

There are already many different launching systems available for both UAVs and RC-aircraft. Most of these systems use elastics, springs and pneumatics to propel the UAV. Because those already existing systems do not meet all the requirements set up by the company, a new concept has to be designed from the ground up. After this literature study it was clear that a pneumatic system would be the way to go, as it suits the requirements set by Clear Flight Solutions best.

There are several important requirements that this design has to meet. The most important ones are:

- Easy and safe user interaction.
- Portable, smaller than 100x30x30cm when folded, and lighter than 24kg.
- Consistent launch of the Robird at the determined velocity and acceleration.
- The Robird should clear the ground with 3m at the highest point.
- System should be assembled within 5 minutes.

After gathering those requirements where set up, the actual design could start. First, a test was carried out with a normal hand launch of the Robird. With this data, Alan Voogd did most of the calculations on the acceleration and velocity of the Robird in his Thesis "*Robird autonomous take-off: pneumatic launching system,* 2017". The Robird should have a velocity of 13m/s at the end of the launching ramp. Clever solutions to the foldability and weight reduction were applied. By making the cylinder part of the structural frame of the total ramp, weight could be saved. By using simple latch clamps for attaching and detaching the 1m pieces together, usability was greatly improved. The concept was made in SolidWorks and parts were ordered. After this, the build could start.

After completely building the system, the last tests could be carried out. First a test to prove the working of the pneumatic air cylinder and piston. This test was not successful at first, and it was clear that some improvements had to be made. After improvements that made the cylinder and piston more airtight, a second test was carried out. The result was that the 13m/s was reached at a pressure of 4.5 bar.

After this, a test with the Robird could be carried out. This was also successful. The Robird reached 2.95m of the required 3m. This could be due to the fact that the Robird should be launched into the wind, and was launched downwind in our case.

The last test was a user interaction test. The user was able to completely assemble the system without any manual, and well within 5 minutes. Operation was also no problem, and was intuitive.

However, there are some recommendations. The system is mainly focused on functionality, but safety should also be taken into account. With the use of sensors, the safety of both the user and the Robird could both be taken better into account. Also, the materials used are good for a working prototype, but could be higher quality in a future build, this would make the system more durable and easier to use.

Although there are some recommendations, the launcher is capable of reaching all the requirements. Some however, just, or with a slightly higher air pressure than calculated earlier. The working prototype proves the capability of this design and could be optimized in a further research.