Slider Spring Release System for Microsatellite Launcher

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Aim of the Project

The Aim of the project is to design, build and test a slider spring release system for a Microsatellite/CubeSat launcher.

Background

This project was a follow on from the group project of last semester, which was to build a Microsatellite launch system. The Slider release system was based on a protype microsatellite design from James Drew, a researcher in the Hartnett building. Microsatellites are small satellites weighing less than 1kg that are used to take pictures in space and are used by both private companies and international Space agencies. There were strict regulations such as weight, mass, certain materials laid out by NASA , Space X and Firefly Aerospace that had to be followed. The spring had to be capable of moving three satellites weighing 0.25kg each and the slider roller system. The total weight was 0.782kg.

Operation of system

The Slider spring release system operates by the spring being under tension. Once the door in the launch system opens the spring pulls the slider and roller along the rail which pushes the satellites out of the launcher. As the spring pulls the slider upwards it coils around the roller .

Slider

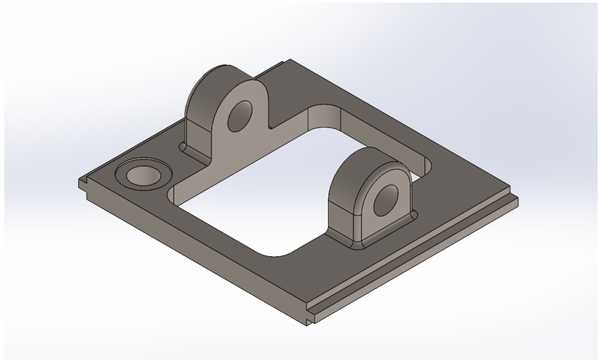

Figure 1: Slider

The final slider design was based off James Drew's original design but was modified so it could be machined using CNC. The roller attaches to the middle of the slider and the spring pulls the slider upwards which pushes the satellites out of the launch system. The final Slider was made from Aluminum as it is lightweight and doesn't deform in Space.

Spring

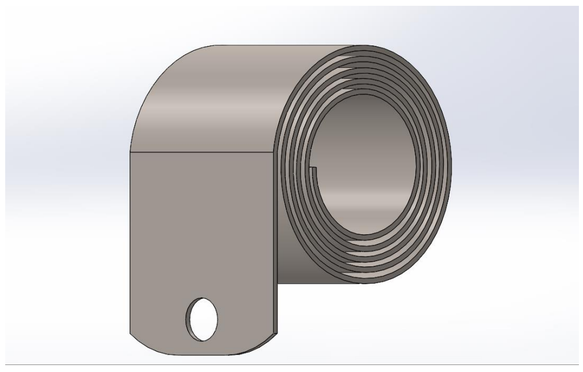

Figure 2 Variable force Spring

The spring needs to be a flat strip variable force spring as the satellites must leave the launcher 1 second apart. As the first satellite leaves the weight is decreased so if the force isn't varied the satellites would leave too quickly leading to collisions and misalignment.

The Spring can be made from stainless steel or titanium, stainless steel being the ideal material as it is lighter and cheaper to acquire, The spring could not be machined and had to be acquired from an outside manufacturer which proved difficult to find due to the fact that most companies only manufacture springs on an industrial scale i.e. hundreds or thousands of springs.

Roller

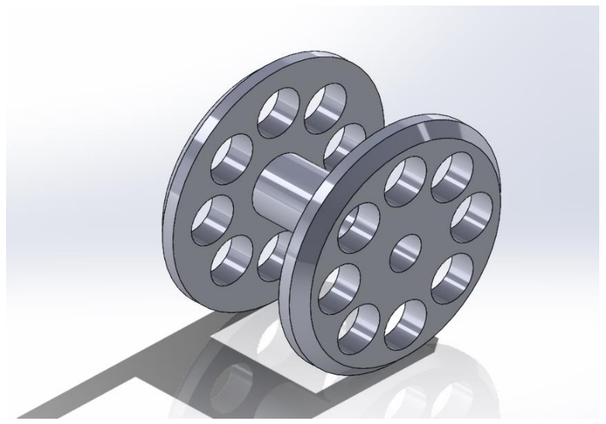

Figure 3 Roller

The roller attaches to the slider by a bolt going through the center hole. The Spring is also attached to the roller and coils around the roller as the slider is pulled upwards along the rail.

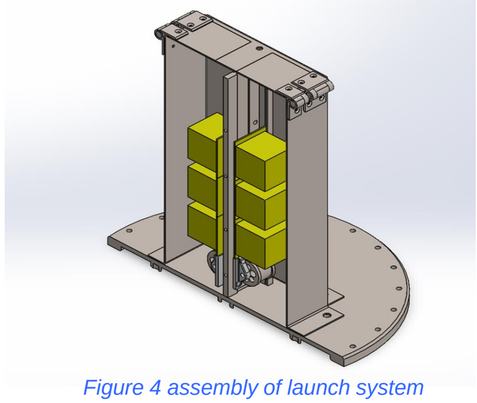

Figure 4 assembly of launch system

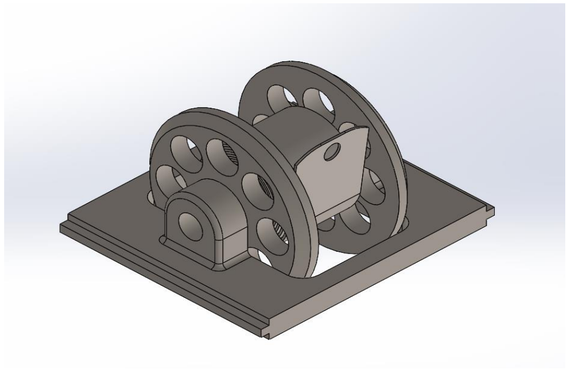

Figure 5 Slider system assembly

Conclusion

The hardest part of the project was figuring out what type of spring to use to release the satellites correctly and where to acquire the spring. Manufacturing the Rollers was successful, and the G code for the Cincinnati Hawk TC-150 could be changed to allow for variation in Roller size and dimensions if they were to be manufactured industrially. The Slider was programmed correctly using Solid CAM and was machined in the college using the Spinner. The variable force springs were ordered from McMaster-Carr in the United States and were used to carry out accurate tests, as the spring in measuring tape was used for the first tests to see if the slider/roller system would move along the rail system.

Acknowledgments

I would like to acknowledge my supervisor Ciaran O' Loughlin for his constant help throughout the project with research and machining the rollers. John Walsh for his assistance with machining. Thanks to James Drew for his help with guiding me on requirements and regulations to help progress this Project