Small scale satellite launching system

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Aim of the Project

The Aim of the Project was to design and build a nitinol operatrd latchsmall-scale satellite launching system that ejected 6 micro satellites (3 on either side of the main rail) at intervals of 1 second while also complying with space regulations and passing rigorous tests including vibration, acoustic, shock, pressure, electromagnet and temperature

Objectives

- Research the regulations associated in sending a satellite to space and evaluate how they apply to the project (materials, weight, size)
- Design a working assembly excluding the nitinol release latch that complies with the regulations
- Test the force needed for the constant force spring to eject the micro satellites.
- Machine the parts using the CNC and assemble

James Drew is a software engineer and researcher in the Hartnett Building in TUS and tasked the group with expanding on his previous porotype. He provided us with knowledge on what we could use and what we couldn't use for example pressure systems and magnets couldn't be used as they had a chance at damaging the payload or throwing the rocket off course.

Figure 1 prototype model

Background

Micro satellites or nano satellites are small satellites usually weighing less than 1 kg. They are used to take pictures and record various images of the planet and surrounding solar system. They have become more commercialized and can be launched with certain space Companies such as Space X, NASA and Firefly Aerospace.

The design for the launch system was heavily influenced and restricted by the regulations of Space X and Firefly Aerospace provided to the group by James Drew.

Design

Shown above is a section view of the final assembly drawn up in SolidWorks. It consists of the base, the main rail, two sliders and two rollers, Outer Casing, four hinges and two Hinge doors and six Cube Micro Satellite Models. Our design was based on James protype, our main task as a group was to make a functioning model that improved off his base design. His design gave us a starting point that helped us decide what we needed to do and how.

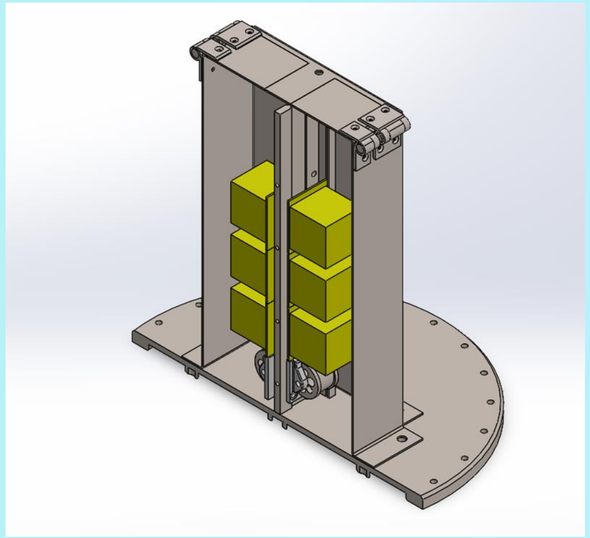

Figure 2 final assembly

Manufacturing

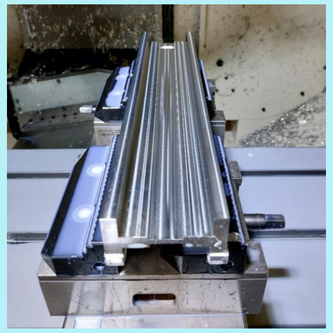

Figure 3 rail being machined using CNC

Figure 4 Rollers being manufactured in the Workshop

Figure 5 slider being 3D Printed

Figure 6 Base Plate being 3D printed in four sections

Manufacturing

The manufacturing of this project involved many process which included designing parts on Solidworks, CAM for the parts to be machined and Solidworks files being converted so pieces could be 3D printed. The sliders and base have been 3D printed due to lack of time and struggling to find a source of aluminum big enough that can accommodate the required base size set out by the regulations of Space X and Firefly aerospace

Conclusion

Due to time constraints and the fact that there was a massive workload to complete our project It was decided that the latch release system be left for next semester. Due to the compressor on the CNC machine being broken for the last 2 weeks we were unable to manufacture our satellite pushers that house the rollers and decided to 3D print them as an alternative we also 3D printed the base as we could not source stock big enough. The Base and slider will be machined next semester using CNC, the base being machined from Aluminum and the slider will be made from Teflon.

Figure7 Final manufactured assembly

Acknowledgements

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