

**Project Name:** Flying High Towards Aerospace Engineering

**Team Number:** 1715Z

**Team Name:** RedFlagZ

**Location:** Hopkinton Middle School, Massachusetts, United States

# INTRODUCTION

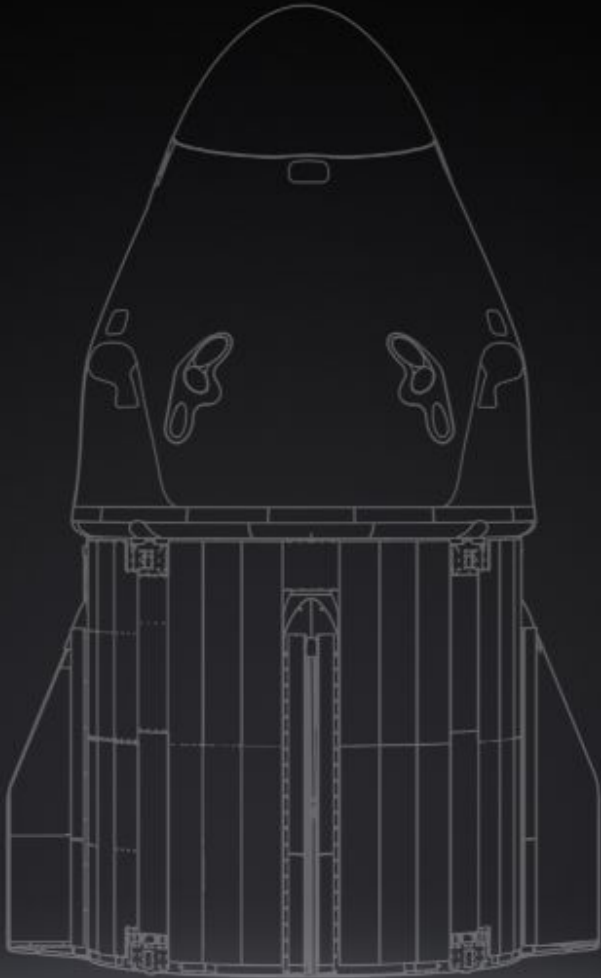
This Online project outlines how the engineering design process is used by Aerospace engineers and by our team 1715Z. By analyzing how Aerospace Engineers do their job, we can understand how to better our own process



# STEM Career

The STEM Career that our team decided to research is an Aerospace Engineer. The main reasons that we chose this career is because:

1. They use the Engineering Design process almost everyday in their workplace
2. They work on projects like Space exploration that we find very interesting
3. One of the Parents of our team member has a friend who has a Ph.D. in Aeronautical Engineering and works as an Aeronautical Professor



# Aerospace Engineers Design Process

We interviewed Dr.Venkatachalam, an Aeronautical Professor from the Amrita Institute of Technology in Coimbatore, India to find out more about how they use the Engineering Design Process in the jobs of Aerospace Engineers. We found out that they have a documented design process, and that some Aeronautical companies like SpaceX use thinking processes, for example, First Principle Thinking that they can adjust accordingly to what they are designing.

1. They start off with the problem definition, which is the step where they identify a new demand in the market
2. After Identifying the demand or need, they move on to Conceptual Design, which is the stage where they brainstorm ideas and will be revised thoroughly and come together to form the initial configuration
3. Stage 3 is the Preliminary design stage. In this stage of the design process, they create a model of their ideas and figure out whether the aircraft will fly and delve deeper into flight mechanics.
4. In the Detailed design stage, every component of the design will be continuously tested and different design teams work closely together to finalize the design

# Our team's approach to the engineering design process

Our approach to the Engineering design process is relatively simple compared to that of an Aerospace Engineers. We approached designed our robot after looking at the constraints that the REC Foundation had put in place for this years Vex IQ Challenge.

At our first few meetings we got together and brainstormed jobs for everyone based on their strengths and we also brainstormed different design ideas, and started documenting them in our Engineering Notebook.

After that, Rian, our CAD designer CAD'ed our best design based on how easy it was to implement and how well it would play this years challenge and presented it to the team. We also made a [Youtube Channel](#) to explain things about our robot and keep the videos for future reference for ourselves and others.

Throughout our building and documenting process, we started to understand ideas like gear ratios and mechanical advantage that we shared within the team for future reference and design.

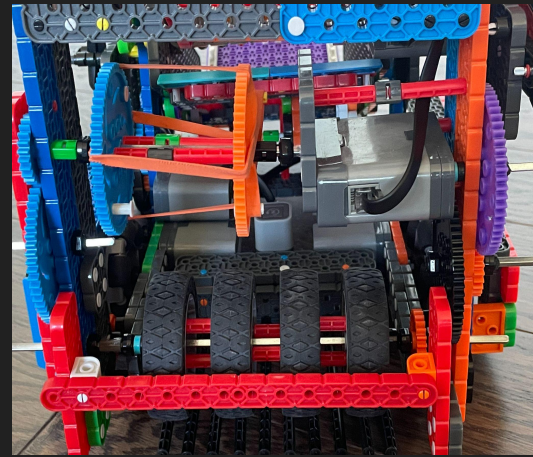
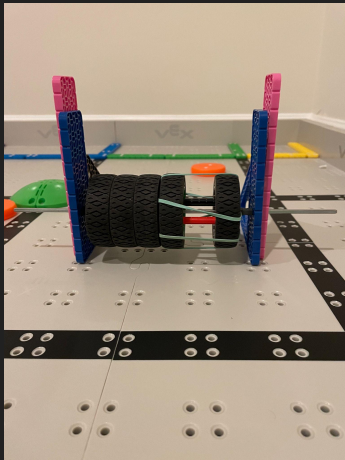
Our first design was able to score enough points to get us to regionals, but our team also had a few problems with our flywheel, as it would not shoot into the desired goal zone or spin the purple dispenser fast enough. In the next slide is all of our trials for the "perfect" flywheel.

# Evolution of Our Flywheel Shooter

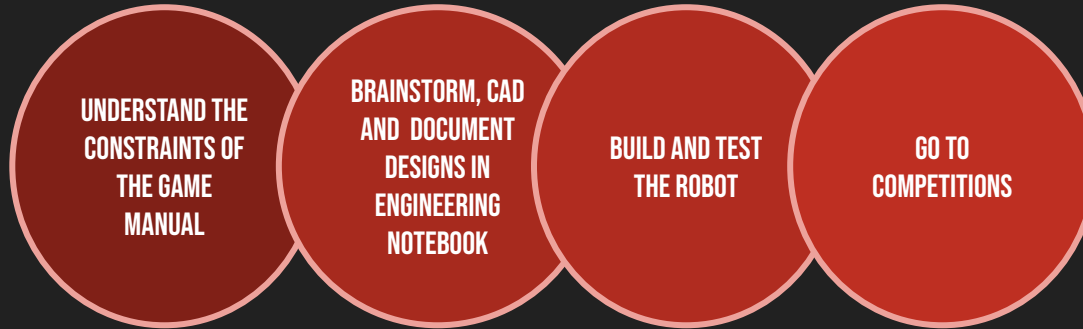
This was the Mark 1 flywheel that we designed. When designing in CAD, we did not realize that the small intake on the side of the flywheel would interfere with the shooting of the bot and we also forgot that it would be very hard to line up with the small room for error that we have with the Purple dispenser wheel.

This was the Mark 1 flywheel that we designed. When designing in CAD, we did not realize that the small intake on the side of the flywheel would interfere with the shooting of the bot and we also forgot that it would be very hard to line up with the small room for error that we have with the Purple dispenser wheel.

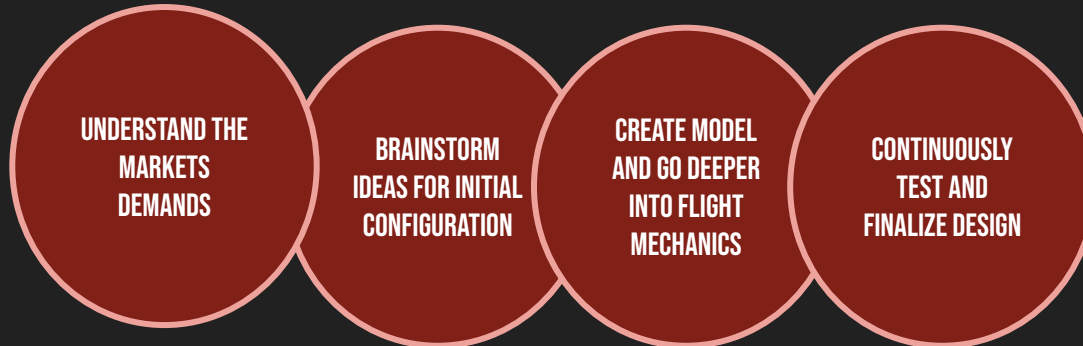
This is the Mark 3, or "Goldilocks Flywheel" we had made, this time however, we did not use CAD because of the Competition date that was coming fast. We made sure to account for the size of the wheel and settled on a drum intake that was above the flywheel, because we found that wheels worked best for shooting, we decided not to interfere with them by adding an intake to the side of the wheels.



# Side By side Models of Both Design Processes



*Engineering Design Process used by 1715Z (above) and Design Process used by Aerospace Engineers (below)*





# How has Vex Robotics prepared us for our future career?

While we tried to compare the engineering design process of Aerospace Engineers to our own design process to better our understanding of its uses in different careers, we understood that both design processes are somewhat similar. The Design process that these engineers use is essentially a more advanced version of ours.

1. Aerospace engineers use their vast engineering knowledge to make their designs. We also learn engineering principles while doing VEX robotics, like torque and speed gear ratios, that could help us in the future and give us an advantage over people who do not participate in VEX
2. Engineers often document their designs. With the introduction of the Engineering Notebook that VEX provides, we get first hand experience documenting our designs and our processes.
3. Engineers sometimes use CAD (computer aided design) to make their designs before they use physical parts. Our time and experience using softwares like LDCad and SnapCAD allow us to expand our knowledge at a very early age.

We feel that our teams participation in VEX IQ will help us understand the ever changing world of engineers better and will better suit us in the future to occupy engineering based jobs.



# The Team:



## **NIHAAL CHERKARDY:**

Lead Taskmaster, Backup coder and lead system integration technician. Age 12, Grade 6, Hopkinton Middle School. First year VEX



## **VIKRANT RAMESH:**

Team Captain 2, Lead coder, Builder, Hopkinton Middle School, Age 13, Grade 7, 2nd year in VEX, Worlds 2021



## **ADITYA MATHUR:**

2nd Coder, Builder Backup driver 1st year VEX, age 13, grade 8th, Hopkinton Middle School



## **PARSHV SHAH:**

Backup Autonomous Coder, Stem Challenges. Grade 6, first year VEX, Hopkinton Middle School



## **ANAND NARENDHAN:**

Team Captain 1, Lead Autonomous Coder, Builder. Hopkinton Middle School, Grade 8, age 13, second year VEX, VEX worlds 2021



## **RIAN SEBASTIAN :**

Backup coder and CAD designer. Age 12, Grade 6, Hopkinton Middle School. First year VEX

# Resources

Websites Citations:

<https://www.nasa.gov/astrobee>

<https://kidadl.com/facts/aerospace-engineering-facts-that-will-get-you-inspired-to-become-one>

<https://www.history.com/this-day-in-history/first-man-in-space>

<https://www.britannica.com/technology/aerospace-engineering>

<https://www.ucas.com/explore/subjects/aerospace-engineering>

<https://www.engineeringclicks.com/aircraft-design-process/>

**Special Credit to our Parents for setting up the interview and Professor Venkatachalam (Ph.D.) from the Amrita Institute in Coimbatore for patiently answering our questions**

# Image Citations:

<https://www.teslarati.com/spacex-us-military-study-rockets-cargo-delivery/>

Nihal's Iphone for pictures of the team

<https://kb.vex.com/hc/en-us/articles/360035591572-Selecting-a-VEX-IQ-Drivetrain> (2 pictures from this site)

<https://www.jpl.nasa.gov/edu/teach/resources/engineering-in-the-classroom.php>

<https://www.spacex.com/>

<https://kb.vex.com/hc/en-us/articles/360046678712-Get-Started-with-VEX-IQ>

<https://www.spacex.com/vehicles/starship/>