# TEAM 17152

# NASA

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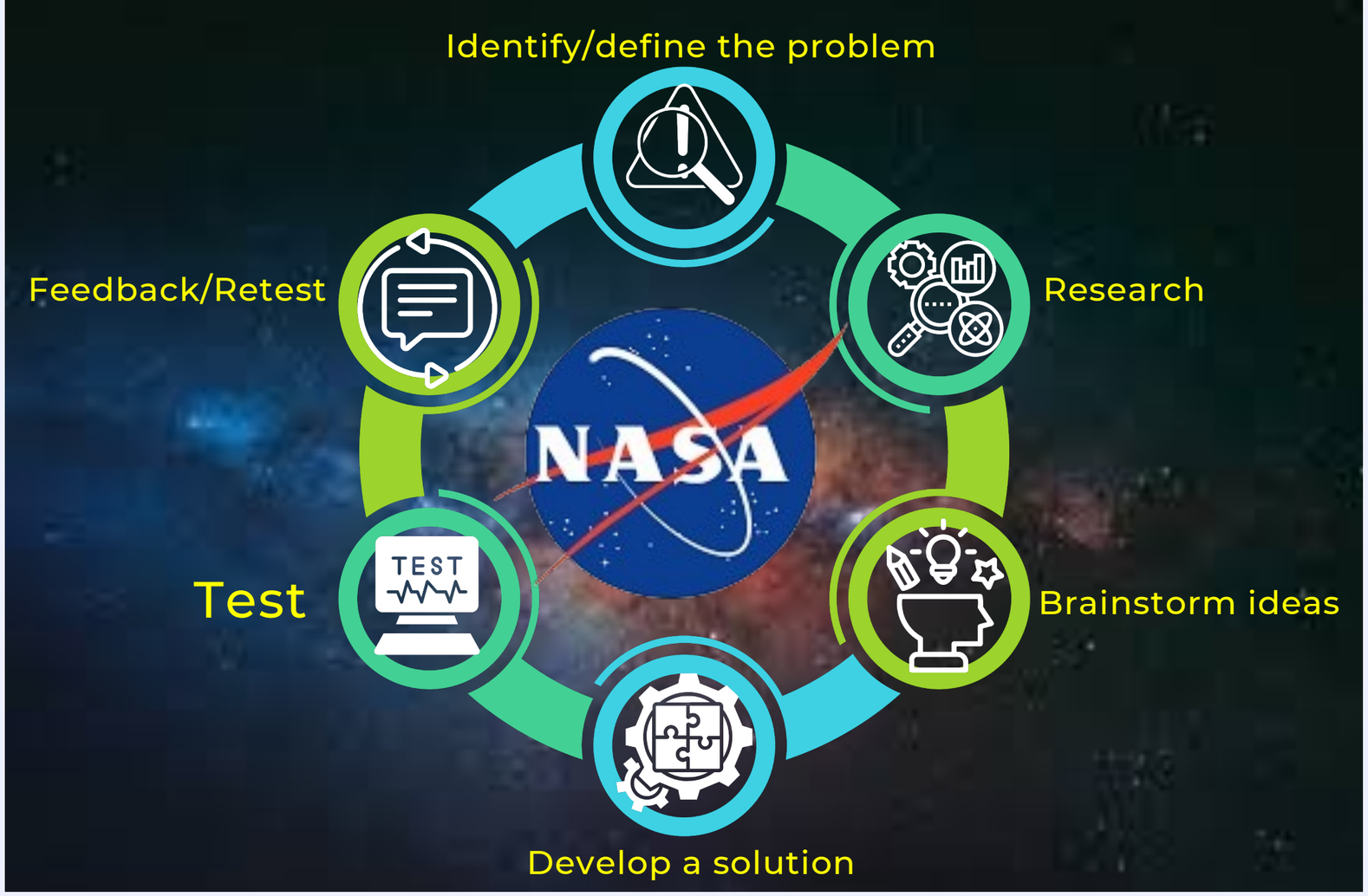
**In fact, NASA doesn't use the F-word; instead, they call failure early attempts at success**

*-Mike Myers*

# INTRODUCTION

NASA is revolutionizing space exploration with groundbreaking technology, revealing unprecedented possibilities for aerospace engineers. Explore NASA's design process through articles.

# WHY NASA?




NASA was chosen for 1715Z's engineering design project due to its commitment to thorough testing, risk reduction, enhanced technology performance, and effective communication.

NASA

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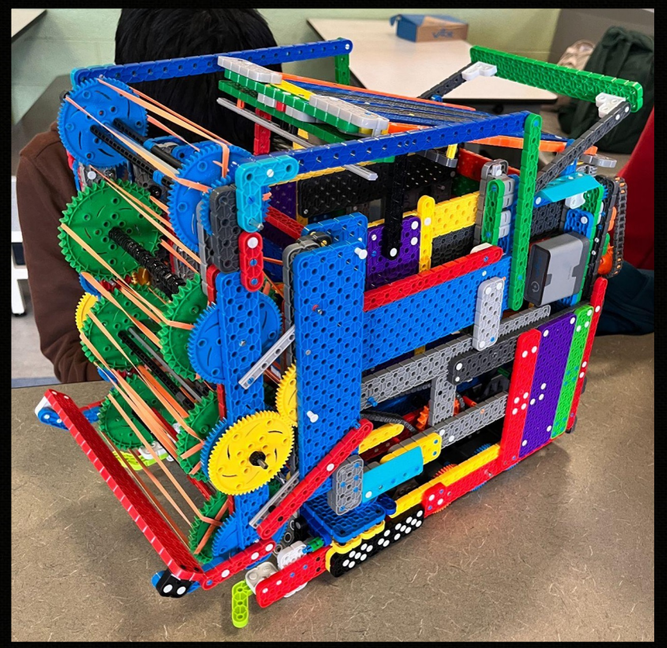
V.S



# Similarities and Differences

## Between NASA and VEX Robotics

# Define / Identify Problem

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NASA addresses problems by analyzing mission objectives, scientific goals, and technical challenges, collaborating with scientists, engineers, and stakeholders to define the mission's purpose and address necessary problems.


Workers at NASA looking at a problem

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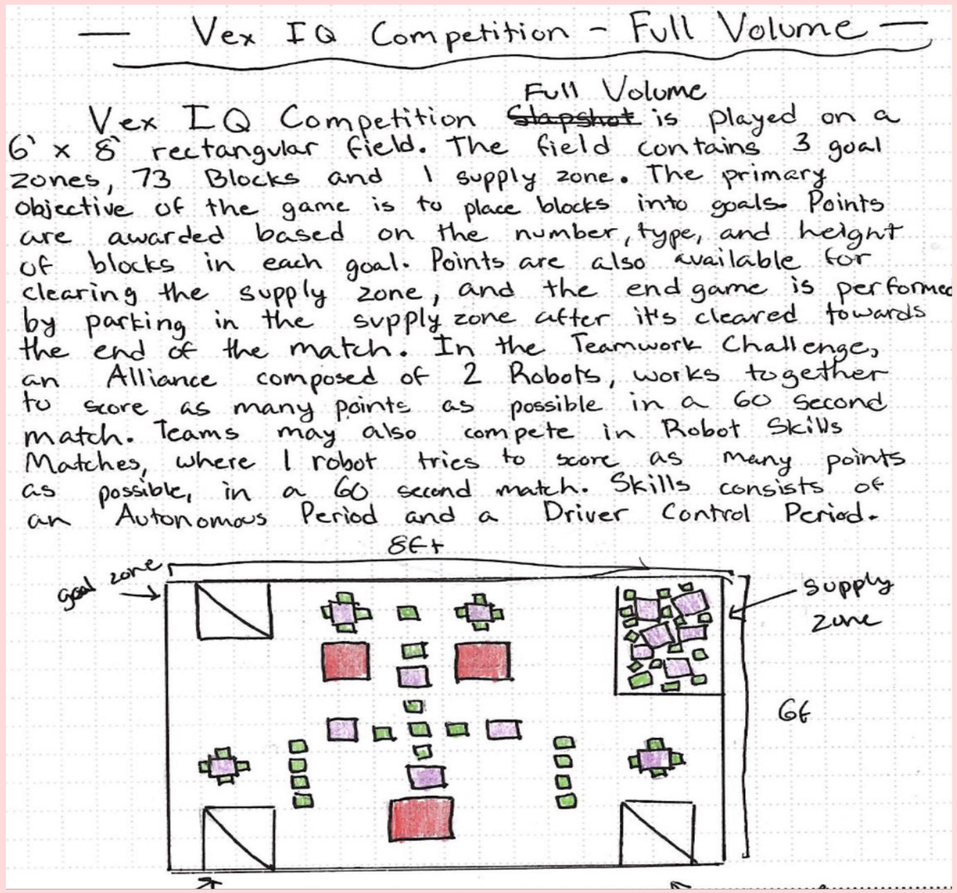
1715Z Notebook Page:



— Vex IQ Competition - Full Volume —

Full Volume

Vex IQ Competition ~~Slapshot~~ is played on a 6' x 8' rectangular field. The field contains 3 goal zones, 73 Blocks and 1 supply zone. The primary objective of the game is to place blocks into goals. Points are awarded based on the number, type, and height of blocks in each goal. Points are also available for clearing the supply zone, and the end game is performed by parking in the supply zone after it's cleared towards the end of the match. In the Teamwork Challenge, an Alliance composed of 2 Robots, works together to score as many points as possible in a 60 second match. Teams may also compete in Robot Skills Matches, where 1 robot trics to score as many points as possible, in a 60 second match. Skills consists of an Autonomous Period and a Driver Control Period.

8ft

goal zone

supply zone

6ft

A meeting is held to assess the objectives, needs, limitations, and assumptions of a new game, like NASA, and to break it down into its fundamental truths.

NASA

# Research

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The next stage will be to collect as much information as possible to ensure the best solution is created. This information can help later when creating a product/solution.

astronauts researching in space

NASA conducts a thorough research phase in the design process, gathering crucial information, understanding requirements, and aiding decision-making for subsequent design phases.

1715Z – Notebook page:

## Envisioning Drivetrain

### What is a Drivetrain

A drivetrain is the base of the robot on which the entire robot is built and it helps the robot move from one place to another.

### Goals for Drivetrain

1. Needs to fit in the size limit
2. Operate at fast speed
3. Four S: Strong, Stable, Sturdy and Secure
4. It should hold its own weight along with the added blocks
5. Compatible with Autonomous; meaning that going forward and backward is straight
6. Should be able to access parking zone
7. Should not drift

### Note

Our team was very quick enough to build the first prototype of the drivetrain in a week after VEX IQ Full Volume revealed the game. We did this while talking and dismantling our previous robot. It was fun! Vikrant used the learnings from the previous failures of drifting drive train and built the first prototype with secured omni wheels and 3:2 gear ratio.

We drew inspiration from past robotic games, identifying rules and limits, and exploring various solutions to understand and proceed with the design process.

# Brainstorm Ideas

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After analyzing the information acquired during this research process you can start to brainstorm ideas. Brainstorming can begin in the form of sketches and such to help visualize what the final design options can/will be.

engineers at NASA brainstorming a solution for Apollo 11

NASA uses a brainstorming approach, involving scientists and engineers, to generate innovative ideas for mission objectives and challenges, fostering innovation and selecting viable design concepts for further development.

1715Z – Notebook page:

## Designing - Phase Drive

**Identifying Problem**

How are we supposed to go into the supply zone to get cubes and how do we park?

**Brainstorming/Research:**

There are many different ways to solve these problems, here are some of the ways we thought of.

1. Making the bot lightweight, have strong torque, and adding ramps to try and go over the supply zone.

- This was one of the first ideas we came up with. Our robot is essentially going to climb over the bar and get into the supply zone.

1. Making the bot being able to slice through the bar (adding a hole into our robot for the bar to slide into).

- While brainstorming we essentially thought of this when relating to arts and crafts. When putting two pieces of cardboard together you make a cut in both, and then you wedge those pieces together to connect them.

The team will conduct a meeting comparing their research to NASA's, examining various solutions without judgment, and willing to experiment with multiple designs due to cost-effectiveness.

# Develop A Solution

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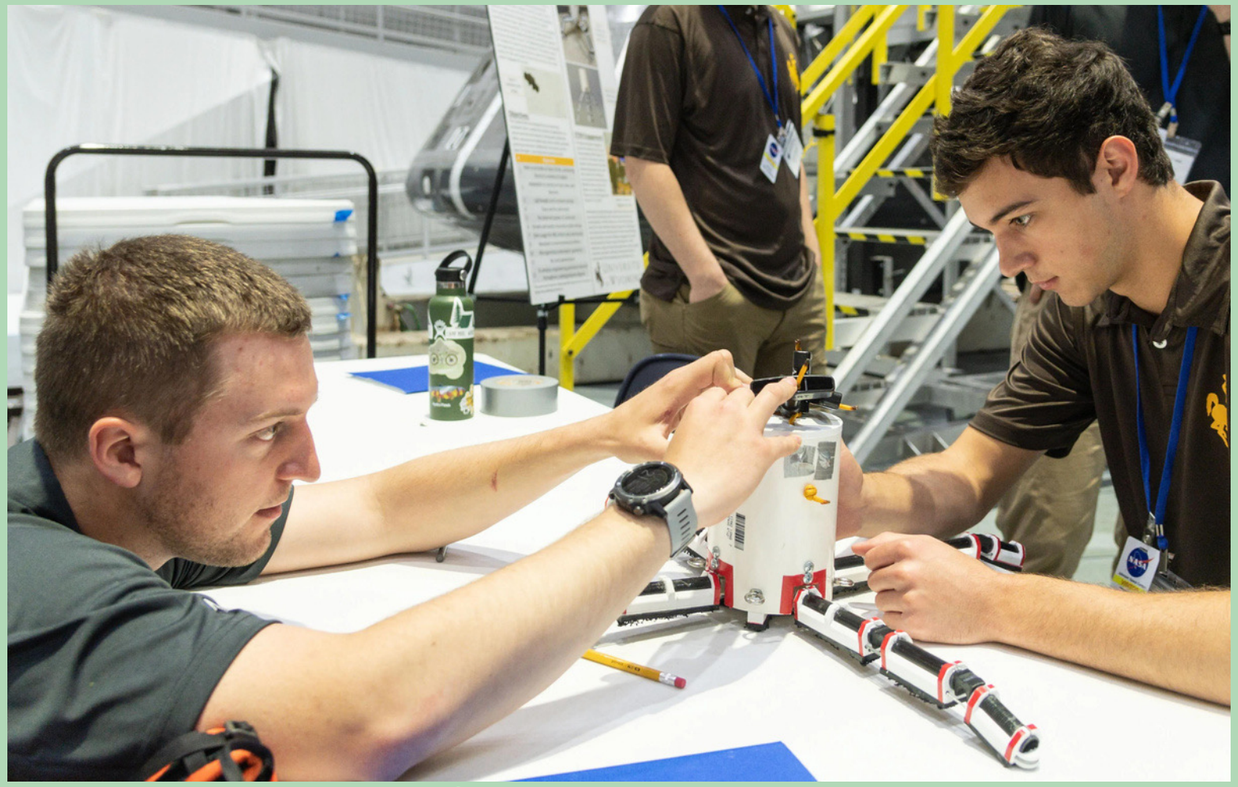
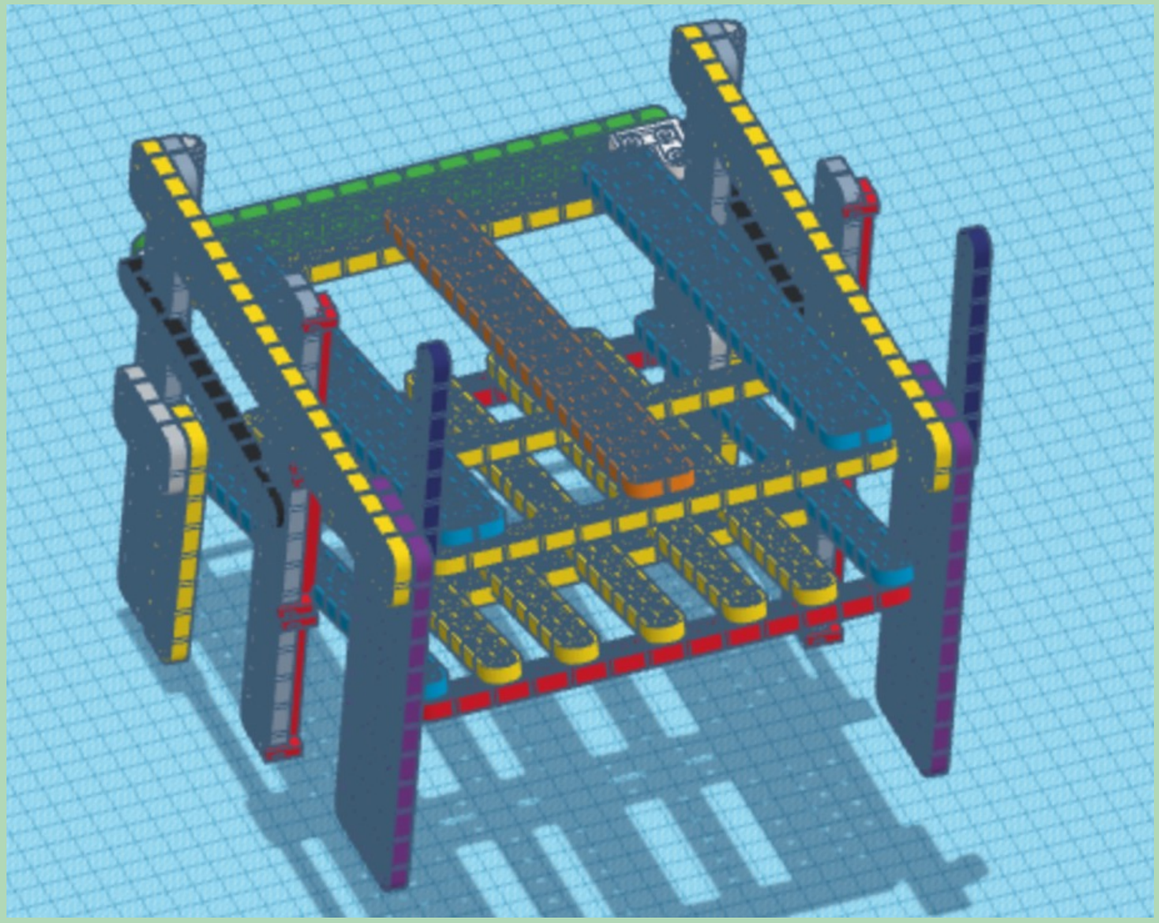
The next step is to develop initial ideas further until a viable solution can be selected. From which small-scale models and prototypes can be built to represent the real idea.



engineers create a prototype

NASA employs this step to create detailed designs and plans for selected mission concepts, focusing on refining the chosen solution for mission objectives and safety.

CAD model:



1715Z is diligently using a prototype using Tinkercad software, to develop a solution to a problem on our robot.

# Test

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In the "Test" step of the design process, you check if your solution works as intended through experiments or trials. This helps identify and fix any issues before finalizing the design.

Engineers test ER dynamics

NASA uses "Test" steps to ensure the reliability and readiness of spacecraft and technologies, conducting experiments and trials to identify and fix issues before deployment.

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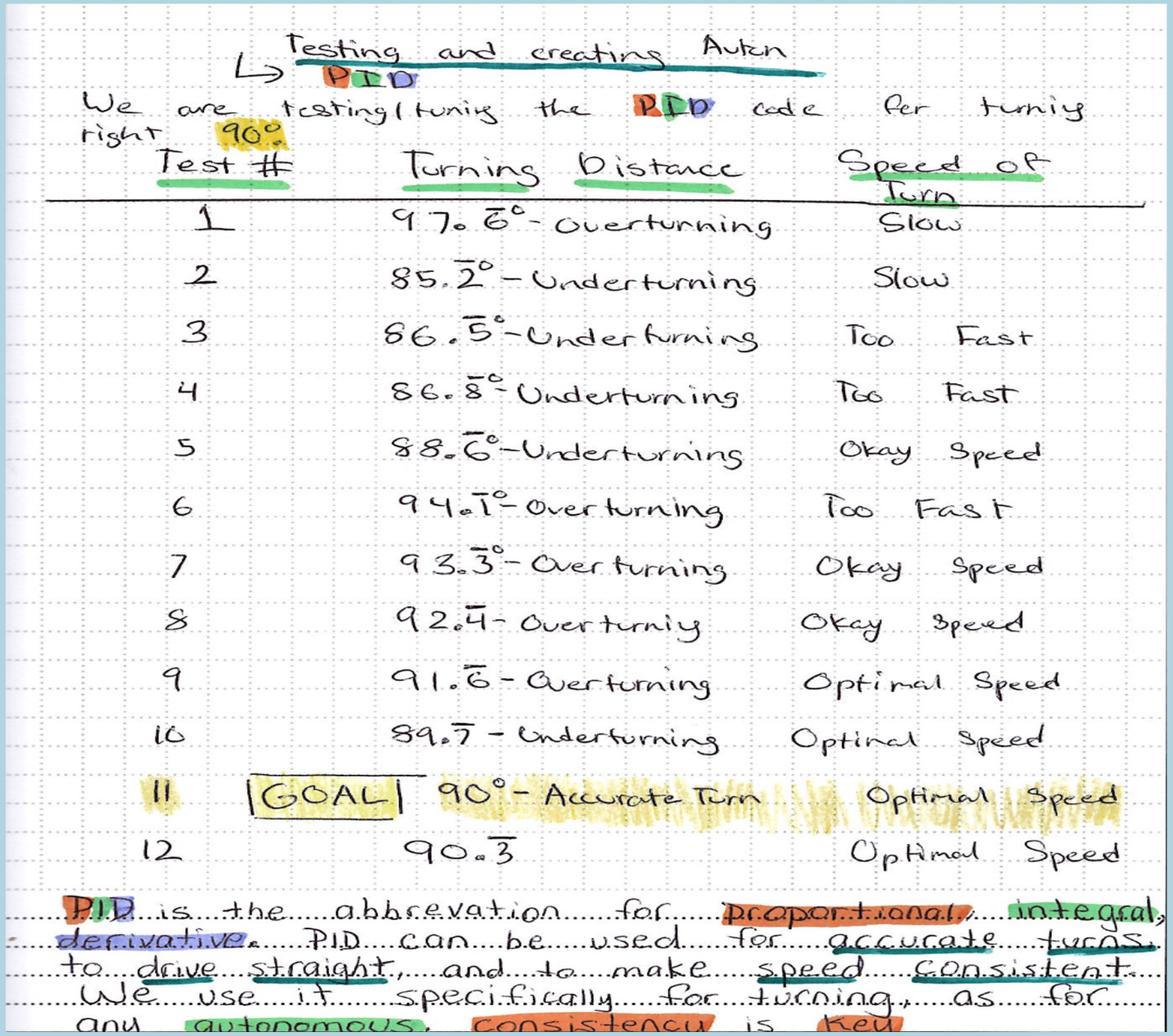

Testing and creating Auton
PID
We are testing/tuning the PID code for turning right 90°.

| Test # | Turning Distance | Speed of Turn |
|---|---|---|
| 1 | 97.6° - Overturning | Slow |
| 2 | 85.2° - Underturning | Slow |
| 3 | 86.5° - Underturning | Too Fast |
| 4 | 86.8° - Underturning | Too Fast |
| 5 | 88.6° - Underturning | Okay Speed |
| 6 | 94.1° - Overturning | Too Fast |
| 7 | 93.3° - Overturning | Okay Speed |
| 8 | 92.4 - Overturnig | Okay Speed |
| 9 | 91.6 - Overturning | Optimal Speed |
| 10 | 89.7 - Underturning | Optimal Speed |
| 11 | GOAL 90° - Accurate Turn | Optimal Speed |
| 12 | 90.3 | Optimal Speed |

PID is the abbrevation for proportional, integral, derivative. PID can be used for accurate turns to drive straight, and to make speed consistent. We use it specifically for turning, as for any autonomous, consistency is key.

The prototype is attached to the robot, motors are connected to the brain, code is created, and tests are conducted to identify necessary changes.

# Feedback/Retest

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In the "Feedback/Retest" step of the design process, you use information from testing to make improvements and refinements to your solution. It's a cycle of testing, gathering feedback,

Engineer’s point out feedback for a shuttle

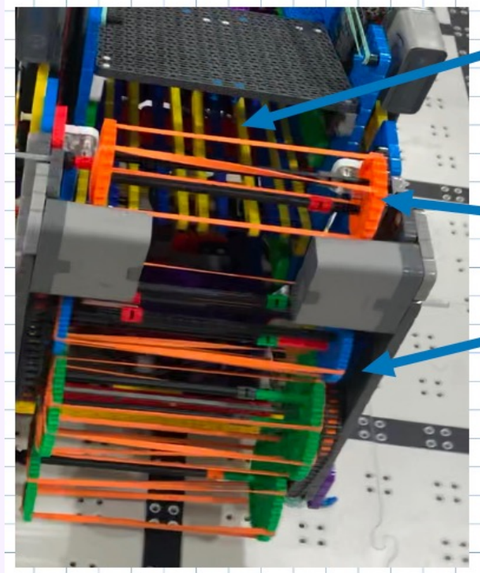
NASA employs the "Retest/Feedback" method to continuously enhance spacecraft and technologies by gathering feedback, analyzing data, and refining designs to improve mission success.

1715Z – Notebook page:

## Block Intake- Barrel Intake V1

**Problem Statement**

When testing out our robot to prepare for the competition, we noticed that our intake was very uneven and bending a lot due to the rubber bands on the wall which is used to bring the cubes into the lift.



There is a missing rubber band that is needed on the wall. And there is unevenness and bending.

The cubes kept jamming in this area

Gear ratio placement is unorganized

**Solution**

To fix these problems we are going to rebuild our intake mechanism to solve unevenness, bending and improper gear ratio.

After testing a mechanism, we record any changes or problems in our notebook, identifying areas for improvement and restarting the design process.

# HOW WILL VEX BENEFIT OUR FUTURE?

## Learn Technical Skills:

You'll gain hands-on experience in building and programming robots, boosting your skills in engineering, mechanics, and electronics.

## Enhance Problem-Solving:

The skill of solving problems effectively in robot design is a valuable skill applicable in various aspects of life.

## Develop Teamwork:

VEX Robotics promotes teamwork, enhancing collaboration and communication skills among its employees.

## Prepare for STEM Careers:

VEX Robotics equips individuals with practical skills and knowledge, preparing them for success in various science, technology, engineering, or math-related careers.

# REFERENCES


Website citations:
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