VEX Online Challenge: Career Readiness

Aerospace Engineers

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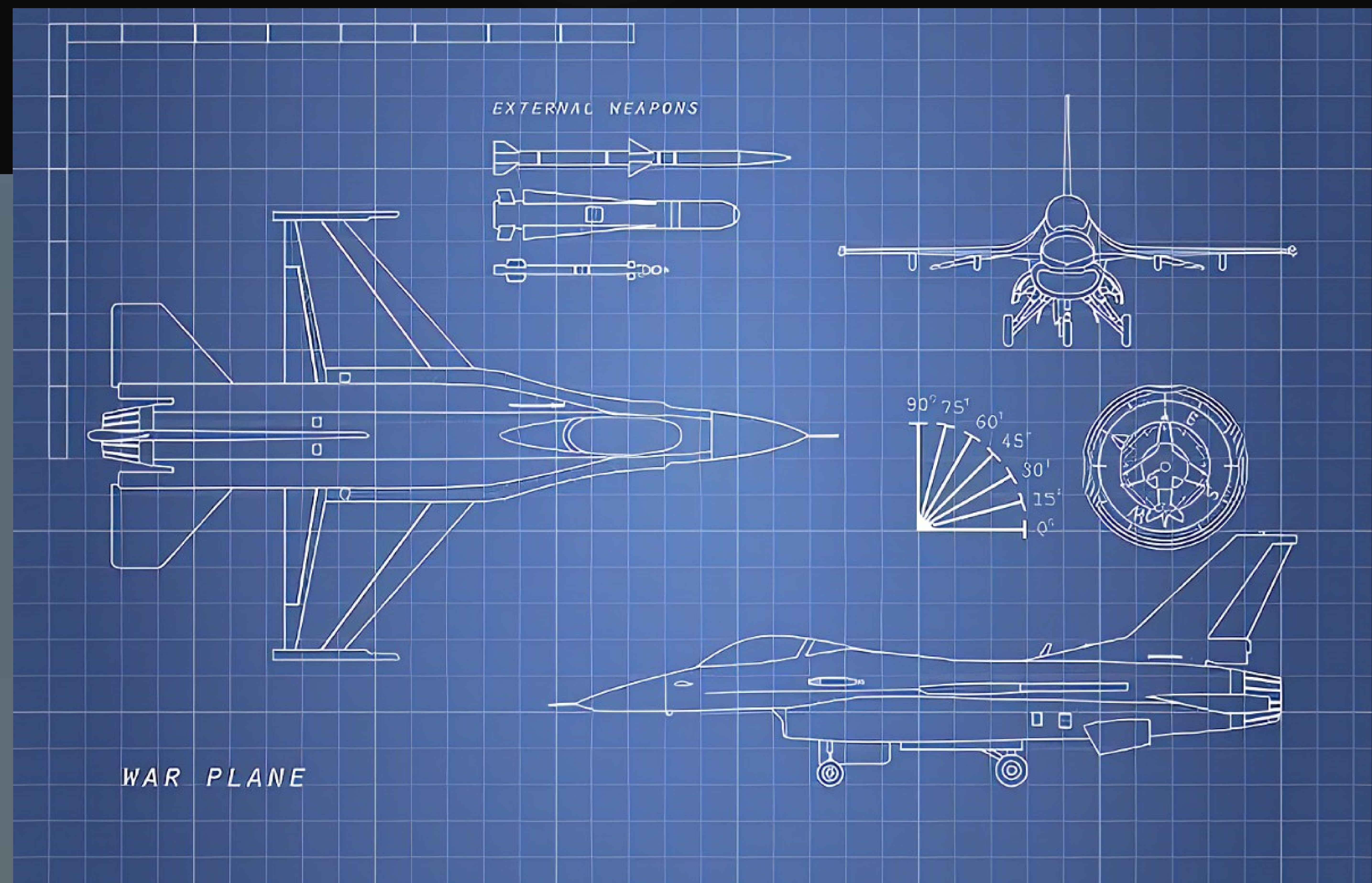


An often overlooked part of aerospace engineering is the design process such as the blueprint above, essential before the actual product can be made, such as the rocket to the left.

What is Aerospace Engineering?

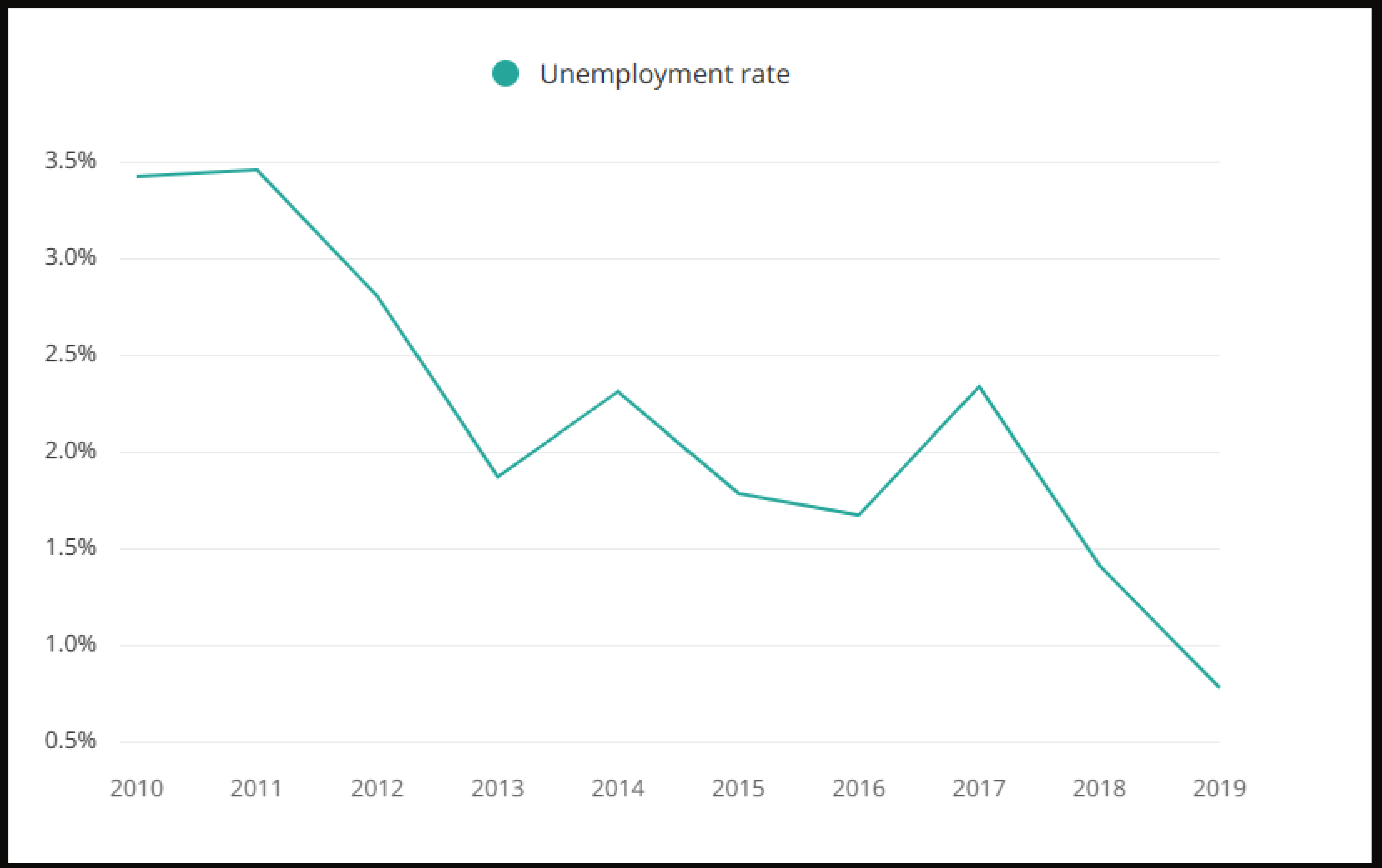
Aerospace engineering involves designing, manufacturing, and repairing spacecraft, aircraft, missiles, and other man-made machines designed to be airborne or made to be sent beyond our planet. There are two types of aerospace engineers: aeronautical engineers (who work with aircraft) and astronautical engineers (who work with spacecraft). For example, the satellites, that orbit our planet to give us information on the weather, all involve aerospace engineering. STEM is used prominently to design these vehicles. For instance, STEM is used in deciding what shape a rocket should be (e.g. it must be aerodynamic and slim to prevent air resistance).

Why this STEM career?

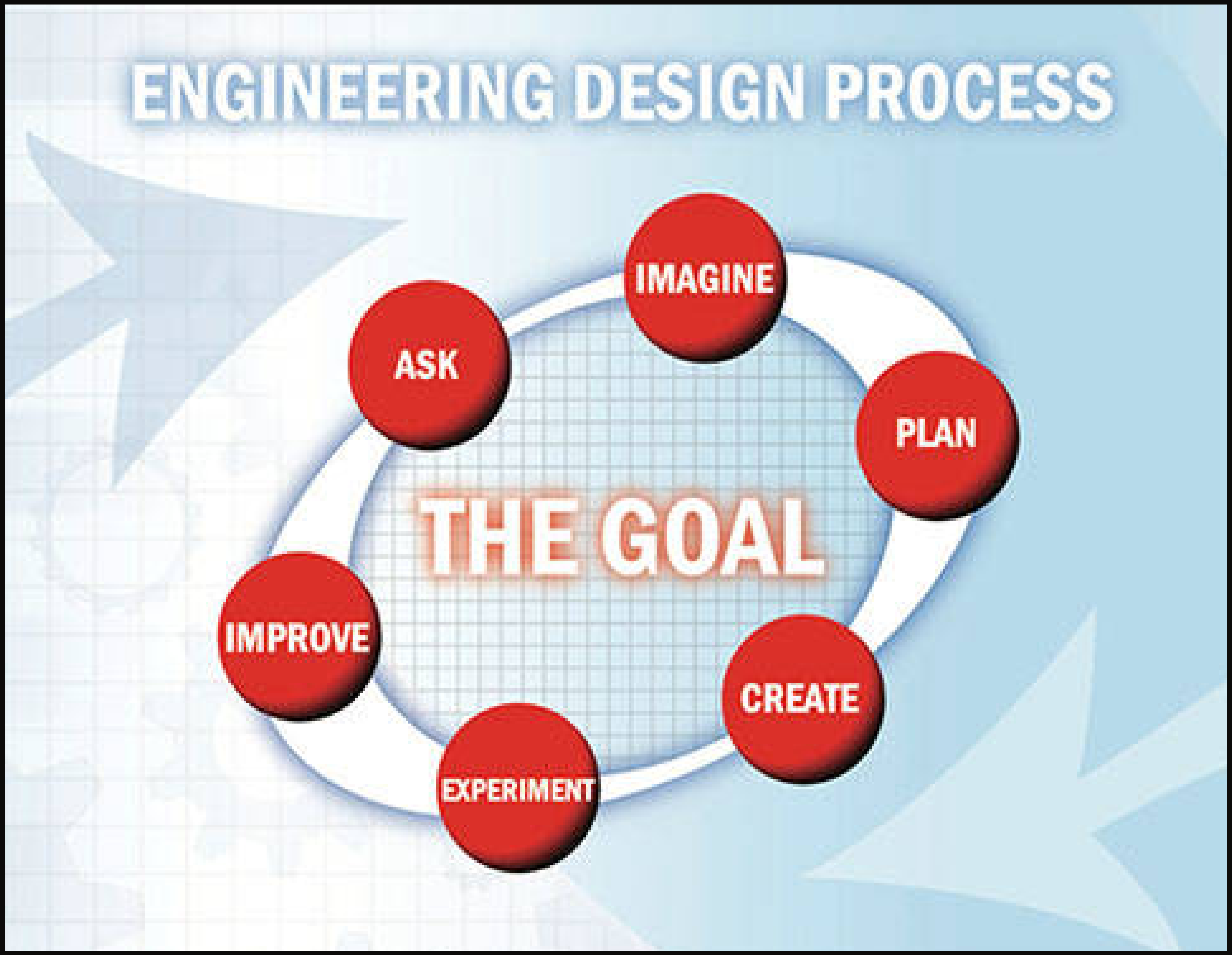
This submission will focus on astronautical engineering due to its increasing popularity and the potential it has in the future. I have also chosen to write about this career because of how interesting astronautical engineering is. Particular emphasis will be given to designing a spacecraft, where many skills used there can be found when participating in VEX. We will also talk more about NASA because it is one of the most famous aerospace engineering agencies.

Left: NASA engineers in mission control, ensuring the safety of the Apollo 13 operation

Right: A graph showing the unemployment rates of aerospace engineers. The general trend shows that more engineers are being hired, meaning the unemployment rate will generally go down.



NASA's Design Process



The first part in NASA's design process is the "Ask" stage, where a set of requirements are laid out that will later be followed in the build process. These involve design specifications and briefs but it isn't until the "Imagine" stage where ideas are brainstormed. Sometimes inspiration can be drawn from previous projects. The "Plan" stage involves 2 to 3 designs being sketched out before a final design is chosen to be built. The create stage involves a model being built and finally the real product. The "Experiment" stage involves testing the product and analysing what could be better. Advantages and disadvantages are listed and move onto the "Improve" stage. The process is not linear, so after improvements are made, NASA would then return to the "Ask" stage.

Similarities and Differences between our design process and NASA's design process

Similarities

- NASA engineering involves lots of experimenting to see if a machine will work or not. Our design process is also similar because we too use lots of testing to see, for instance, which kind of drivetrain would be best for our robot.

- NASA has a stage in its design process where engineers brainstorm ideas and create several initial designs. We also did this and, like NASA, eventually settled on a final design that we would build and test.

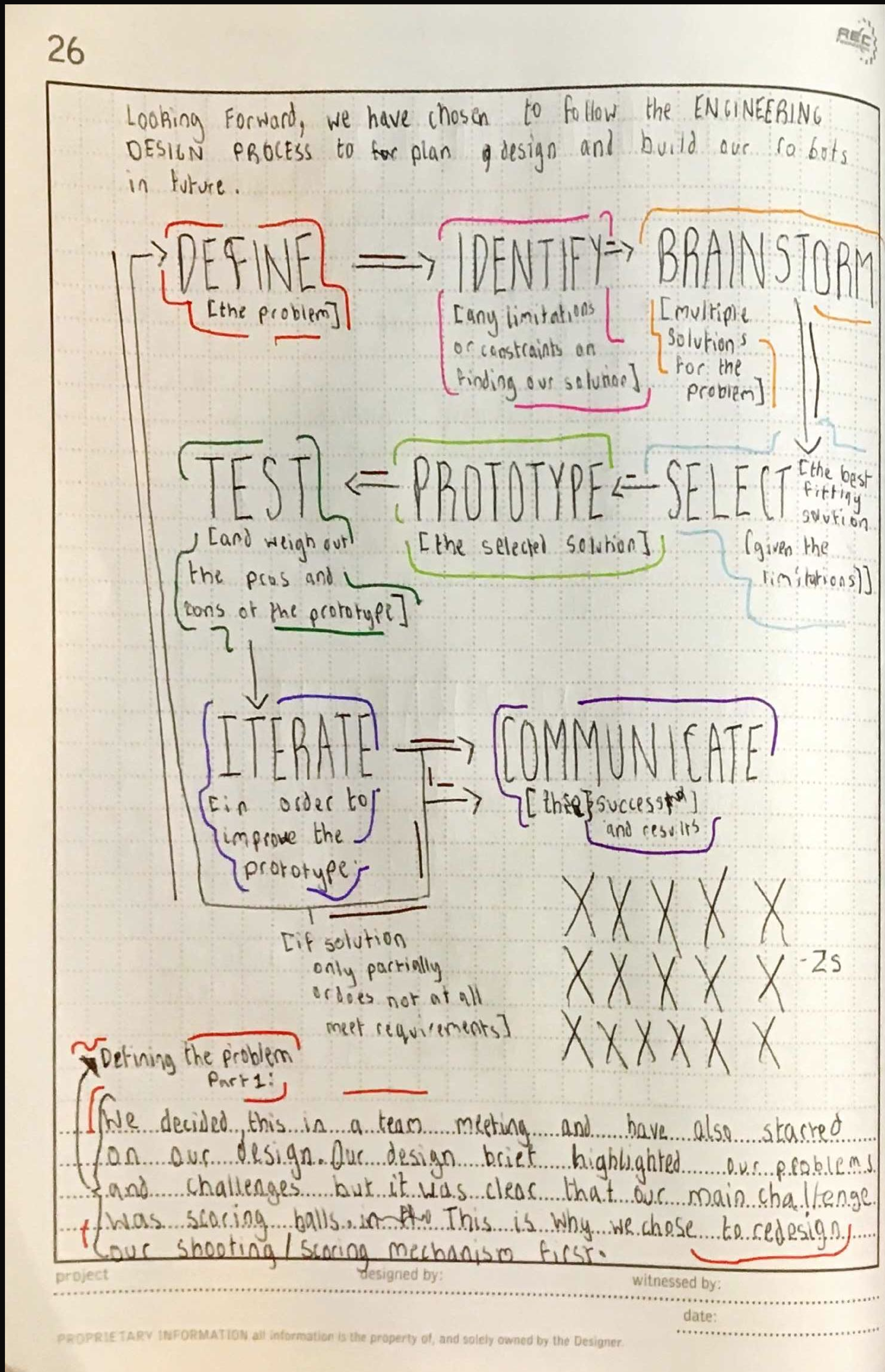
- Similar to NASA's design process, our's is not linear so we are constantly changing ideas. Once, we even scrapped our whole idea because it didn't work efficiently. We constantly make improvements in order for our robot to fit the specifications from the beginning and for it to be more accurate in what it does.

Differences

- Testing NASA equipment involves more care because the materials needed to build these products are expensive and sometimes are irreplaceable. However, our experimenting stage can be more flexible and require less thought since VEX parts can be constantly reused.

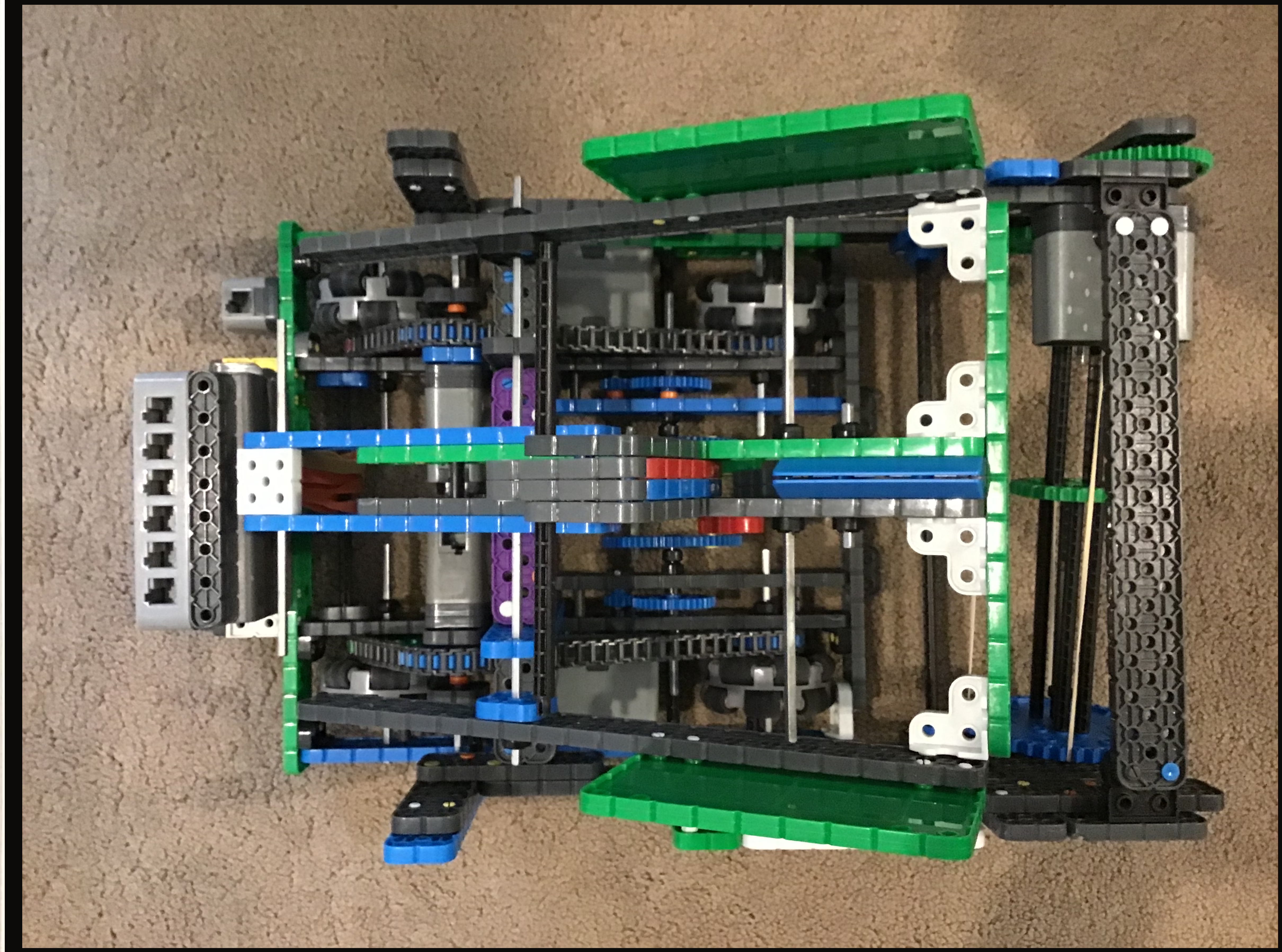
- Unlike NASA design process, we spent less time writing out our design brief and specifications since it was simple and straightforward. However, NASA engineers must spend plenty of time on specifications because it lays out the essentials to a spacecraft, and if missing, could have devastating consequences.

- NASA makes several studies before designing something to make it as accurate and safe as possible. However, we did not conduct any studies, although we did make plenty of research to ensure our robot was as efficient as possible.



Left: Our Design Process in theory

Below: Our design process in practice. Although we have made many improvements, there are still some parts that are left unaddressed such as the stiffness of the catapult mechanism. Some parts have not been through the entire design process either, since the catapult mechanism idea wasn't thought up by our team.



How does VEX prepare me for a future career in astronautical engineering?

Creativity

VEX helps me think creatively to fix problems. For example, our team used rubber bands to increase the tension on the catapult, allowing for more upwards force when the catapult is released. A big reason why creativity is useful in, not just astronautical engineering, but engineering in general, is because many problems arise during a project and most of the time, the problem has not been seen before. In order to solve this problem, engineers need to be creative because they cannot just copy someone's solution from the past.

Teamwork

VEX taught us a lot about teamwork and how to settle disagreements. Often we disagreed on how the robot should be built but overtime we have learnt how to settle these. I believe that developing teamwork skills early on is very important because in the future, there will likely be bigger disagreements than just what kind of gear ratio to use.

Organisation

Just after joining VEX, none of the team was very organised, leading to many of our parts going missing and progress being much slower compared to more organised teams. This is much more serious in the real world of astronautical engineering because parts are expensive to replace in making spacecraft. Luckily, we have since learnt to be more organised, meaning we can progress faster

Bibliography

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