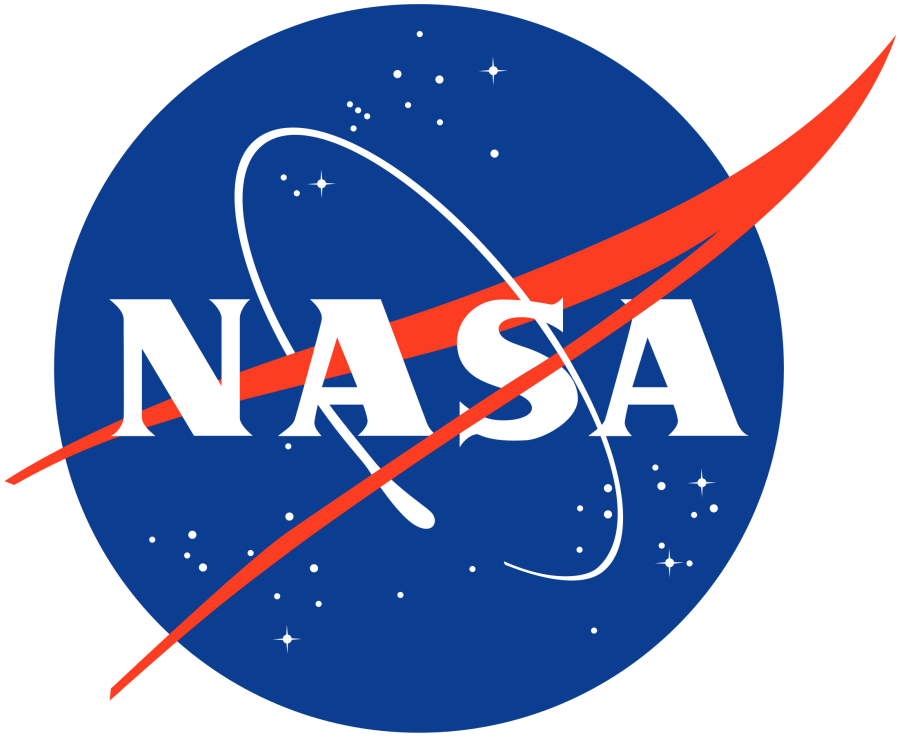
Career Readiness
(Team 98000A)

NASA's Engineering Design process



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Ask to Identify Needs and Constraints

- In Vex Robotics we are given constraints, we have a height constraint, a length constraint, and a width constraint. To meet these constraints we needed to figure out first what we had to have for our robot to be at least somewhat productive when it came to point scoring. Then we had to take that and come up with how we could implement it into a legal, possible robot. When NASA is figuring out what they have to do to make Mars liveable they have to think, “how can we get a good amount of oxygen for outer astronauts?” Their answer was MOXIE. When the question “How can we protect our astronauts from space radiation?”, they came up with one possible solution for the problem, hydrogenated BNNTs otherwise known as Hydrogenated boron nitride nanotubes NASA says that these are “… Tiny nanotubes made of carbon, boron, and nitrogen, with hydrogen interspersed throughout the empty spaces left in between the tubes. Boron is also an excellent absorber of secondary neutrons, making hydrogenated BNNTs an ideal shielding material.”. Couldn’t have said it better myself.

Research The Problem/Solution

- When NASA is researching a problem they first ask what the problem actually is, for example how can they create breathable air on mars, they also need to do research on the topic and ask other scientists from around the globe for their input. They have tested many many prototypes and they have asked countless times the same question, how is this

possible and they have created a system called MOXIE, that can extract little oxygen particles out of the air and it will turn the mostly CO2 atmosphere into a breathable healthy environment for astronauts to live and thrive in. Now for us when we are coming up with a solution for a problem we first ask what the problem is, we then go forward and ask how the problem can be solved and what we need to actually solve it. For example when my team was looking for solutions for our ball intake we all put our heads together, did research and found that extending the intake would ultimately benefit us the most, and we tested and tested and finally found our solution.

Plan And Create A Solid Idea Of The Solution

- One of the many ways NASA plans their prototypes is by going through and talking first discussing again what they need to be successful, then they will draw or sketch three or more ideas and they will go over facts, they will pick which one that makes the most sense and they will plan their prototype. Like their mission to mars us students do the same thing we get together as a group and we go over the facts, what we need, what we want, and ultimately what's going to work the best then we draw and plan the prototype, figuring out what pieces we are going to need and what pieces are going to work and not work is crucial to the success of a build, and more often than not this is the best time for the most sketches and prototypes, because you really want your creation to work and there is no such thing

as a perfect build so you are constantly working and improving, adding and taking away.

Creating The Prototype To Your Needs And Wants

- When we are creating a prototype or model we first need to build something that works, and that is within restraints and restrictions. For example when we were creating our robot to be able to go under the bar to be able to clear both chorales we needed to figure out how to still make it functional and capable. NASA has to take these things in to consideration too while creating a prototype or model because if they are sending something into space it needs to be a certain weight and it needs to be a certain size to where it will be effective and not take that much effort to be set up and used on the field, but creations never are set in stone they are always changing and being updated and that is just the way things roll.

Build and Test Prototypes:

- One prototype NASA is currently working on are deep space habitats, there are 5 unique prototypes and nasa will conduct a series of ground tests in them. 5 different companies have made prototypes for NASA to test. The testing will show NASA engineers and technicians the habitat systems' capabilities and performances proposed of each prototype and human factors teams will consider the layout and efficiency of each design figuring out what will and will not work with each design. For us when we are building and

testing prototypes we build different examples and we test and we write down the results and discuss the ups and downs of the creation, for example when we were engineering our flywheel we all had different ideas and we all drew and then built them and we decided which would work the best.

Improve and Redesign as Needed

- Our team while building our flywheel were having problems with consistency when actually shooting the ball into the high goal. So we went and took a closer look. At one point one of us was taking a slow motion video of the flywheel flinging the ball multiple times using that data to find out what was hindering the flywheel and what we could do to improve/fix it. In NASA's definition of improvement in the engineering design process they say that students should make improvements upon their design based on the results of tests, and identify changes they will make and justify revisions for the design. There's always a way to improve a design and make anything better. You need to use the engineering design process to figure it all out.