

STEM Career in Materials Engineering

Team Number: 1715K

Team Name: Krypto Knights

Location: Hopkinton, Massachusetts, USA

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Entire Team

STEM Career

We interviewed someone who has a career at Commonwealth fusions systems, working as a materials engineer. The person we interviewed has a background in Masters in Materials Engineering. The acquaintance is working on a device called Sprac. Sprac is a fusion device that produces clean energy that works on the principle of Nuclear Fusion. Nuclear Fusion has been active for more than 100 years but no one has not been able to produce positive energy from it. The Commonwealth fusions system aims to harness positive energy by using sprac and prove that it can be handled. Their project is still a work in progress as they are still in the design stage. The main reasons why we chose this profession is because:

1. A close acquaintance works at the Commonwealth Fusion System and has been mentoring us toward the engineering design process.
2. The company branched out from MIT. The complete form of MIT is the Massachusetts Institute of Technology. This is one of the most prestigious colleges in the entire world for people who want to pursue engineering as their profession.
3. Their goal is to become the first company to harness the positive energy that can be properly handled.



Commonwealth Fusion Systems

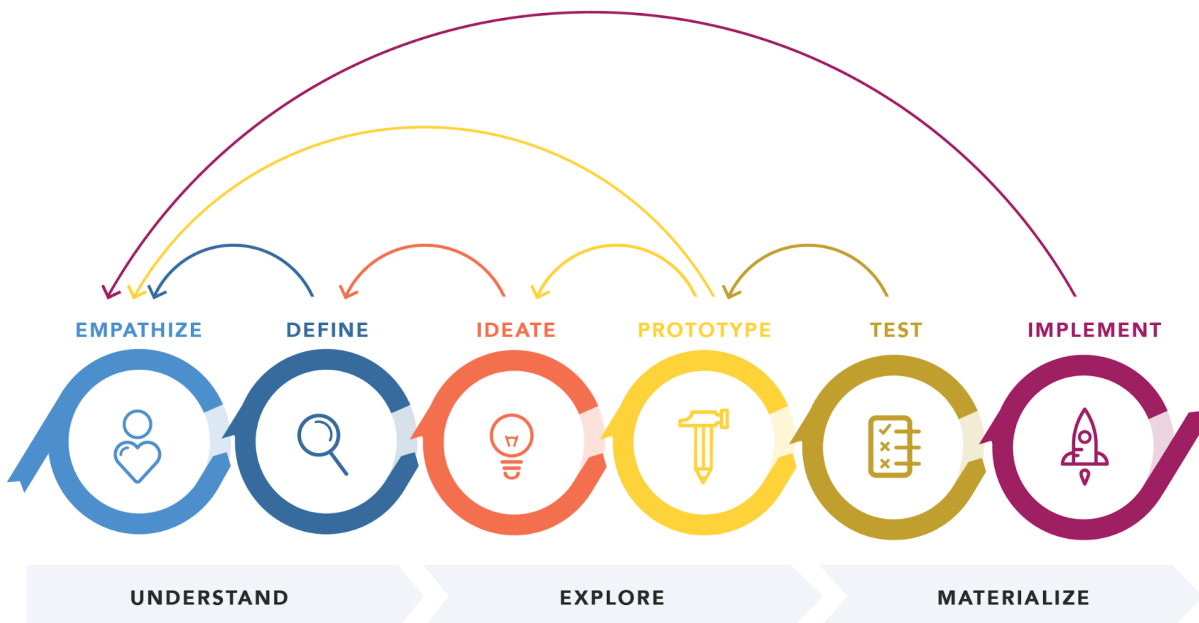
Engineering Design Process:

We interviewed professionals in this company to learn about the Materials Engineering profession in nuclear fusion companies and what the differences are between the design process that they followed and the design process we followed. We learnt that design engineers have used a standardized design process and document the process flow. They used the combination of following steps and adjusted accordingly to the nature of work:

1. They first start off with the designers taking a nuclear fusion device that has already been scientifically proven to be the most feasible design that can be worked for a fusion device. The designer then uses CAD and other designing software to plan what they are going to build.
2. After coming up with a nuclear fusion machine design that is proven to be effective, the designers take the design and modify it accordingly so that it can produce positive energy. The basic fusion machine design would have multiple components. The first component is Vacuum vessel inside which the fusion reaction takes place. Then there are four different types of magnets that are outside of the device which helps to confine the reaction in that space. So after coming up with a basic design then development process would be split apart to build certain components for the Device. An Example includes Group A works on the overall outer shell, Group B would build different magnets, Group C would work on the Cryo State which will make the magnets stay cool, and Group D will build the Vacuum vessel. After that there will be a group of Physicists who would inspect and approve the fusion machine components for the next steps.
3. After they are done building the device components the quality check engineers and developers would test the device components to see if it passes or fails. If they fail then they would restart their process and try to identify the problem and understand the issue. The need could be tweaking some of the components for the existing design. That's when the materials engineer comes in. They give suggestions on what type of materials to use so that the structure could be strong and can't be broken. They typically follow the following steps to identify the problem and how to solve it.

1. What is the problem?
2. Which component had problems?
3. Why are the components having this problem?
4. How to solve the problem?

4. Finally after identifying the problem and rectifying it, they repeat all the tasks that were done before and make modifications to the device components so that they work properly and become successful.



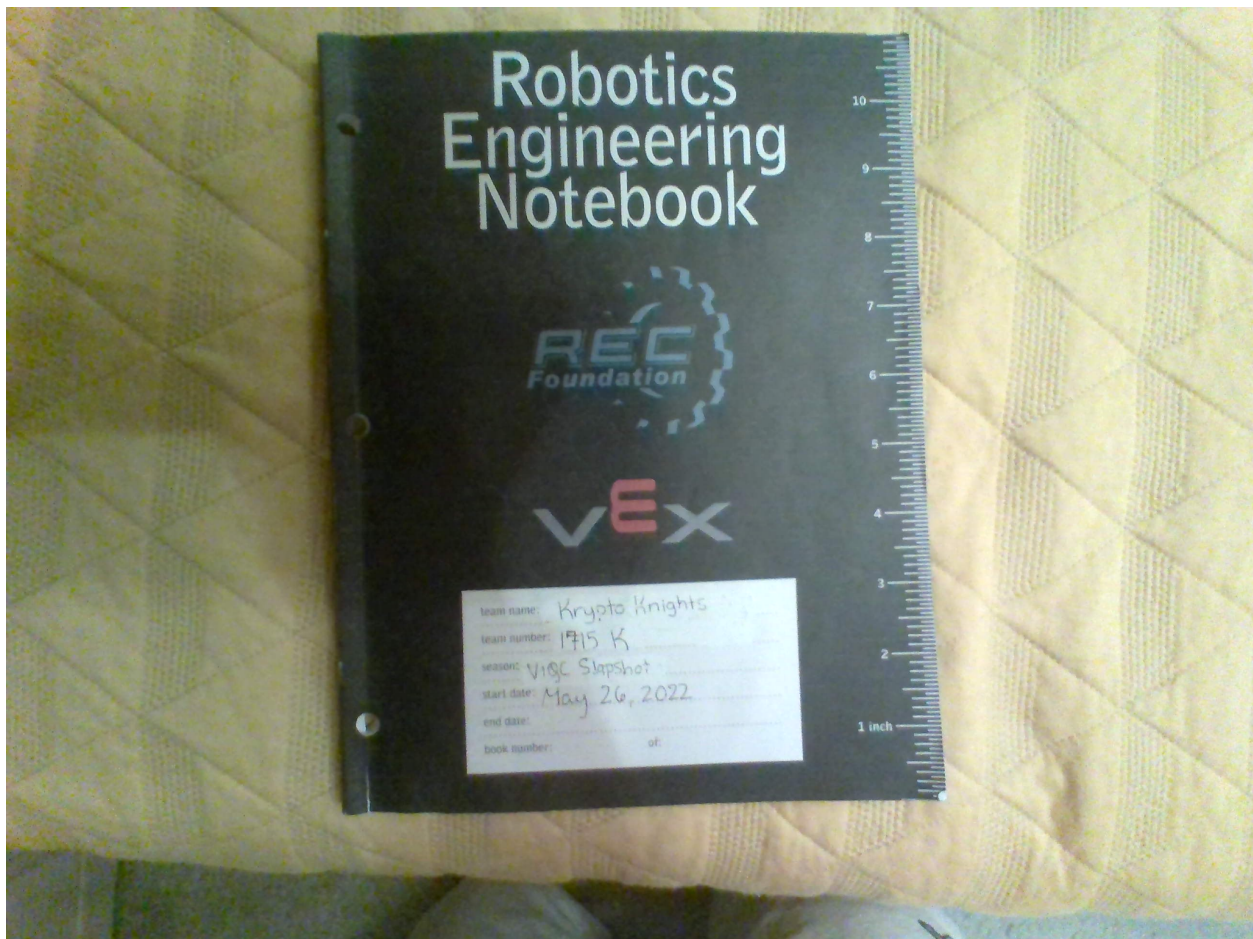
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CommonWealth Fusion Systems Design Process

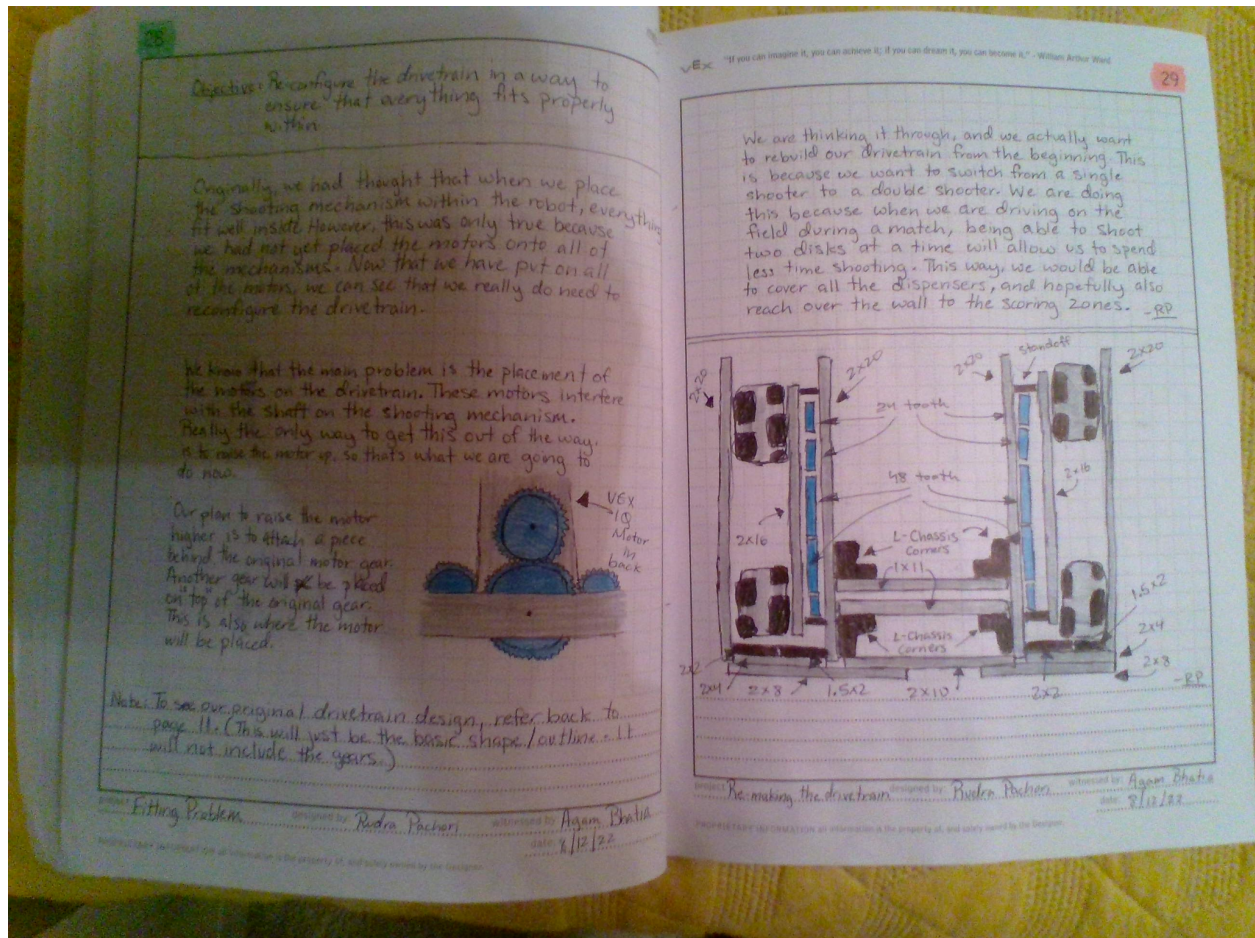
Our Engineering Design Process

We first approached designing our robot by watching the game video and seeing how the game functions and how to get the maximum amount of points. Then we studied all the rules, regulations, and requirements of the game by using the VEX IQ Slapshot game manual to understand the constraints like the objects that are there on the field and what type of interaction are allowed.

During the first meeting of the season, the whole team brainstormed on designs that can be used for the construction of our robot. We look for designs that are effective in scoring consistently, how difficult it is to build and how long the construction process will take. We make sure to document all of our ideas in our Engineering Design Notebook for reference if we face any problems in the future.



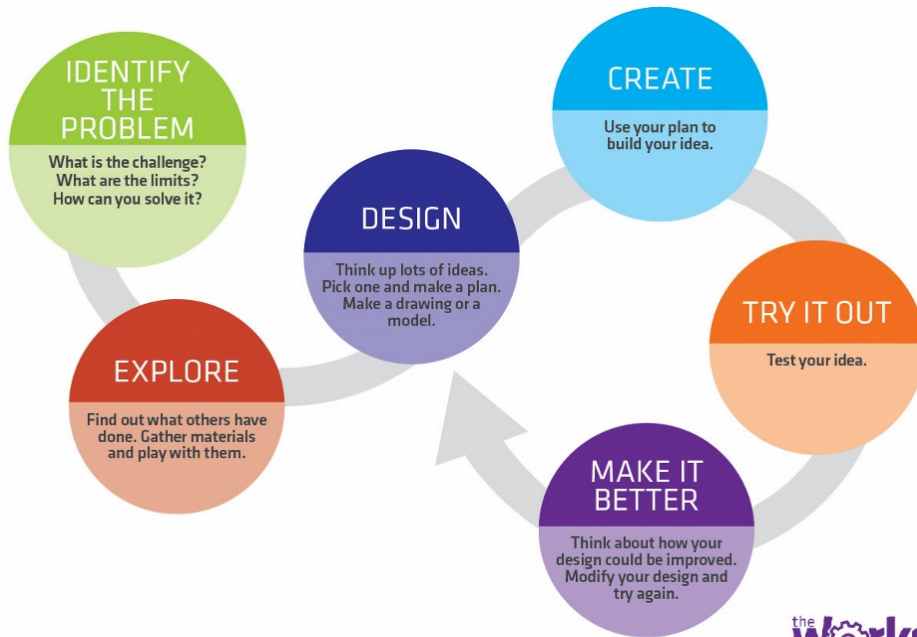
As we make noticeable progress with the building design, we capture the drawings of our design, and document what worked and what did not work in our engineering design notebook.



We also started to understand various engineering principles and terms which we use for our robot to be functional, fluid, and durable. Some examples include gear ratio, torque ratio, control system, manipulators, drivetrain, and sensors. We watch videos on these concepts to see why they are used, and we try to figure out how we can use it in our robot. The pros and cons of using each principle on our robot furthermore understand these various engineering terms and principles, so that we can use these in the future.

Our first competition of the season went very well. Even though we won the Teamwork Award, First Place, and qualified for the Regional championship, there were a lot of changes that needed to be made so that the robot could be at its peak form. So, we went back to our drawing board and redesigned the current mechanisms that were not constituent at our previous competition. During our redesign process, we looked back at the previous ideas that we considered and documented originally in our Engineering Design Notebook.

ENGINEERING DESIGN PROCESS



Engineers use the Design Process to create something new or make something better.



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1715K Krypto Knights Engineering Design Process

VEX Robotics Prepares Yourself for the Future:

In conclusion, we tried to relate the engineering design process used by the engineers and designers in a company with the design process that we use for the construction of our robot. In general, the engineering and design process is commonly used a lot by engineers which is more advanced and complicated than what we are using for our robot design. We gladly say that VEX Robotics can prepare for the future because, not only does it help an individual to improve his or her core subjects in Math and Science, but it can also help us with communication skills, teamwork and opens up many more opportunities that gives an individual a taste for future careers, which one might pursue. Despite using only one example that uses the engineering and design process, there are still tens and thousands of companies that use the engineering design process in some form or another. They might use different ways or steps on how they approach the engineering design process, but still have some connections. One of our team members' aspiration is to become a surgeon and VEX will allow them to give themselves a head start, not only in this branch of career but so many more. We found that many people apply for jobs that use the Engineering and Design process in areas such as biomedical engineering, mechanical engineering, Graphic designing, and more. We 1715K Krypto Knights believe that VEX robotics can clearly prepare us towards the challenges of the outside world.

Credit:

- Thank you to the People at Commonwealth Fusion Systems for spending their time and sharing their knowledge during the interview.
- Deepthi, Materials Engineer working in R&D for fusion materials at the Commonwealth Fusion Systems for sharing the knowledge of the fusion machine design, development, test and build during the interview.

Link to Website: [Common Wealth Fusion Systems](#)