Aerospace Engineers’ Engineering Design Process

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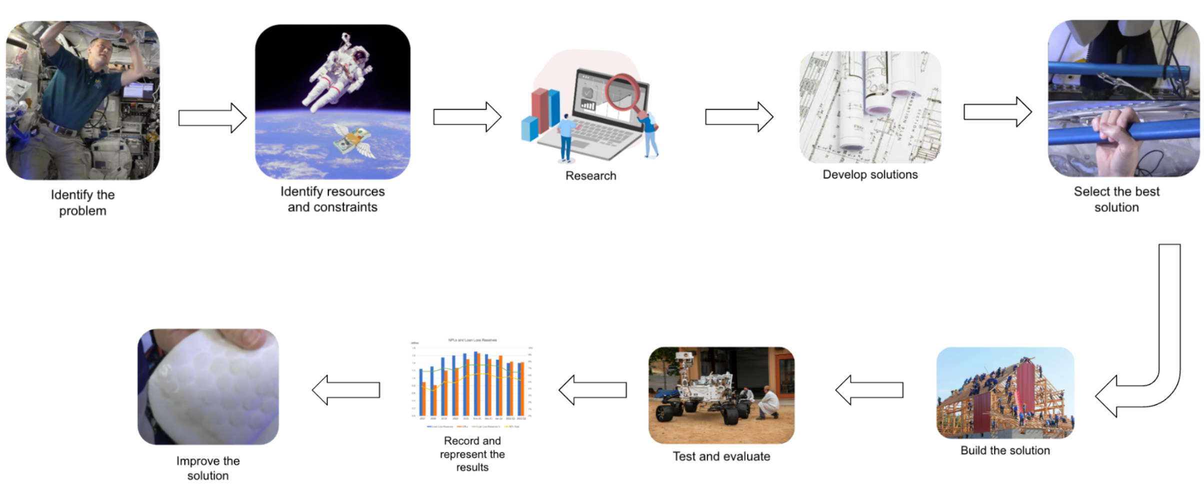
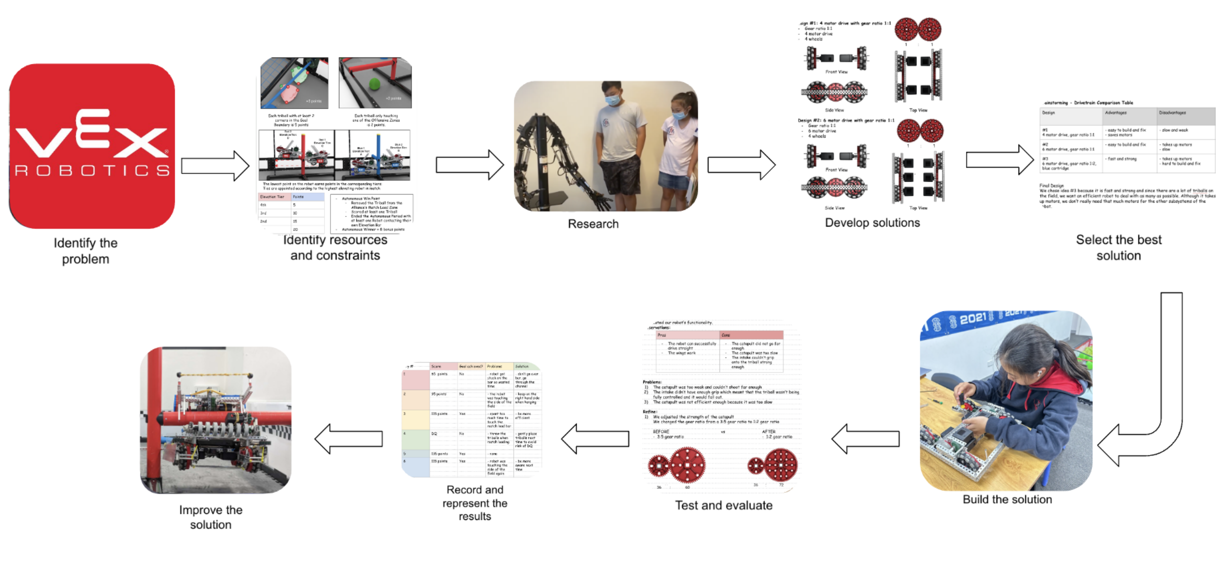
Ever since I was a child, I would stare up at the night sky and wonder what existed beyond the stars. I have always had a passion for space travel, which combines my desire to explore the unknown universe, my personal strength of practical problem solving, and my experience in engineering. This inspired me to research the STEM career of aerospace engineering at NASA as it is also a long time ambition of mine to become a scientist at NASA. I have previously explored my passion for robotics in space in the KIBO Robot Programming Challenge which required us to program the robot Astrobee to go to certain checkpoints and fix a hypothetical air leak on the International Space Station through provided simulations. Once at the world stage, my team's code was uploaded to the real Astrobee on the International Space Station. Our success at this task affirmed that aerospace engineering was a career that I was passionate about, which is why I have chosen NASA aerospace engineering for this career readiness challenge.

For this task, I conducted my research by visiting NASA's website where there were many informative pamphlets and videos explaining their engineering design process. From these sources, I learned about how their systematic approach allowed them to design inventions that targeted a specific issue. In particular, one of their videos explained the nine step engineering process and how that addressed a specific issue they faced in the International Space Station. The first step they outlined was to identify the problem, which was that astronauts found it difficult to remain stationary while working due to microgravity. Next, they identified the resources and constraints - namely microgravity, and that any solution they developed needed to be cost effective and convenient as all astronauts needed to be able to access it. Their third step was research, for instance into the best materials to work with. Next, they developed solutions such as different metal bars that astronauts could hook their feet with or use to grasp with their hands.They selected the best solution which was a simple straight rail and allocated them to be placed in the most optimal positions around the space station. They then built them, tested them, and evaluated them based on astronaut feedback. After recording and interpreting these qualitative results, they then designed improvements. They realised that sometimes latching onto the bars with one's feet for extended periods of time was uncomfortable due to the pressure, leading to the invention of special padded socks. To prevent fatigue, they also designed special bars with foot holders and straps. This process of designing improvements was the last step to the nine step engineering process used by NASA's aerospace engineers.



This approach to engineering design was similar to the process I learned throughout my experiences with VEX Robotics. This season, our team designed mechanisms to ensure the success of our robot whose goal was to score as many points as possible in various tasks such as scoring triballs. At the start of the season, we identified the challenges and the constraints of the field and design of this season. From there we researched ideas for the drivetrain, intake and shooting mechanism, then designed different viable solutions. To decide on the best one, we had a comparison matrix showing the advantages and disadvantages of all the different designs we had come up with. Ultimately, we picked a design where we had a catapult which would shoot many triballs in a limited amount of time and an intake which could score balls one by one. From there, we built the robot by each mechanism and attached everything together with my teammates. We tested and evaluated our robot and through recording our results, we discovered key features that we needed to improve on such as a more efficient way of scoring triballs because the catapult was too slow and inconsistent with the shooting trajectory. To improve it, we built another robot which focused mainly on pushing triballs rather than shooting them which we tested and found out was more efficient. Overall, our design process was similar to the ones used by the professionals at NASA. However, as our goal was for scoring points, our evaluation process focused more on quantitative scores, compared to NASA's example which required qualitative evaluation.



Learning about how the process we learned for VEX robotics is applicable to something as complex as aerospace engineering provides me with confidence that I am in the process of developing necessary skills for my dream career. Through this career readiness challenge, I have also learned how a systematic approach to the engineering design process is a universally helpful skill. Finally, researching NASA's aerospace engineers and their fascinating line of work has reaffirmed my passion and excitement to become one in the future.