//CAREER READINESS

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RAYTHEON

& 6627A

Made by:

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6627A -
Akil Nafi
Norah Wang

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Located in
Santa Ana,
CA, US

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After being founded in 1922, Raytheon Technologies has been a leader in defensive systems technology as one of the most influential companies in the field of aerospace. They started off as an appliance company and evolved into improving aerial and space technology, and developing missile defense systems. From helping with the Apollo 11 mission to making groundbreaking developments in missile technology, Raytheon has greatly influenced many technological aspects of our world today.

Figure 1: Raytheon Technologies Official logo

When deciding what company we wanted to pick, we wanted one that works to inspire the next generation of engineers with their various programs and resources the same way Vex Robotics Competition (VRC) does. Raytheon jumped out to us because their work has completely changed the world of aerospace, a field the majority members of 6627A are greatly interested in pursuing in post-schooling. To do our research we used news articles, the Raytheon website, and a 2004 report. We also talked to Lutfur Rahman, a logistical engineer at the company who we have connections with.
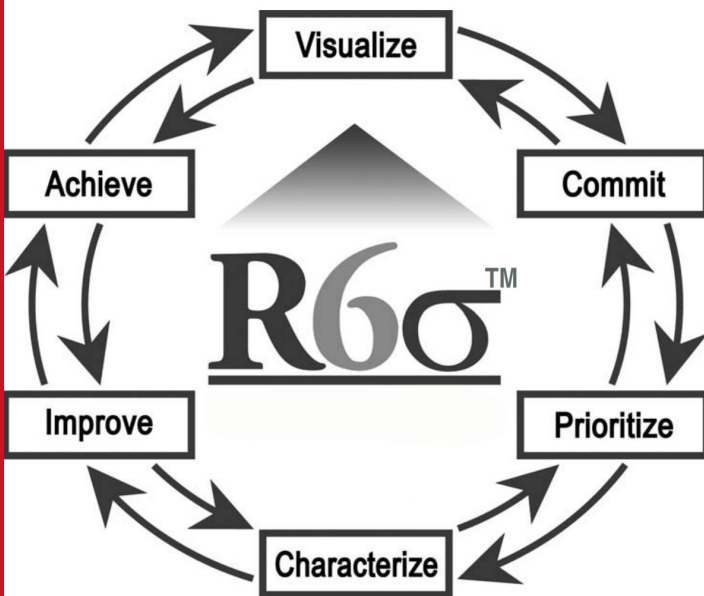
Figure 2: Raytheon's 6 step process that all employees use when trying to complete a project.
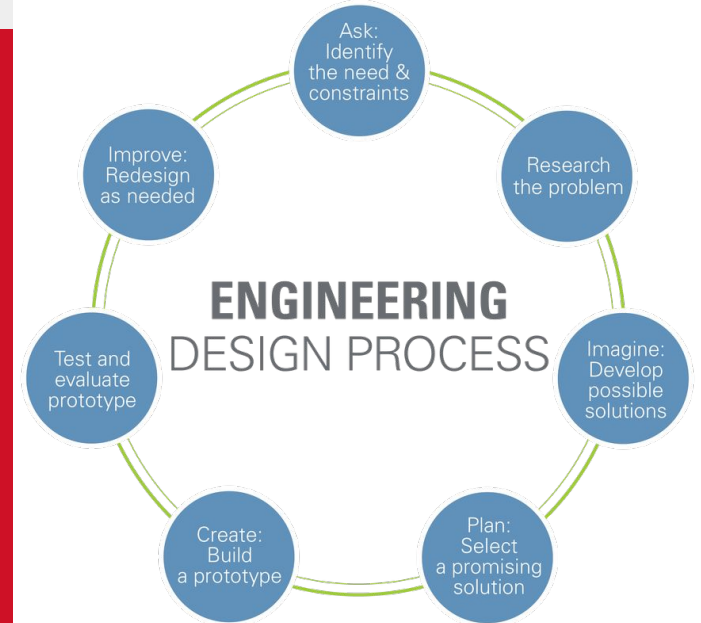

Figure 3: General Engineering Process that most teams follow in Vex Robotics Competition

    To help solve complex challenges, the design process is used to guide an engineer through the process of a project, from start to finish.

    According to their report, Raytheon Technologies uses their 6 step design process, "to identify and accomplish productivity improvements to make customer satisfaction and business growth a reality."

    Although the design process Raytheon uses may be slightly different from the one many VRC teams use, they both fundamentally cover similar steps and aspects.

The first thing that the engineers at Raytheon do is visualize their goal for the future and then either commit to their plans or go back to the drawing board. This allows Raytheon employees to properly formulate a plan and understand if it'll be able to achieve their goal.

For our VRC team, we figure out exactly what we want the robot to be able to do. We also have to use a design matrix in order to not only decide which idea of ours is best, but also evaluate if that design accomplishes all we want. If it does not we will take a step back until we have a design that allows us to accomplish all of our goals.

How strategy leads to design
Fast Fielding
- Fast drive to get to get to all the disks
- Rapid fire rate/multiple disc shooting so you can fire and then reload quick
- Turret to save time, no need to reposition (vision sensor auto aim)

Defense
- Wedges on back of the robot
- 6 motor drive
- Flipout that can be used to keep your opponents pinned in last 10 seconds
- Transmissions to effectively shift your drive base from speed to torque to allow ease when pushing opponents

Counter Defense
- Skirts on the side
- Too heavy to push
- Tractions to prevent pushing from the side

Figure 4: This is an example of the type of visualizing we do, trying to figure out exactly what we want our robot to do.

Name:	Quantity:	Price:	Link:		
Iq Chain	specified		https://www.vexrobotics.com/6p-sprockets.html		
Flex Wheels	10	$29.90	https://www.vexrobotics.com/vrc-flex-wheels.html		
2x C-Channels	2 packs	$79.98	https://www.vexrobotics.com/channel.html		

Figure 5: This is the order list for our V4, prior to making this we thoroughly went over the parts we had, went through our budget and decided what we crucially needed.

In VRC it is crucial to figure out what one needs in order to complete their design. When we finalize a design we evaluate what parts and materials we have. This allows us to make sure we are able to purchase anything we need or find alternatives if we don't have a part that we need. In some extreme cases, we may even need to modify a design if a certain part is unattainable.

Raytheon does something very similar when they are working on a project. As stated in the report, "At this time, resources needed to work the project are identified and initial return on investment (ROI) estimates are completed." This allows the employees at Raytheon Technologies to understand what they are working with to form appropriate steps. If they realize that a part of the project isn't optimized, these steps allow them to see that and modify as needed.

As a team striving for perfection, the hardest, yet most important step is the process of testing and improving. According to the report, "The results are reviewed prior to implementation of the improvements. The Improve Step in the process completes the detailed design and implementation of improvements and control systems necessary to sustain the change."

Raytheon employees make sure that they take good data when they test their projects, allowing them to further analyze where they can improve different aspects of their project.

We follow their footsteps as we take quantitative and qualitative data about our robots' performance. For example, as shown in figure 5 and 6 we test and see how quick and accurate our shooting is, allowing us to make changes as needed.
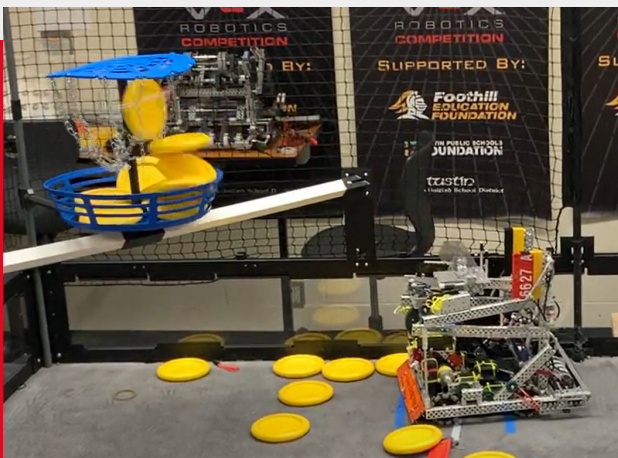

Figure 6: Accuracy testing with our new catapult (Oct 19, 2022)

Figure 7: The amount of disks scored in 1 minute of driver control during test run.

Figure 8: After the Los Angeles State Championship concluded all the teams in finals (6627A, 1437X, 21S, and 62A) had a photoshoot with each other, celebrating our hard work

Raytheon technologies considers their achieve step the part where they are able to publicize their results and are able to celebrate their achievements.

In VRC the achieve step is essentially the process of being able to go to competitions. We are able to show off all of our hard work at competitions and fully appreciate what we have managed to accomplish. Additionally we post our robot online spreading it to the community. This allows us to really show off our work and what we have managed to accomplish every season. We also hope that it serves to inspire others and offer some potential solutions.
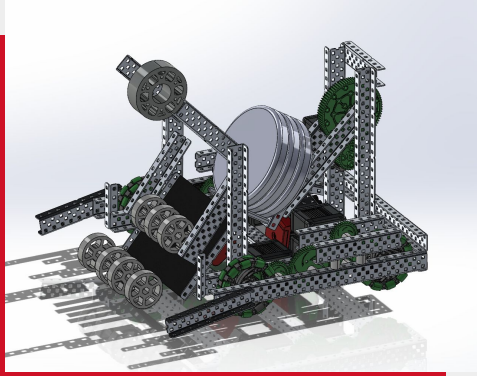
Figure 8: An example of CAD, which help us plan our robot.

Researching about the work done by Raytheon helped us really understand how much VEX robotics has prepared us for the STEM field.

The most obvious way VRC has prepared us for the STEM field is the technical aspects. VRC has allowed us to hone our skills and learn how to work like real engineers. When researching Raytheon we learned about their production process and we realized how skills we've learned through VRC, like CADing and machining, end up being used in the real work force.

VRC taught us how to effectively work with other people. We have learned how to communicate both within our team and other teams when trying to strategize. Likewise, Raytheon is a big company and employees have to work with many people for a single project, even people from other companies.

VRC has also prepared us in documentation and interviewing. One crucial thing we learned about while studying Raytheon is how they are able to document every step of the process and how their employees have learned to explain their projects in full detail. The notebooking process in VRC has provided an opportunity to do the same and learn how to effectively show and communicate our design process.

"100 Years of Era-Defining Innovation." RTX, https://www.rtx.com/news/2022/07/01/raytheon-100-anniversary.

"Made for This Moment." RTX, https://www.rtx.com/who-we-are/what-we-do.

Raytheon-New Challenges, New Solutions, and Documented Results. (2004).