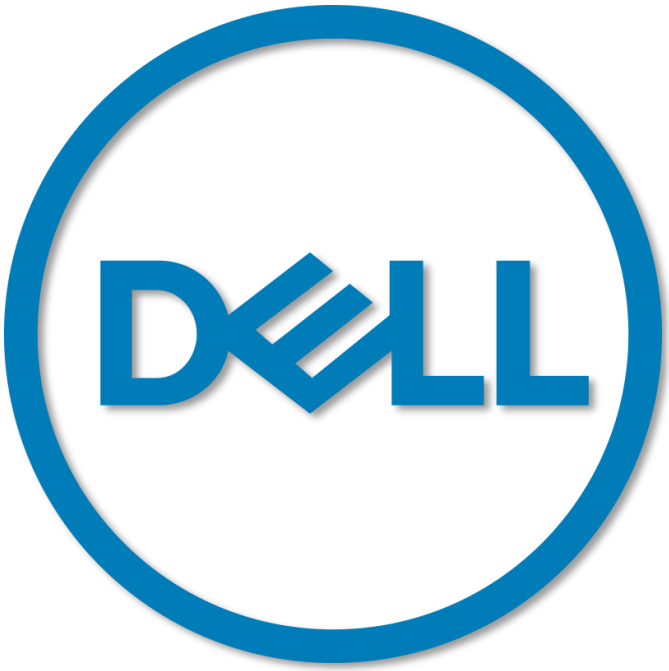
Design Thinking:

How



Does It

9181F – Frenzy | Delta, BC

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Special Thanks to Antonio Latto, Design Director at Dell

WHY CHOOSE DELL?

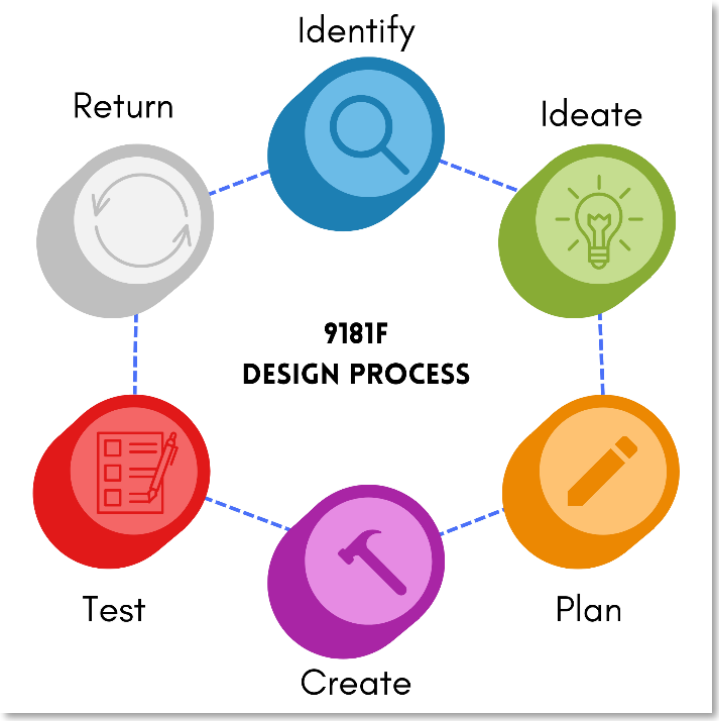
Dell Technologies, founded in 1984 by Michael Dell, thrives today, a prominent presence in the modern tech world. This company is no joke, considering its humble origins. The $1,000 company with the 1985 Turbo PC becoming a 100+ billion powerhouse providing a variety of tools to both individuals and companies stands as proof that the Engineering Design Process really works to innovate and influence on all scales. In fact, the computer lab at Seaquam Secondary, home to our robotics program, has 24 Dell PCs. There's no arguing with the fact that Dell is a relevant subject in the STEM world. The fascinating journey and widespread impact of this corporation is what drew our team in. How did they do it, and how is our team the same? We reached out to Antonio Latto, the Design Director at Dell, for more information on how Dell uses the Design Process. We were also fortunate enough to discover a couple of white papers published by Dell with diagrams and descriptions of their process.

Dell's headquarters in Round Rock, Texas.

Meeting with Antonio Latto on Zoom.

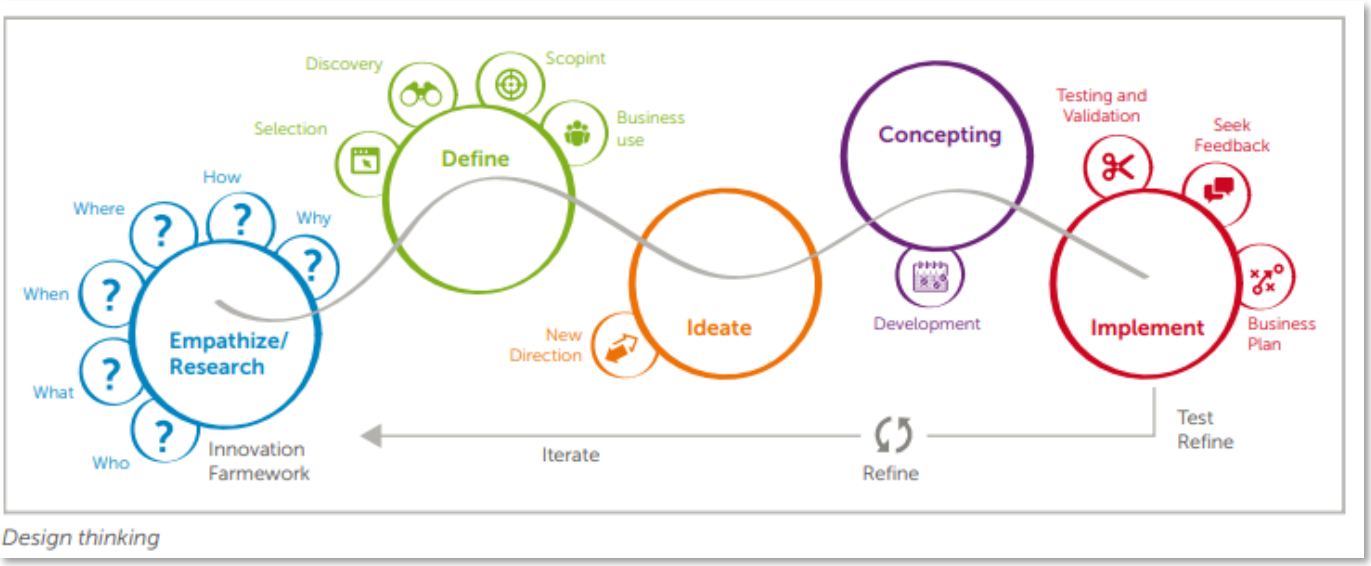
PROCESS

The purpose of the design process is to lay out a pathway for a team/individual to follow in order to reach a certain milestone. The bottom image shows the 5 key steps of Dell's design thinking journey: Empathize, Define, Ideate, Concepting, Implement, and Iterate. It can be noted that although Dell's process is broken into segments, it portrays the same pathway as our team's engineering design process.



(top right): 9181F's Engineering Design Process.

(below): Dell's Design Thinking diagram

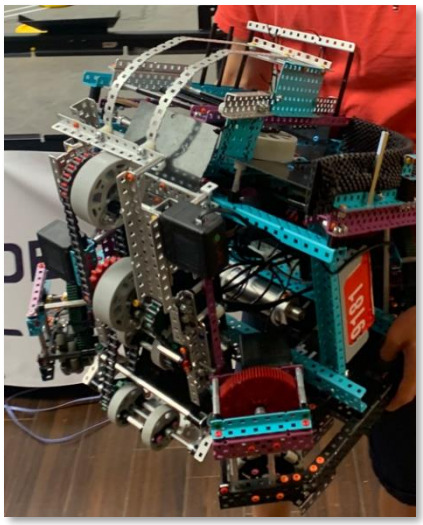


Design thinking

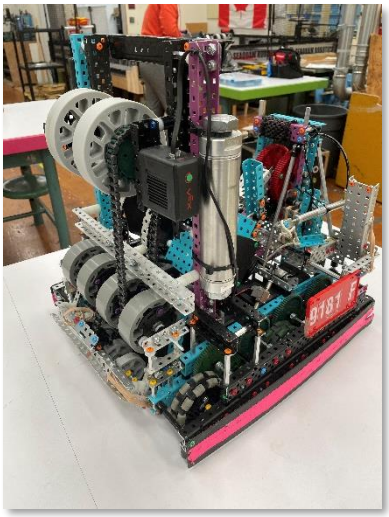
STEP 1:

EMPATHIZE

To empathize means to understand. As a company, Dell's first priority is to do "primary and secondary research to develop a strong set of data points about the challenge or problem" (Jain 5). When Dell empathizes, they observe from a variety of different perspectives. Latto provided a few examples: "what are the trends that are happening in fashion and automotive, architecture … what's going on around the world?". We search for trends by performing secondary research, observing work done by past teams who participated in VRC; YouTube is one source we use. A change in trends we experienced in BC was a change from flywheels to catapults for launching Discs; we adjusted accordingly and improved our performance.



Our first Robot, which used a flywheel to launch Discs. However, we came last place in a scrimmage (11th out of 11 teams).



Afterwards, we found out that people were switching to catapults and therefore changed our plan, performing better and placing 8th out of 45 teams

Build Habits In VEX Robotics

18K views • 2 years ago

The Basics Of Vex Bar Lifts | Seaquam Robotics

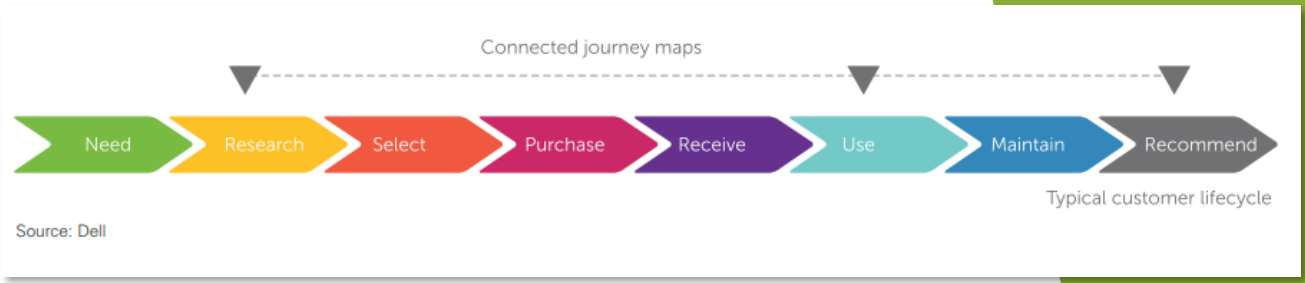
2.1K views • 2 years ago

YouTube videos posted by past members from our robotics program. They are currently posted on the Seaquam Robotics YouTube.

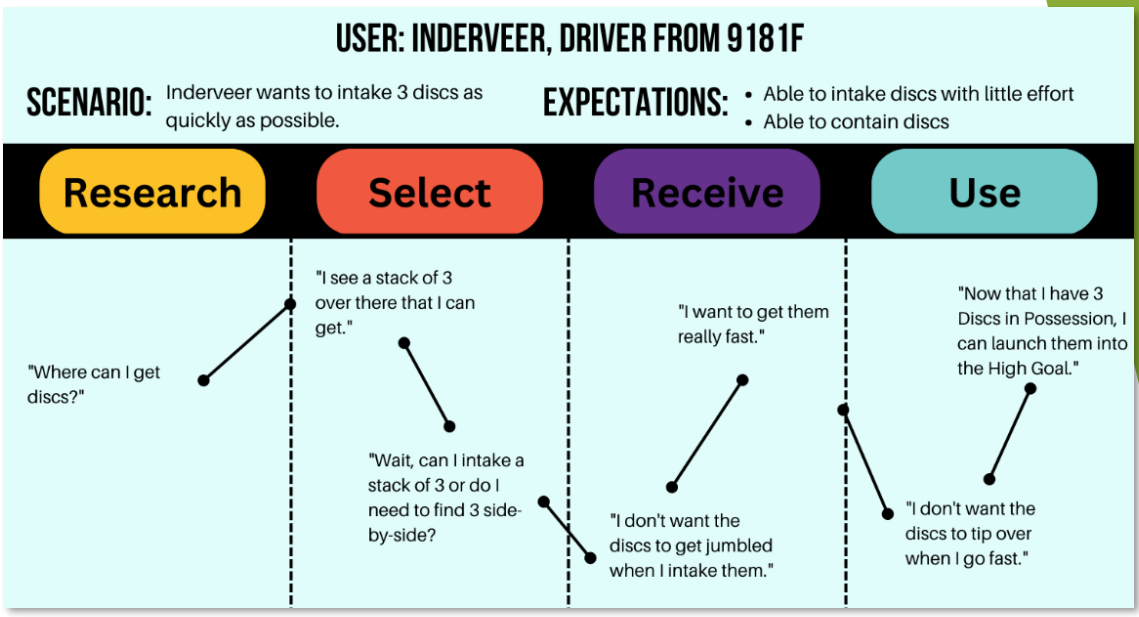
STEP 2:

DEFINE

Dell utilizes journey maps to visualize the decisions and thoughts of a customer. In our interview, Latto explained what Dell explores concerning the customer's experience with the product: "What's their first 30 seconds going to be like? First 30 minutes? First 30 days?". By analyzing different situations, Dell ensures that their products are dependable. Like Dell, we visualize our driver's experience when designing a subsystem for our robot; we analyze his pain points in a situation involving what we're designing.



The various steps Dell explores in a journey map and when defining the customer experience



A journey map visualizing what we analyze when designing a new subsystem and defining goals

STEP 3:

IDEATE

For the brainstorming process, Dell develops multiple solutions by splitting the think tank into two: "The teams came up with two radically different prototypes that helped them create a final prototype that worked for all team members and stakeholders" (Jain 6). Like Dell, we develop multiple solutions to challenges presented; to do this, we split up our team of four into three and develop 3 different concepts, weighing them with a decision matrix.

Intake Weighted Decision Matrix (OUT OF 10)

Criteria	Weight	Flex Roller		Band Roller		Tube Roller	
		Rating	Total	Rating	Total	Rating	Total
Speed	4	8	32	5	20	9	36
Settle	5	3	15	8	40	3	15
Grip	4	10	40	8	32	5	20
		97		92		71	

Values highlighted in green are positively affected by past experience.
Values highlighted in red are negatively affected by past experience.

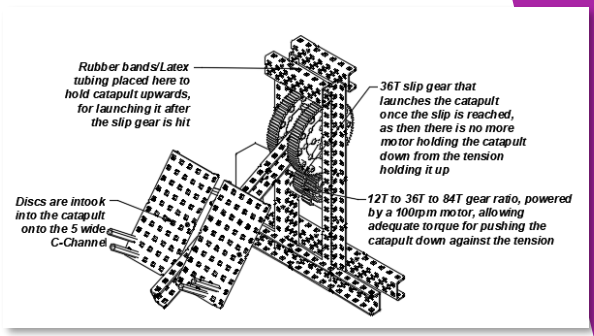
Using a decision matrix to choose the ideal solution to our problem

STEP 4:

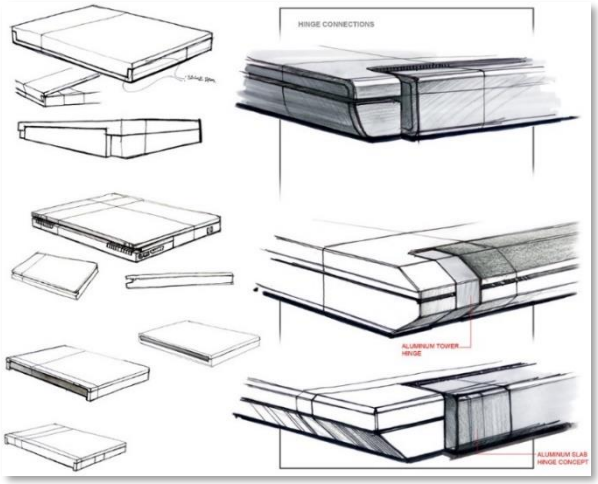
CONCEPTING

Utilizing storyboards, high and/or low fidelity visual representation, and sometimes 3D prototypes, Dell visualizes how the final product will look and feel (Jain 5). Latto explained, "Some people are better at that kind of thinking than others … others are like 'well, I don't know, I don't get it', and for those people, you have to really show what the finished product is going to be … it's really more of a conversation we have among ourselves." Latto said that Dell uses PTC Creo to CAD and KeyShot to render. We also use CAD, using Fusion 360 to create mockups of a design and then render it; as Latto said, these help us to communicate our ideas to each other more effectively.

A rendering of our chosen solution, in this case the drive train, in Fusion 360.



A drawing of our catapult with labels, also made in Fusion 360.

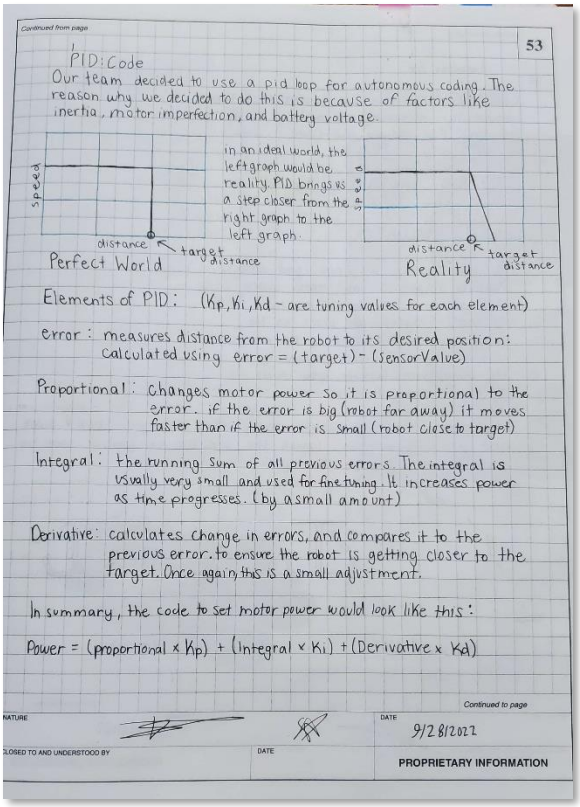


Some of Dell's concept sketches for their Latitude E-Series.

STEP 5

IMPLEMENT

Once a prototype has been completed, Dell presents the concept to stakeholders (Jain 5). Latto keeps a sketchbook and an iPad with Autodesk Sketch to record his ideas. We also have stakeholders that we need to present to: judges. In an interview, it's our job to 'pitch' our idea to the judges and tell them why our design is effective. Business skills are crucial at this stage; being able to explain and persuade is a huge part of winning a judged award, and documentation helps bring the point home.



PID: Code

Our team decided to use a pid loop for autonomous coding. The reason why we decided to do this is because of factors like inertia, motor imperfection, and battery voltage.

speed — distance — target distance — Perfect World

In an ideal world, the left graph would be, reality. PID brings us a step closer from the right graph to the left graph.

speed — distance — target distance — Reality

Elements of PID: (Kp, Ki, Kd - are tuning values for each element)

Error: measures distance from the robot to its desired position: calculated using error = (target) - (SensorValue)

Proportional: Changes motor power so it is proportional to the error. if the error is big (robot far away) it moves faster than if the error is small (robot close to target)

Integral: the running sum of all previous errors. The integral is usually very small and used for fine tuning. It increases power as time progresses. (by a small amount)

Derivative: calculates change in errors, and compares it to the previous error. to ensure the robot is getting closer to the target. Once again this is a small adjustment.

In summary, the code to set motor power would look like this:

Power = (proportional x Kp) + (Integral x Ki) + (Derivative x Kd)

Continued to page

DATE 9/28/2022

CLOSED TO AND UNDERSTOOD BY — DATE — PROPRIETARY INFORMATION

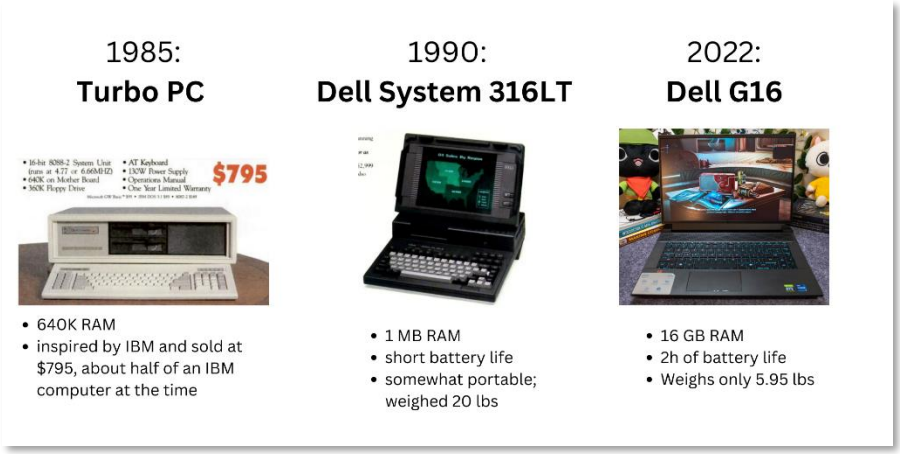
A page in our design book on PID, written by Sanah.

Dell presented a new easy-repair laptop concept, Concept Luna, at CES 2021.

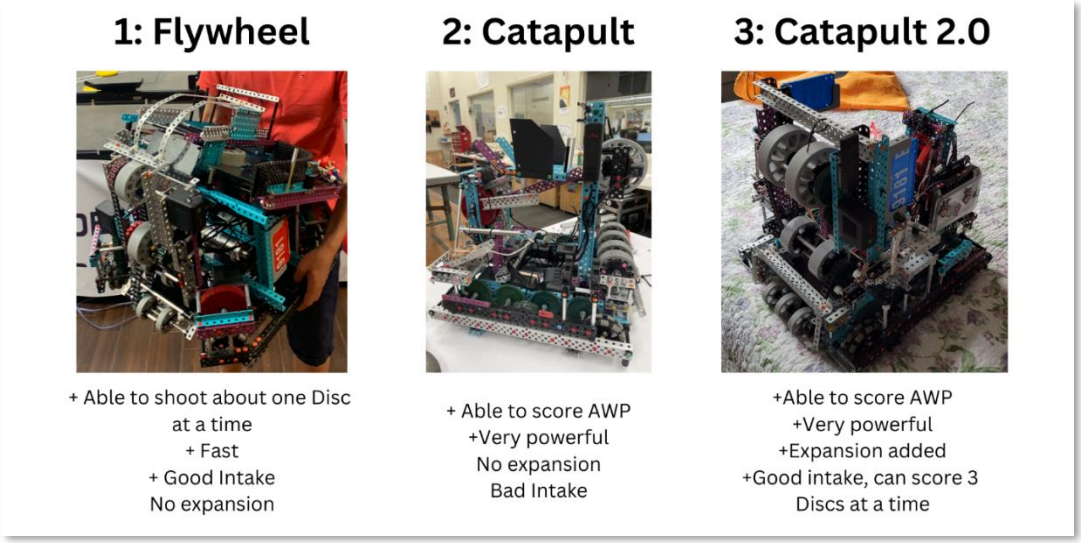
STEP 6:

ITERATE

The tech world isn't a dormant one. “Existing business processes often need the most reinvention to keep up with customer demands” (Jain 6). In order to rise above the competition, Dell continually improves their products. We follow this methodology; in fact, we’ve completed 3 design cycles this season. With each iteration, we learn new things and our robot evolves. Iteration, for our team, means understanding which capabilities should be kept and which ones should change; this can be seen in our robot’s development over time.



Some of Dell's computer models from the very beginning to the present.

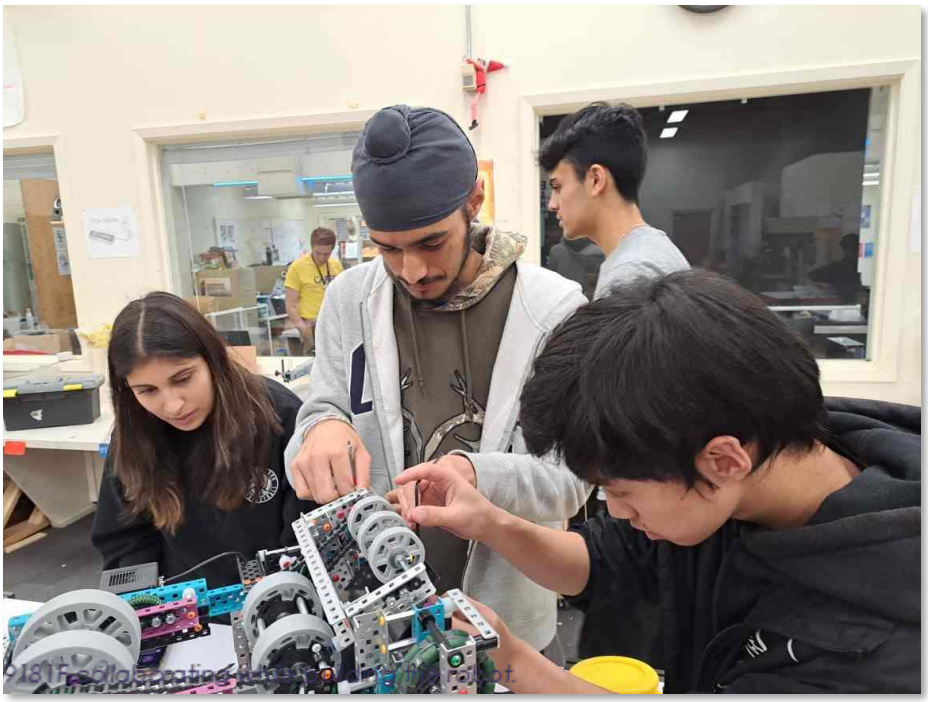


Our robot's evolution over time. As the robot changes, its capabilities change as well.

CAREER PREPAREDNESS: HOW VEX DOES IT

We were able to make a multitude of connections between a career at a company like Dell and the everyday skills a VRC student utilizes. The habit of thinking like an engineer is one of them: generating multiple ideas. Documenting your work. Using sketches/CAD to communicate ideas. The practical skills are also crucial; in both worlds, builders work with a variety of materials, and programmers use a language to bring everything to life.

Apart from the STEM skills learned by students in robotics, there's another skill learned that Dell employs to maximize their design thinking potential, one that's difficult to master but is used by the best VRC teams out there: communication. Judging interviews and notebook work increase a student's ability to communicate important ideas to someone else. Like Dell's teams, our team's individual teammates have been able to connect and discuss their different approaches to the challenges presented by the game, together. Together, with VEX, we're developing the skills that'll make us the next generation of leaders.



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