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Surrey Robotics Innovation Lab

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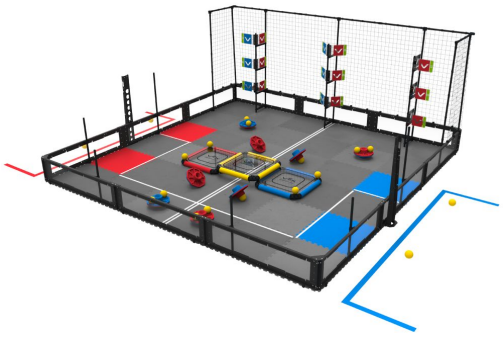
1. Overview

Establishing the Surrey Robotics Innovation Lab is my dream for Surrey. It's a year-round space for youth across Surrey can get together to expand their interests for Science, Technology, Engineering, and Math (STEM). Teens can bring their robots to work and collaborate in a space dedicated to VEX Robotics, get access to the workshops and resources offered at the Surrey Robotics and Innovation Lab, and expand their STEM knowledge to succeed in VEX Robotics and beyond. Immersed in an inclusive and innovative culture, youth will be motivated and supported by mentors to reach their full potential of creating robots and multi-functional innovations.

1.1 VEX Robotics - The World's Largest Robotics Competition[1]



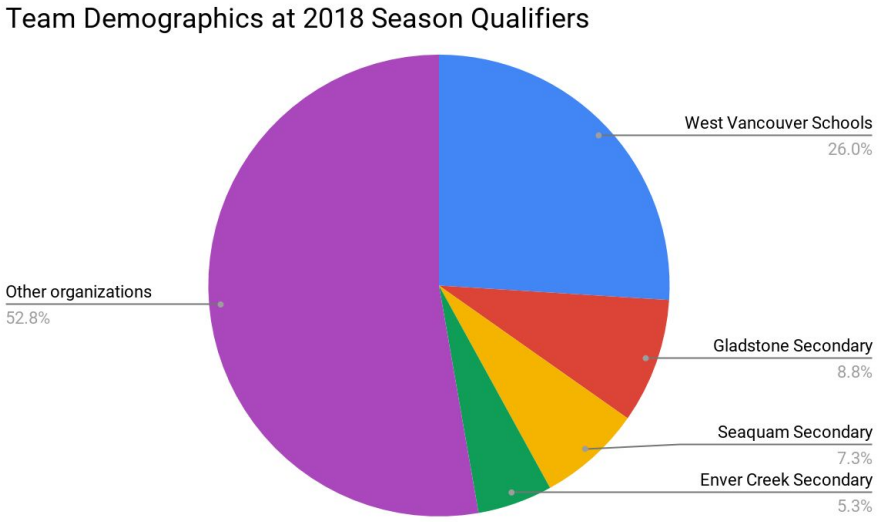
VEX Robotics is as exciting, challenging, and captivating as any varsity sport. Nowhere else will you find hundreds of competitors, teachers, volunteers, staff, and judges from across the province gathered at one of BC's 12 annual VEX Robotics tournaments. A game-based, engineering challenge is presented each year. Matches take place in a 12 feet by 12 feet arena, where 4 robots, paired into Blue and Red teams, compete in 90 second rounds for the highest score. They execute scoring strategies and play defence to outscore, outplay, and outthink one another. In this jam-packed and intense environment, teams and educators cheer on the star players in the arena - robots built from an assortment of metal, screws, axles, and wheels and brought to life with motors, electrical systems, and a robot brain - the result of months of meticulous design, collaboration, and perseverance overcoming countless challenges along the way.

[1] VEX Robotics Competition, REC Foundation.

1.2 Current Competition Landscape for Surrey Teams

BC is one of the top ranking regions for VEX Robotics in the world.[2] However, for most VEX Robotics competitors in BC, it is easy to guess where the elite teams come from.

Here are the organizations from the Lower Mainland with the most registered teams in the 2018 VEX Robotics Season Qualifiers.[3]



*excludes invitational tournaments

Select regions dominate BC competitions. Out of all the teams who competed in the 2018 season qualifiers, 26% came from the West Vancouver School District (Ten Ton Robotics). It has a Premier Mechatronics Robotics Academy Program which charges its students tuition of $2500 per year. Since its establishment in 2016-2017, 3 teams from West Vancouver's Mechatronics Robotics academy qualified and competed at the 2017 and 2018 VEX Robotics World High School Championships and 2 teams qualified for the Worlds this year.[4]

> *The Premier Mechatronics Robotics Academy is an example of West Vancouver Schools' commitment to facilitating increased student opportunities in STEM (Science, Technology, Engineering, Math) education in a creative, exciting and competitive environment.*[5]

[2] The number of qualifying spots a State/Regional/Provincial/National Championship allocates for VEX World Championships is based on the percentage of teams the region had last season in relation to the total number of teams in the program. According to the 2018-2019 VRC World Championship Spot Allocations (page 9), **more spots were allocated to BC teams than 92% of the 48 countries present.**
[3] Robotevents.com contains information about all VEX competitions in any region. Select BC.
[4] Challenges and Competitions, Premier Mechatronics Robotics Academy website
[5] The Premier Mechatronics Robotics Program website

Surrey Schools' after-school robotics clubs are no match for the elite teams in BC, who have access to more resources and formal training. As a Surrey VEX Robotics competitor throughout my high school years, it is still eye-opening seeing high performing teams such as Ten Ton from West Vancouver District, Robosavages from Gladstone Secondary, Navigators from NIDES/Navigate, and Seaquam Seahawks from Seaquam Secondary in all aspects of VEX Robotics competitions. From arriving early with a team of teachers and school staff to set up their large workstations to competing with their robots built of standard VEX components as well as 3D printed parts and other materials we have never seen before, these teams are well prepared and professional. Finally, at the awards ceremony we learned that every component of their robot has been designed and visually assembled using Computer-aided Design (CAD) before they were built - something we had never thought of nor had the time to do. Our scattered work hours at lunch and after-school are often filled with distractions. Due to the non-formal nature of the robotics club, teachers may not have the time or the specialized knowledge to provide help. Additionally, our tools and parts are often limited and/or inadequate - I remember spending more time finding and figuring out how to use a grinder to sharpen one of our hex keys than building the robot component I was working on. The lack of productive space, mentorship, and resources reduce team efficiency and teams' ability to build a complete robot, test it, develop game strategies and an autonomous program, and practice in the arena to adequately prepare for competitions.

Although BC's highly competitive BC VEX Robotics landscape can be discouraging, those with the access to resources and education, and a passion for challenging the status quo can achieve uncommon excellence. For most competitors from Surrey, it is hard to believe that Ten Ton Robotics, the organization that finishes at virtually every tournament as the tournament champions and receives multiple awards, was only established in 2016. Previously, West Vancouver schools ran after-school robotics clubs much like Surrey's current robotics system. VEX Robotics competitions in BC were just as fierce back then, as illustrated in Jason Brett's[6] VEX official forum post in 2014 arguing that, statistically, the VEX Pacific Northwest Championships in BC is a more difficult tournament than the VEX World Championships. The increasing success of West Vancouver teams against traditional powerhouses shows that with the resources and a commitment to fostering teams' passion for learning robotics, making an impact in the highly competitive VEX Robotics culture in BC is possible. I believe that there is so much potential for Surrey against the current and traditional powerhouses in VEX Robotics in BC, and I want to create the environment and the facility to empower Surrey teams' success.

[6] Instructor Jason Brett teaches technology at BCIT and still coordinates the VEX Pacific Northwest Championships, the largest annual VEX Robotics competition in BC.

2. Surrey Robotics Innovation Lab

The SRIL will offer free programs and an environment dedicated to fostering youth's passion for robotics by helping them develop a wide spectrum of STEM, teamwork, and leadership skills. Through the SRIL, I am committed to giving Surrey youth the same edge as the other elite organizations in BC. However, unlike traditional robotics programs, I want to extend SRIL programs beyond the goal of developing VEX Robotics tournament champions to cultivate an inclusive, creative, and passion-driven culture to foster the leaders and innovators of tomorrow. This will be achieved through actively engaging the SFU faculty and students and partnering with professors, STEM professionals, and high technology companies to enhance youth's passion for innovation with specialized STEM experiences.

2.1 Mission

Provide all Surrey youth with the opportunity to compete in VEX Robotics and develop their leadership and innovation potential.

2.1.1 Increase youth engagement in STEM

> *The VEX Robotics Competition prepares students to become future innovators with 95% of participants reporting an increased interest in STEM subject areas and pursuing STEM-related careers.*[7]

However, many barriers prevent or discourage youth from participating in VEX Robotics. Talking to my friends across Surrey Schools over the years, main barriers include selective memberships to robotics clubs, intimidating environment, and limited resources to help youth initiate their VEX Robotics journey. Due to limited resources, robotics clubs in some schools can only offer memberships to a few students, often those with the most experience. This decreases opportunities for new members to discover their interest in STEM, especially since the VEX Robotics environment is already challenging, highly competitive and male-dominated.

The Surrey Robotics Innovation Lab will provide a space where youth of all backgrounds feel welcomed and supported in their VEX Robotics journeys. The SRIL plans to partner with Surrey Schools to share VEX Robotics resources between the SRIL and schools in Surrey. Mentors at SRIL will support youth to develop design, engineering, programming, and problem-solving skills, and increase their confidence and ability to build tangible results. Through initiatives to increase access to VEX Robotics resources and education, the SRIL will encourage the diverse youth community in Surrey to explore and use STEM to create positive impacts in the world.

[7] VEX Robotics Competition, REC Foundation

2.1.2 Provide a better alternative to gangs

The Surrey Robotics and Innovation Lab offers free programs and a year-round safe space dedicated to building robots. Youth will be able to connect with a community of like-minded peers, expand their robotics passion, collaborate with others, and be welcomed, included, and valued. The VEX Robotics experience at SRIL will support youth to develop key employability skills such as communication, teamwork, problem-solving, creative and analytical thinking, and resilience. Through encouraging Surrey youth to develop a love for learning and a passion for turning one's ideas into reality, the SRIL hopes to help youth find their purpose in competitive robotics and change the assumption that gangs may be the best or only option.

2.1.3 Develop the leaders and innovators of tomorrow

In addition to empowering Surrey youth's success in VEX Robotics, the SRIL will offer opportunities for youth to learn about and engage with the leading technology through partnerships with universities and high technology companies. Students and professors from universities such as UBC and SFU will be invited to share their career experience and expertise in STEM. Through these opportunities, Youth will gain access to cutting-edge technology and discover career opportunities in STEM fields, and be inspired to apply the iterative design process of competitive robotics to solve real-world problems and embrace innovation as a lifelong goal. SRIL's culture of hands-on learning, collaboration, and innovation will empower teens to dream big, complex ideas to make significant positive impacts in the world, and be supported in their journey to turn their ideas into reality to become the next entrepreneurs, innovators, and technology leaders.

2.2 Goals

2019 to 2021

Secure funding for resources

- Year-round room for SRIL in SFU Surrey
- 5 computers ($5,600) with VEX Code program (free)
- VEX Robotics competition field ($1792 one-time) and game elements ($728 annually because the VEX Robotics game changes every year)
- Spare VEX tools such as screwdrivers, screws, collars and axles if possible

Gather a team of mentors to guide Surrey teams and engage younger generations in robotics

- Invite SFU Mechatronics Engineering and STEM students to mentor youth in VEX Robotics

- At least one mentor will be present during all operation hours after school and on weekends ($20 per hour)
- Mentors will help youth develop a passion for robotics and a wide spectrum of STEM and teamwork skills to enhance teams' success at Regional and Provincial VEX Robotics Competitions

Partner with Surrey Schools

- To develop a "Share VEX Parts" policy to give all students in Surrey Schools access to the VEX Robotics parts and eliminate parts scarcity in individual schools
- To promote and incorporate the SRIL learning experience into high school robotics clubs

Coordinate speaker sessions and workshops

- Invite professors and STEM professionals to share the latest STEM and robotics technology, offer specialized knowledge to help youth improve their robots, and inspire them to pursue careers in robotics and innovation

2022 to 2024

Send teams from Surrey Schools to the VEX World Championships

- Increase specialized SRIL programs by offering high-level programming, robot optimization, and mechatronics engineering workshops bi-monthly
- Send Surrey teams to the VEX World Championships annually by continuing to increase the resources and programs offered at the SRIL to empower a growing community of engineers, programmers, creative problem-solvers, and leaders to develop their full potential through years of VEX Robotics

2024-2027

Secure sponsorships for teams competing in World Championships from local and global organizations

- The current VEX World Championships take place in Louisville, Kentucky. Sponsorships will help support teams' travel and accommodation as well as competition resources for this potentially annual trip

Partner with high technology companies

- Such as the companies on Innovation Boulevard in Surrey and local and global companies solving the pressing problems in society

- To enable Surrey teens to explore and incorporate these technologies into their projects, and inspire their ambition to achieve similar impacts through entrepreneurship

2027-2029

Expand the SRIL to become a center for not just robotics, but for all innovation

- To encourage teens to initiate projects in fields such as health technology, machine learning, Artificial Intelligence, clean energy, and so much more
- To enable more youth locally and globally to immerse themselves in a culture of innovation and discover their potential for creating a positive impact through robotics and STEM

2.3 Budget Plan

2020

Description	**Cost**
President ($20 per hour, 8 hours per week)	$8,320
Robotics Mentor(s) ($20 per hour, 24.5 hours per week total)	$25,480
Robotics Design Session in September	$500
Programming Session in November	$500
Robot Skills Session in January	$500
5 computers with the VexCode program	$5,600
VEX Robotics competition field and game elements	$2,520
SFU room rental ($10 per hour, 24.5 hours per week)	$12,740
Total	$56,160

2021

Description	**Cost**
President ($20 per hour, 8 hours per week)	$8,320
Marketing and Communications Officer ($20 per hour, 5 hours per week)	$5,200
Robotics Mentor(s) ($20 per hour, 31 hours per week total)	$32,240
Robotics Design Session in September	$500

Programming Session in October	$500
Sensor and Actualization Session in November	$500
Robot Skills Session in December	$500
VEX Robotics game elements	$728
SFU room rental ($10 per hour, 31 hours per week)	$16,120
Total	$64,608

2022

Description	**Cost**
President ($20 per hour, 8 hours per week)	$8,320
Marketing and Communications Officer ($20 per hour, 5 hours per week)	$5,200
Partnerships Coordinator ($20 per hour, 4 hours per week)	$4,160
Robotics Mentor(s) ($20 per hour, 45 hours per week total)	$46,800
Robotics and Computer-aided Design Session in early September	$500
Electrical Systems Session in late September	$500
Programming Session in early October	$500
Driver Control and Autonomous Session in late October	$500
Robot Skills Session in November	$500
Innovation in Robotics and STEM Session in December	$500
VEX Robotics game elements	$728
SFU room rental ($10 per hour, 45 hours per week)	$23,400
Total	$91,608

In year 3, the SRIL will be open for 10 hours on weekends and 5 hours on weekdays after school with mentors available during all operating hours. At its full capacity, the SRIL costs 42% less than the total tuition the West Vancouver Premier Mechatronics Robotics Academy Program receives.[8]

[8] There are at least 29 teams from Ten Ten Robotics. If each team has at least 3 students, it is estimated that there are at least 87 students enrolled in West Vancouver's Mechatronics Robotics Academy. The tuition for each student is $2,500.

3. Summary

The Surrey Robotics Innovation Lab is my dream for Surrey. It is the coalescence of my passion for VEX Robotics and the limitless growth it can unleash, and my vision to realize Surrey teens' potential of making significant positive impacts through STEM and innovation.

Through initiatives to increase youth engagement in STEM, provide a better alternative to gangs, and develop the leaders and innovators of tomorrow, the SRIL will equip Surrey youth with the key employability skills to pursue rewarding careers in STEM. It will foster a culture of innovation, learning, and collaboration at the heart of Surrey to build a safe and engaged youth community. The SRIL is centre for youth of all backgrounds to gather, collaborate, get inspired by the latest technology in robotics, and pursue their potential for excellence in VEX Robotics under the mentorship of leading STEM educators and leaders.

The SRIL vision for an engaged youth community with a shared passion for making a positive impact through innovation aligns with Surrey's long-term goals to *provide an equitable and integrated network of civic and recreational facilities to support community and neighbourhood life*[9] and *a comprehensive and innovative life-long learning system in Surrey*.[10] With support from the City of Surrey, SFU, and Surrey Schools, the Surrey Robotics Innovation Lab can become a reality. Surrey youth at the forefront of making transformative change is a future we can all look forward to.

[9] Surrey Official Community Plan (OCP) Theme C: Infrastructure and Facilities, Objective 4
[10] Surrey Official Community Plan (OCP) Theme F: Society and Culture, Objective 2