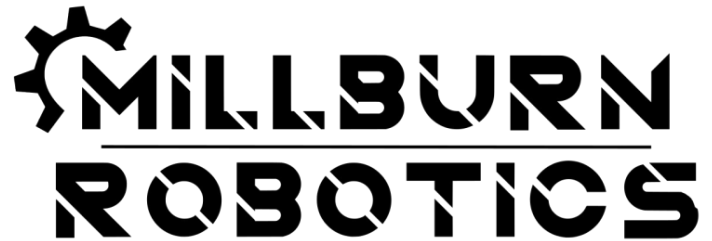


VRC Girl Powered Essay Team 7405M: Empowering Women in STEM through
Robotics



Growing up, I never questioned the idea of women leading in STEM. From a young age, I was inspired by my mother, who I'd consider to be my earliest STEM role model. After graduating college as a Chemical Engineer she became a computer science data analyst at MBS. Her confidence in being a female in technology inspired me to first look into STEM and try it out for myself. In 5th grade, I started my first robotics class at a nearby robotics center, which was my first real interaction with the gender gap in STEM. Surrounded by boys, I immediately felt as though I was out of place. This feeling of imposter syndrome, the sense of not belonging, is unfortunately a feeling that many other girls and women experience in the STEM industry, and at that young age, I faced it head on. Due to this discomfort, I had doubts about continuing robotics, even though I truly loved it, and came very close to quitting completely. Luckily, my mom was there to support me, encouraging me to continue my passion and to focus on what interested me and made me happy. This encouragement was what I needed to overcome my initial fears and reservations. As I developed my confidence and learned new skills, I became closer with my male peers and started sharing my ideas more openly. Still, being the only girl, or one of the only girls, in a technical class can feel isolating, and my story is unfortunately shared by many women in the field of STEM. Learning and experiencing first-hand how stereotypes and isolation can discourage a person from pursuing their passions is what motivates me to empower girls and women like me who might also be struggling. Now as a robotics captain and high school senior pursuing engineering, I strive to ensure that other women interested in STEM never have to feel that same discomfort that I had felt, and the REC Foundation's Girl Powered initiative is something that my team has fully embraced.

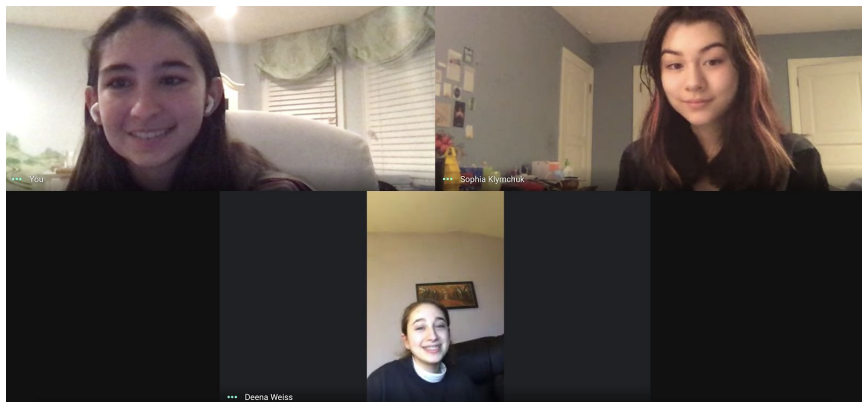


Melanie at a VEX Turning Point competition two years ago



Sophia Klymchuk, a lead builder on 7405M, volunteering as a scorer and judge at a VexIQ competition

Both the REC Foundation and Girl Powered’s ambition to encourage equal participation of young women and men in competitive robotics is a foundational aspect of VRC Team 7405M, New Jersey’s “Millburn Mercury.” Girl Powered, to our team, means having both female and male ideas equally represented and fostering a supportive and empowering community for all members, regardless of background or orientation, to feel comfortable sharing their ideas and contributing while facing challenges as a group. This balanced perspective and participation are pivotal in the functioning of our performance in competition and the growth of each team member, and it has been exemplified both in past and present seasons. Double qualifying for the 2020 VEX Worlds competition at states last year, via the NJ Excellence Award and Tournament Finalists, was an incredible moment for the entire team and we believe that our team’s diverse perspectives and opportunities for equal gender representation were key to this success. Everything from our code, to our build, to our leadership, and engineering notebook was and continues to be a group effort consisting of both female and male perspectives that leaves no member behind. This balance is important in decision making and the entire design process of our competitive robot. Coding, building, designing, prototyping, collaborating, and communicating are all very important aspects of a robotics team and we are proud to say that the young women on our team are both large contributors and leaders in every aspect.



Due to COVID-19 and taking all safety precautions, our team has been able to safely socially distance and meet via Google Meet to continue communicating and working on our bot!



Taken last year when the team qualified for NJ states!

I'm Melanie Herbert, a captain, builder, and coder on 7405M. After starting robotics in elementary school, I competed on VEX IQ before joining a VRC team my freshman year. My favorite aspects of robotics include problem solving along with being able to apply my math and physics background in a hands-on challenge. This is now my fourth, and senior, year competing on a VRC team and I hope to share my background and knowledge with the entire team this year. I also hope that by being a female captain, I can demonstrate that women not only belong in STEM, but in leadership positions as well, and to inspire other girls with passions for STEM to take on higher roles. Witnessing first-hand the under-representation of other young women in STEM like me motivated led me to become an advocate for females in tech and to work as a part of a team committed to sparking positive change as well. Having such a diverse and supportive team has given me the ability to explore many different areas of robotics. I work alongside Deena Weiss, a leading code team member, in programming the robot's autonomous runs, driver, and odometry code. My experience with robotics over the years not only allowed me to expand upon my coding skills, but also inspired me to pursue a software internship this past summer at CACI International. Working on the design and prototyping stages also challenged me to learn how to CAD using AutoDesk Fusion 360 and I found it helpful and fun to learn new build skills from my teammates. Sophia Klymchuk is a lead builder on the team and I enjoy working alongside her and others on the build team on the mechanical aspects of the bot. Overall, my experiences with 7405M have helped me realize my passion for engineering and leadership. I plan to major in Electrical Engineering in college next year, bringing all the knowledge and experiences robotics has given me these past years along with my commitment to working with a diverse and collaborative community.

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Problem: Block elevator is causing instability and tipping
 Idea: What angle and length should we choose?
 Investigate calculations

Investigation:

length = 4.15 inches = 1.05m
 block length = 5.8 inches = 0.147m
 block weight = 285g = 0.285kg
 $\theta = 67^\circ$

However each block is at a different distance on the load tray. It is block length from last block

distance block 1 distance perpendicular distance block 2

Torque is a twisting force that causes rotation. This can cause our robot to tip.

$T = F \cdot d_{\text{perpendicular}}$
 mass of block is = 285g or .63lbs
 $F = \text{force} = \text{mass} \cdot \text{gravity}$
 distance = $L \cdot \cos \theta$

$\sum T$ of each block

$T_{\text{block 1}} = 0.285 \text{ kg} \cdot 9.8 \frac{\text{m}}{\text{s}^2} \cdot 1.05 \text{ m} \cdot \cos 67^\circ = 1.145 \text{ kg} \cdot \text{m}^2 \cdot \text{s}^{-2}$
 or 1.145 Newton Meter

$T_{\text{block 2}} = 0.285 \text{ kg} \cdot 9.8 \frac{\text{m}}{\text{s}^2} \cdot 1.05 \text{ m} \cdot \cos 67^\circ = 0.9103$

Signature: *Melom* DATE: 7/18/15
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Problem: Our drivetrain was having some friction issues and not moving as properly/quickly as we wanted it to.
 We decided to investigate
 Idea: Will adding Spacing help
 Formula: Rolling friction equation
 $F_r = \mu_r N$

F_r = the resistive force of rolling friction
 μ_r = the coefficient of rolling friction for the two surfaces
 N = the normal force pull/pushing the wheel to the surface

Sliding friction is the ratio of the force of friction between two bodies

μ_r for Rubber vs Stainless Steel = .64
 μ_r for Rubber vs Urethane = .60

This is about the same, ~~no~~

Resolution: add plastic spacer to decrease the amount of surface area and reduce the coefficient of friction
 In order to fix the ~~rolling~~ problem used 2 tub spacers to create some distance between the rubbing parts

Signature: *Muhammed Hubra* DATE: 6/29
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Scan of some of our favorite notebook entries with physics calculations which helped us win the NJ State Excellence Award!

My sophomore year in High School, I co-founded a 501(c)(3) nonprofit organization, [Girl Tech Boss](#), with Molly Cantillon, a fellow girl on my previous robotics team. Through the initiative's make-a-thons, robotics workshops, and online resources, we aim to empower the next generation of female tech entrepreneurs, extending the ideas represented in our tight-knit robotics program to a larger community.





Melanie organizing VEX parts for build distribution over the summer, so multiple team members could safely work on various parts of the robot at home.



Deena Weiss working on testing and coding the robot at home

Another way that our team promotes our values of equal representation across genders is through our encouragement of exploring different team roles for each individual. Through our shared experiences in robotics and STEM in general, many members of the team have noticed the all too common stereotype of the “female notebooker,” where it is often automatically assumed that young women on robotics teams only contribute to the team through the engineering notebook, rather than through the many other options available, such as driving, coding, or building. As a team, we recognize that all aspects of the VRC competition, such as maintaining documentation through the engineering notebook, are equally important, and therefore no role should ever be delegated to a single gender or seen as inferior. To combat this as together, we actively encourage members to seek out roles that they feel play to their own individual strengths and interests, as well as to try contributing in new ways that they had not previously done before. For example, we emphasize the importance of the engineering notebook, rather than viewing it as an inferior task, and we share the task of notebook upkeep with all members, regardless of gender. The result of our efforts is a team in which every individual contributes to the group in their own unique way, rather than simply following stereotypical gender roles. This is evident in the representation of both genders in every aspect of 7405M, from decision making to coding, building, and even notebooking.

As a team, 7405M fosters a supportive dynamic in which all members are encouraged to speak up about their ideas and be represented in every aspect of our decision making and working processes. We treasure the unique perspectives and contributions of every team member and actively work to undo the stereotypes that often pervade the field of STEM. The young women on our team, fueled by their own individual experiences and inspired by their own role models, strive to be good examples for others who are interested in pursuing passions in STEM, and all members of our team work together to create a community where diversity and representation are valued goals.

Credits:

Authors: Melanie Herbert, Sophia Klymchuk

Registered Team Number: 7405M

Title of Submission: Empowering Women in STEM through Robotics