Team 610

2014 Engineering Notebook

Team610.com

Table of Contents

Introduction

When Team 610 started over 16 years ago, it was simply a robotics club where students could join together to build a robot over six weeks. Over the years, our team has grown in size and spirit, and has expanded not only within our school, but also into the greater Toronto community. Our team's passion for engineering has led us to develop handicap-friendly technologies for the children of Sunnyview School, incorporate FIRST-related activities in our school's many tech design courses, and annually host both FLL and VEX tournaments, to spread our love of FIRST with the community. Beyond our school doors, we have taken on the challenge of mentoring teams with limited FIRST experience. To our team, robotics programs serve as essential factors in bringing people from all grades and cultures together, to collaborate and celebrate the scientific and technological achievements of Canada, and the rest of the world.

In this notebook, you will find information on the technology related initiatives we run within and outside of our school, as well as a detailed, daily account of our build season. It has been an incredible season for our team this year; we have seen much promise from our aspiring engineers. As we move towards our collective goal of becoming a world-class team, we look forward to having many more great seasons in the future.

Preparing our Engineers

Grade 9 Exploring Technologies Program

Over the years, robotics has seeped into every level of our Upper School. To build interest in robotics right from the get-go, Grade 9 students participate in a program that introduces them to CAD, RobotC programming and the Design Process. The skillset the students acquire is then integrated into a Final Evaluation Challenge Project. The course attempts to spark an interest in science and technology in the students, with the outcome of them taking the Robotics class or joining the FRC robotics team the following year.

The curriculum begins with an introduction to Solidworks (CAD). They begin to create simple models and gradually gain an appreciation for computer-aided design and the design process. By following lesson plans designed by our own FRC mentor, Mr. Stehlik, students are guided through the preliminary step of the design process. They are tested on occasion with CAD quizzes and complete assignments such as modeling a water gun.

Once the first third of the course has been completed and the students have mastered the basics of Solidworks, they move into the second part – programming. Students learn basic and intermediate elements of RobotC including autonomous coding, light sensing, ultrasonic sensing, and using encoders. They gain this knowledge from the lesson plan designed by team mentor Mr. Stehlik and taught by team mentor Mr. Grant. This section culminates in a programming challenge that varies every year. This year, students had to traverse a maze using only light and ultrasonic sensors. In the few weeks they were given from start to finish, every student was able to complete the challenge.

The final third of the course allows students to gather all of the knowledge they have gained and apply it to a final project. First, the project required students to CAD a part that would attach onto their VEX Squarebot to complete the following challenge, called Robo Ringer.

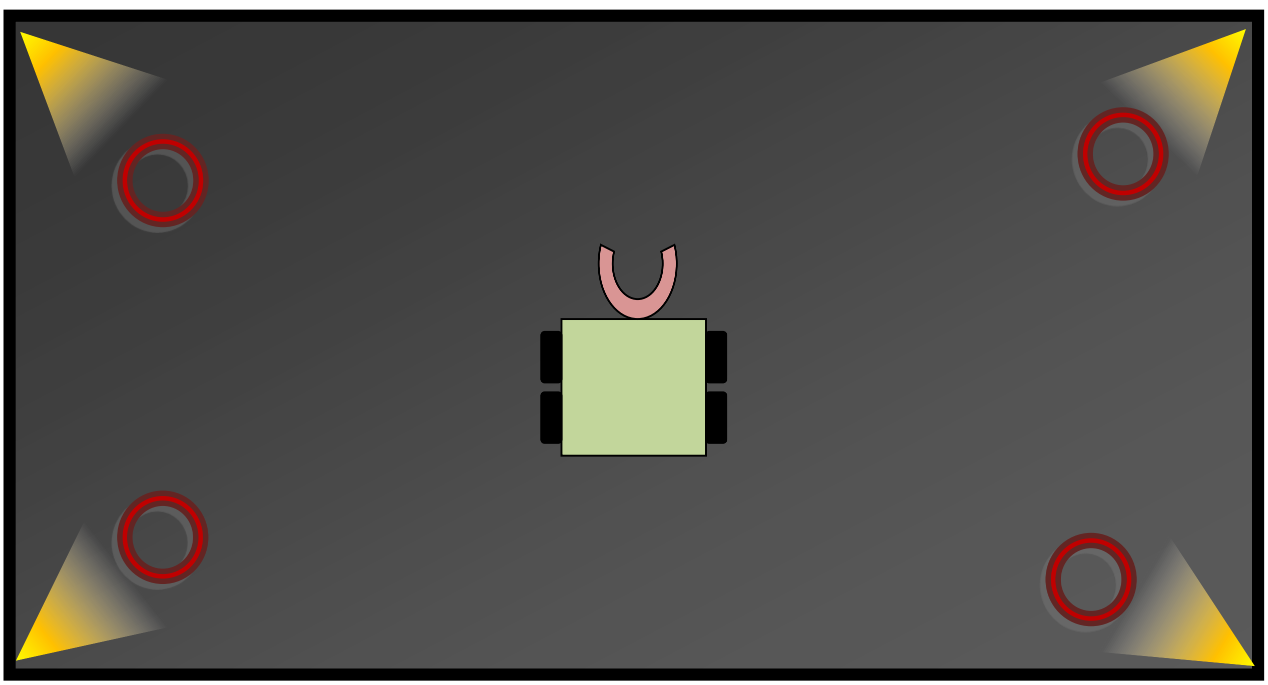
<u>Robo Ringer</u>

Your challenge is to design and build a mechanism for your robot that will enable it to transport rings.

The robot will start in the middle of the table, and attempt to collect a ring from one of the corners, and then transport it to the circle in the middle of the table. To aid in navigation, lamps will be placed in each corner so the light sensors can detect them. Only one lamp will turn on at a time. Once the robot has successfully retrieved a ring and placed it in the middle circle, another lamp will turn on, indicating where the robot should go next.

The rings are made of plastic and are approximately 3.5″ in diameter, and 1.1″ tall.

Your mechanism has to lift the ring off the floor. The goal is for the robot to autonomously retrieve all the rings as within a 1 minute time period.



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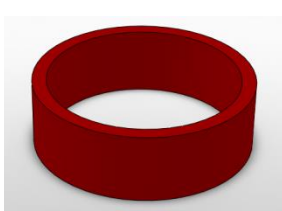
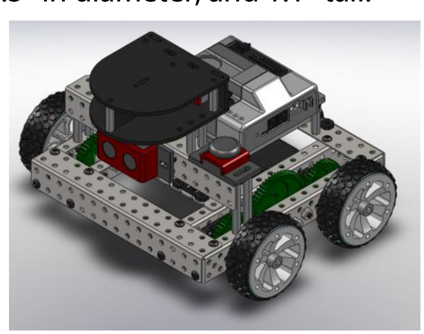
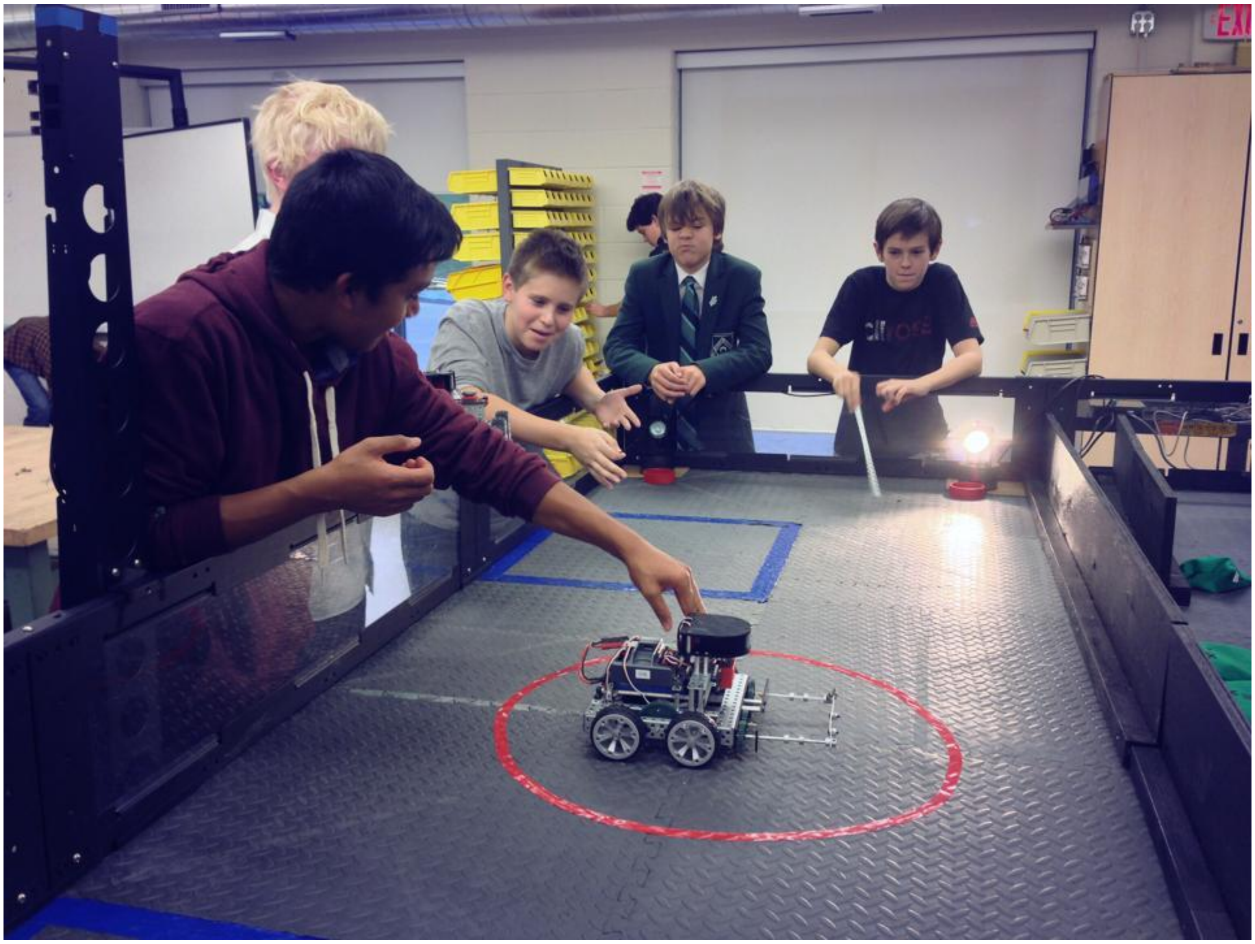






Grade 11 Technological Design

At Crescent School, one of courses that is offered for Grade 10 and 11 students is the Grade 11 Technological Design class. This is class is meant to offer a course that will show students what engineering is all about. The course uses students' prior knowledge from the Grade 9 Tech class and begins to build upon these skills. The first term is finished with the students splitting up into 4 teams and creating VEX robotics robots that they use to compete at VEX competitions. This was the first year that the tech class went to two different tournaments with their robots. Their first tournament was the inaugural Crescent VRC Qualifying Event. The next tournament that they travelled to was the tournament that all the prior classes have gone to. They travelled down to St. Catherine's to compete in the Southern Ontario Vex qualifying event. Once the students return from the holiday break, they begin possibly the most exciting and interesting projects you can complete while at Crescent. The students in the class are given the opportunity to design and build another VEX robot out of custom metal. The students begin by CADing their designs; they can then create drawings of every part and prepare to cut the parts to their requirements. The students have the opportunity while making these custom pieces to use the Mill, CNC, and Lathe, Chop saw and drill press. In addition, the students have the opportunity to program the robot themselves. At the end of the year, the final exam consists of three parts. The first part is programming skills. This is where all of the robots and teams are able to program the robot. With these pre-programmed functions, the robots are supposed to score as many points as possible in 60 seconds. The next part of the exam is robot skills; this is the same as programming skills, except the team is allowed to control the robot with the controller. The final part of the exam is a tournament that has all the teams and their robots face off against each other in 2 v 2 matches.

Hosted Tournaments

First Lego League

610 has been running the FLL Middle School program since 2003. The program was launched after veteran mentors Mr. Grant and Morrison first discovered FLL at the FRC World Championships in 2002. They were very impressed with FLL and in that moment, they decided to bring it to our school. The two mentors immediately worked together with FIRST Robotics Canada to not only implement FLL in our school, but to spread it across the province of Ontario and further afield. They were successful that the following year, they hosted the 2003 Mission to Mars Inaugural Ontario Provincial Championships in the school's field house. Since then, we have worked tirelessly to improve the program for our own students, and for the attendees of our regional event.

Each year, a large group of young, aspiring engineers from grades 5-8 accept the Lego League Challenge. The purpose of the program is to promote science and technology through creativity and teamwork. We want to show students, at an early age, that robotics is exciting. The ultimate goal is that the children will continue their involvement in robotics, or at least take away other skills they have developed from the experience. Many of the students on team 610 have competed in Lego robotics. Most would say that FLL at Crescent was what first got them excited about robotics and technology, and they would attribute their high level of involvement in FRC to their enriching, enjoyable FLL careers.

Our FLL program has been able to thrive to this day because through the help of our dedicated mentors and every member of the FRC team volunteering their time. Middle school teachers mentor the youngsters while balancing numerous other responsibilities. Over the years, they have been able to make the program extremely fun and educational for the students. Every year, the FRC team volunteers to host a regional FLL competition, with around 20 teams returning to compete every year. Our Crescent teams may not always come out on top, but are very big advocates of self-improvement and selflessness. Even at such a young age, the kids do all they can to improve their robot, regardless of whose idea it was; they want to do the best job they possibly can, and it is this wonderful quality that continues to be reflected years later in the 610 FRC team. Crescent's FLL program clearly sows the seeds for the future.

Crescent VRC Qualifying Event

This year, Crescent hosted our inaugural Vex Tournament. The tournament hosted 16 of the most talented teams from around Ontario including 4 teams from Crescent School. The tournament was held in our Centre for Creative Learning and the tournament field was located in our theatre. The tournament gave teams the opportunity to qualify for an Ontario Provincial Championship through robot and programming skills.

Community Outreach

Sunnyview School

A program in which Team 610 has delved into, is the effort to improve the quality of education at Sunnyview, a special needs school in Toronto. Beginning in 2010, our robotics team began partnering with Sunnyview Public School, a local elementary school for disabled children. Our contact at Sunnyview is Dale Zimmerman, a renowned education assistant who specializes in adapting toys and education specifically for each child's needs. Her goal is to give the children a greater level of independence, and results have been astonishing. Our robotics program has connected with Dale and has offered to lend some assistance with mechanizing some of her adapted toys. Last year, we worked on motorizing a mirrored wheel, which is used to stimulate the children's senses. The motorized wheel was built with a switch, and depending on the child's abilities, the switch can be modified to suit them.

In the past, we have taken on several ambitious projects, including the collaboration with the art teacher at Sunnyview. The first project involves the modification of a paint spinner. Several of our senior members have taken on the challenge of building both the spinner and the paint dispenser from scratch. This involves a detailed design in CAD, selecting the proper motors and gears, wiring up a power supply, and cutting the parts out - essentially all of the skills obtained during a robotics build season. Another project we are currently working on is converting the controls for a toy to make it more suitable for disabled kids. The “Color Bug” is a commercially available toy that has a marker attached to a remote-controlled car in the shape of a bug. Sunnyview has had a number of these toys donated to them, but while they are immensely popular with the kids, the fine motor skills required to operate the joysticks have proven to be far too difficult for the physically challenged children to truly appreciate this toy. We have taken on the project of converting the controller to one with touch-sensitive buttons, so less precision is required. The last project Team 610 is helping Sunnyview with is converting a toy similar to a spirograph to be remote-controlled, making it more accessible to the students.

It has been very rewarding for members of the robotics team to take some of their skills acquired during the robotics season and apply them to a real cause. For some of the students that helped out, Sunnyview was more than just a technological case project - it was a place with life, hope, and shared excitement for technology. We hope that our partnership with Sunnyview continues to flourish in years to come.

Grade 12 Technological Design

A program offered to Grade 11 and 12 students alike, the Grade 12 Tech Design course is the highest-level technology course we offer to students. Building on knowledge gained from two previous years of robotics instruction, students are given the opportunity to use their skills to impact the community. Taught by two Woodie Flowers Finalist Award winners Don Morrison and Shawn Lim, students are instructed by knowledgeable, highly certified mentors. The course, which can be divided into 3 major parts, is how Crescent School prepares our students for University and for FIRST Robotics.

The first few months of this course is dedicated to refining students' skills in the workshop. They have regular CAD quizzes and practice machining parts, to ensure they are experts at using the tools they will need later in the year. The beginning of the year sets a solid foundation, allowing the rest of the year to run smoothly. By the time January rolls around, every single student can confidently contribute to building the FRC robot.

The limited time Team 610 has to build the robot is expanded thanks to the students in this course; many of which are on the FRC team. Since our team machines an enormous amount of parts ourselves, it is greatly beneficial having students making them during class, expediting the process. Students partake in other tasks such as constructing field elements and assembling machined parts onto the robot.

In the final part of this course, we partake in a program that is dear to our hearts. For many years, we have been working with Sunnyview Public School, a school for physically disabled children. Students in the Grade 12 tech course are challenged to build toys for these children with simple controls, so they can also play with fun toys. A notable toy made for them in the past, built by alumnus Aidan Solala, is a remote control ladybug operated by large touch panels. This is yet another way Team 610 reaches out to the community, and a cause we believe impacts us the most.

The Grade 12 Technological course gives students the opportunity to refine engineering skills, contribute to the FRC robot, and impacts the community though our connection with Sunnyview Public School. Led by two outstanding mentors, this program is one we are proud to have at Crescent.

Design Process

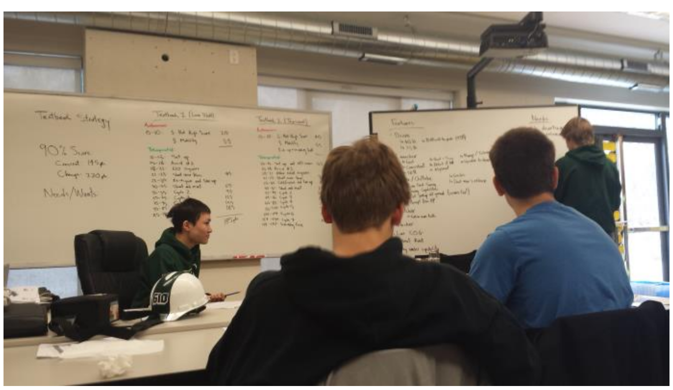
Saturday, January 4th – Kickoff Day

The 2014 FIRST Robotics Competition game has finally arrived! Everyone gathered in the Centre for Creative Learning, all extremely eager to see what this year's game would be. Much speculation was heard from our team, as well as two other teams we had invited to watch the webcast with us. After watching the game animation, people were saying, "Hmm. This game seems pretty boring," or, "I wonder if defense will be important in this game!" Little did we know how much of a key role strategy would play this year. We headed to the lab to study and learn the rules thoroughly, which is how we always kick off the season. We can't brainstorm or make any decisions until we understand our limitations. Our next step was to discuss the strategic aspects of Aerial Assist and deciding on the score we would need to win 90% of our matches at both a regional and the Championship. The figure we came up with for our robot was 185 points.

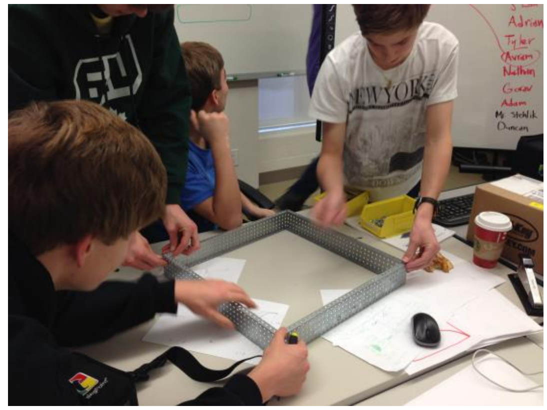
Meanwhile, a Quick Build was being hosted for 18 local teams in the school's Field House, helping them build their kitbots. It can extremely beneficial for teams to get their kitbot out of the way so they can focus on scoring and the other aspects of the game. Our new grade 9 students joined them and were able to build a kitbot of their own. They did an excellent job!

Sunday, January 5th

Two important tasks were completed the day after kickoff. First, we wrote a rules quiz that was prepared by our administration heads, Jason and Neal. The minimum grade was 80% to pass. Team 610 does this to help make sure the students thoroughly understand the rules. Secondly, we created our second-by-second textbook strategy and list of needs and wants for the robot. The textbook strategy outlines everything our robot will do in a match while closely estimating the time it takes to perform a task. Doing so leads us to create a list of things we need the robot to do in order to fulfill the textbook strategy. To that list, we also add things that we want on the robot – things we aren't sure we need but would be nice to have if possible. Our preliminary textbook strategy can be found at the end of the notebook. At the end of the day, we split up the robot into 3 major parts and within that chose designs to prototype. Every student was assigned to work on either the launcher, the catcher, or the intake.

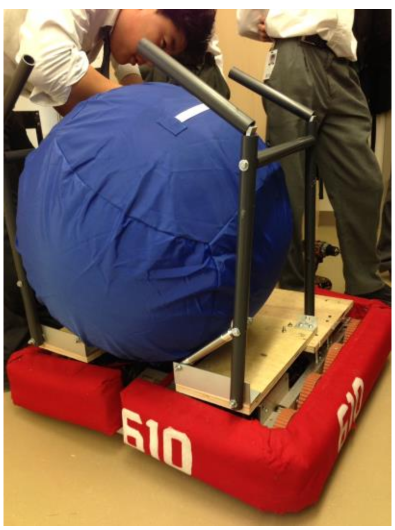


Monday, January 6th



Today we tested three types of intakes and will be moving forward with the two angled rollers, which we are beginning to take full-scale. We put bumpers on our preseason drivetrain and will be putting the full scale intake on it for testing.

First, we tested a wheel shooter. It could not get enough propulsion on the ball, so we decided to focus on the catapult and kicker prototypes. By the end of the day, the catapult proved to be effective, so we decided to take it full scale. The 60% scale kicker is now complete.
Jonathan Pearce and Matt Riley, our Grade 11 assistant heads of the Design and Manufacturing division, continued to work on the new drivetrain.
Jake Fisher, a Grade 12 student, used calculus to determine the optimal distances, heights, angles, and launch velocities for shooting at the goal to get the window of shooting with the largest angle.



Tuesday, January 7th

We machined some prototype parts for the catcher and the necessary materials (pistons, PVC, etc.) to start building it. Some grade 9 students assembled two VEXpro VersaPlanetary motor gearboxes for our intake.

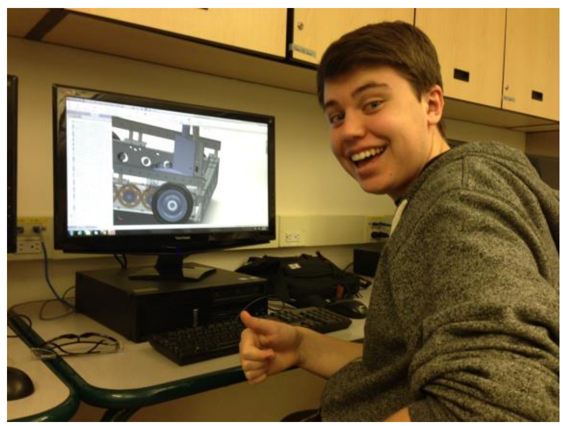
For our Android scouting app, the programmers worked with the strategists to run match simulations. From that, the strategists determined what they wished they would have known about the robots in the match to make sure that the form covers everything.

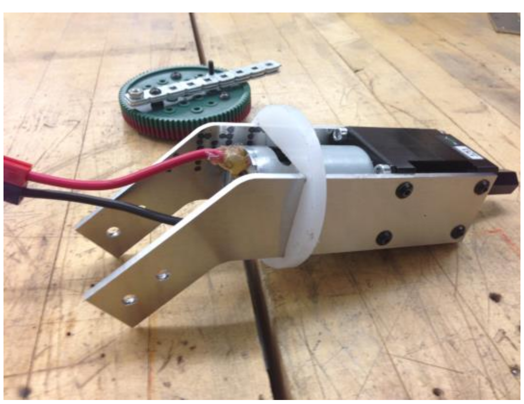
Jamie Rose, a Grade 12 student in the Design and Manufacturing division, took Jake Fisher's calculations and created mock ups in SolidWorks to see if balls would in fact hit the targets. Jamie also investigated the checkmate shooting position, which is up against the front of the low goal, the hardest place to defend against. With that, Jamie will determine how we can hit shots from both distances, while changing only one of launch height, launch angle, or launch speed.

Wednesday, January 8th

The prototyping stage is in full swing! Jake Fisher and Jacob Kachura, a Grade 12 student, worked on the intake in SolidWorks and were able to finish the CAD model. Mr. Lim and

several students continued with their catapult CAD model, which served as a learning opportunity for the Grade 9s to learn the basic principles of design. Meanwhile, Taran Ravindran, a Grade 12 students and one of the heads of the Design and Manufacturing division, was working on pinpointing a location for the cam on his catapult model, aiming to get his catapult CAD done by the end of the week. Matthew Lang, a Grade 12 student in the Energy Systems division and our driver, and David Ferris, a Grade 12 student and head of the Energy Systems division, were working with the catcher prototype on our preseason drivetrain, along with Ian Lo, a Grade 11 student who is head of the Programming division, to get the PVC tubes to catch balls. They got the pneumatics configured and we were catching balls with ease! Our eager to learn Grade 9 and 10 students shadowed our seniors as they worked on all these things. Jonathan Pearce and Matt Riley, the drivetrain duo, put channels on the drivetrain CAD model as bumper mounts and had to ensure we were within bumper rules! Finally, Jeffrey Seto and Adam Murai, two Grade 11 students in the Programming division, continued to fine tune the scouting application with some help from Jason Spevack, a Grade 11 student who is head of the Business and Administration division. A lot goes on during week one!





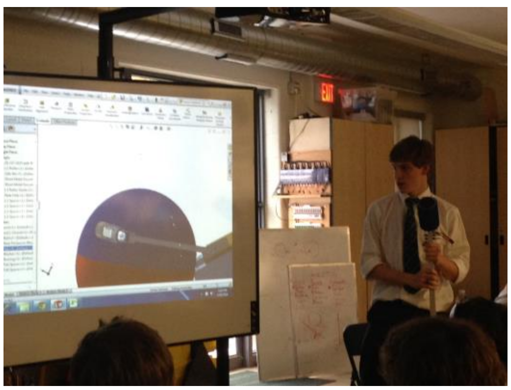
Thursday, January 9th

Today, Jake Fisher, Jacob Kachura, and their team made parts for the intake, which was finished in SolidWorks yesterday. The catapult groups worked on finalizing their CAD models. With the Design Review just one day away, our groups worked on finalizing their CAD models because in the design review, everyone's models are thoroughly critiqued. In a Design Review, we carefully go through each prototype design and discuss the strengths and limitations of each one.

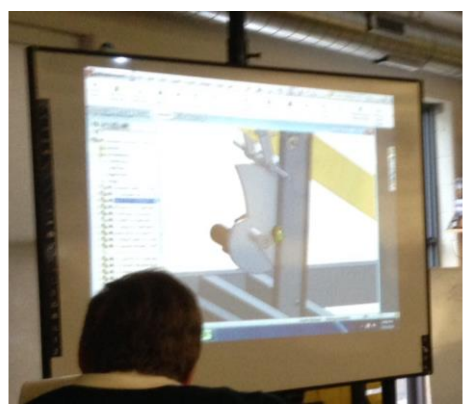
Friday, January 10th

Today we had our first major Design Review. The whole team went over every prototype we tested so far.

Drivetrain: The current speed is quite similar to the speed of Taz, our 2013. We initially considered a two-speed drivetrain that could be optimized for driving multiple distances, but we ended up optimizing our drivetrain for 40ft. (graph) our drivetrain at this point is 28 inches by 27.5 inches. It uses gears in the drive rails, which hopefully means that no maintenance will be required. Our wheels are 5” colson wheels to give more ground clearance than the 4’ wheels we used last year. For a rocker, our center wheel is ⅛” lower than the other two. Each side of the drivetrain. The drivetrain alone is roughly 60 lbs. and includes a square channel at the front to protect from the hits we’ll likely be taking during our matches. We have started machining some of the simpler parts such as gussets.



Jacob Kachura and Jake Fisher made a machined prototype of our intake roller, which was partially inspired by Team 1625’s intake rollers from 2008. It uses two Banebots 550 motors with a VersaPlanetary gearbox for a total reduction of 15:1. It is designed to drop down from the drivetrain and almost reaches the limit of 20 inches. The rollers will possibly run at a speed equal to the drivetrain, so if we go to pick up and then drive back, we won’t lose the ball due to the drive overpowering the rollers. The initial testing has been quite successful, but the mounts need to be more robust for future versions.



The current design of the catapult that is the farthest in the prototyping process has an arm that starts 35 degrees below a line that is parallel to the ground. It then goes 47 degrees above parallel, giving 82 degrees of 1wrotation. We decided to go with a cam rather than a winch because we haven't had much success with winches in the past and there are fewer components to work with. The disc allows for the continual lowering and firing of the catapult, using the stored potential energy in the springs or elastics and transferring it into kinetic energy. The catapult uses a 100:1 gear reduction on a bag motor and takes about 2 seconds to reload after firing. It will be controlled by an optical sensor that uses stripes on the disc, which allow the optical sensor to detect the position of the arm. The end of the catapult will also have a tray for the ball to sit in. We are going to start machining parts today.

Catcher: Utilizing the 20inch expansion rule, folds out to ~18”, and back in to catch. Pneumatically actuated

After the design review, the Intake group was able to successfully mount the angled rollers to the drivetrain. We picked up balls for the first time. The angled rollers are especially great at picking up balls to the side. It failed at picking up balls head on, though, because the unsupported bars had too much flex. We expect to solve this problem by adding pistons and additional supports.

Week 2

Saturday, January 10th

Our students were in full throttle today! All the machines in our shop were being put to good use. Our catcher team attached an optical distance sensor that allowed the claws to close automatically when the ball is sensed. The intake team added pneumatic pistons to drop down and lift the rollers for the intake system. They also sat the bar inside a C-channel to provide a more stable mount. They ran successful intake tests with these modifications. Everyone pitched in to machine parts for the catapult and the drivetrain. By the end of the day the catapult was completed and the drivetrain was 50% machined!

Monday, January 12th

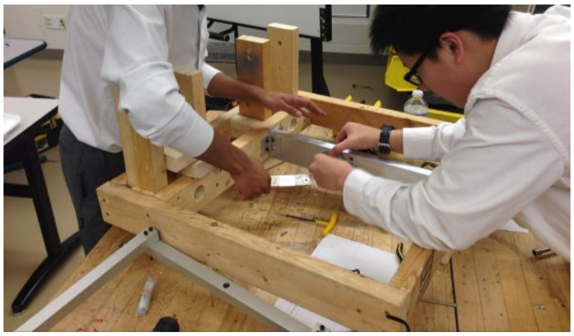
The intake team used a wood block to secure the intake, but it was split by the force of the actuating pistons. They made a sturdier mount, using metal to secure the apparatus.

Behind every success is many failures. The catapult was fully built and ready for its first test when a piece broke off and flew farther than the ball. The team sat down and isolated the problem and began to fashion a new seat for the ball and made sure it was safe for test two.

The catcher team mounted the PVC tubes at a 45 degree angle with a pneumatic system to open and close it. They also began to add surgical tubing to try to test a net system on the catcher to attempt to catch the balls with less chance of losing the ball.

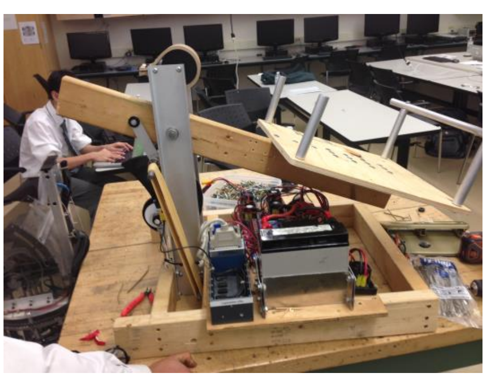
Tuesday, January 13th

We popped our first ball today. Rats. It ok though, our quick thinking team "fixed" it within minutes! Despite this, we made considerable progress in other areas. For the catching prototype, we used string to create a catching net that contained the ball fairly well. We noticed for the catcher to be effective, it has to close on the ball. The catapult beams may take a whole side of the robot, so we'll need to use space on the sides for the catcher. For the catapult, we repaired the basket and installed a stronger one, mounted the electrical panel to the base, and it's now ready to test. The intake ground found we had a dead spot behind the rollers, which was fixed by adding surgical tubing at the base of the arms. A Grade 10 student worked on CADing a winch design for a shooter. We also finished CADing another type of shooter, with what we call the choo-choo linkage. We had a quick discussion about rule updates so that everyone was on the same page.



Wednesday, January 14th

With the intake, we're moving into second iteration, and will be making a few modifications. 1. We don't want it to get damaged when the arms stick out of the robot, that's going to be taken into consideration with the design. We tested the catapult today, and got it shooting into the high goal from 14 Ft., though it could use less flex on the arm. In the future, we'll test to see what our actual release angle and range is. Made updates to the intake on the preseason drivetrain, looking for a design that will go on the final robot. one problem that need to be solved is protecting the intake from side hits, two pieces of channel on a pivoting point that absorbs shock, new mounting system that can integrate into the real drivetrain. Redid the catcher with wings instead of a catcher on the back, since the catapult will be on that side.



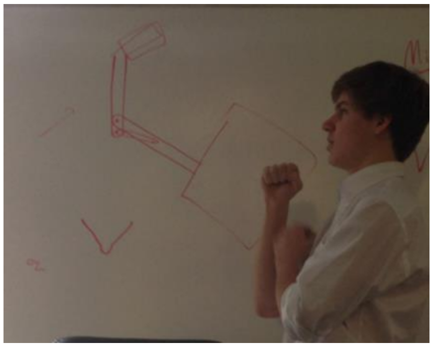
Thursday, January 15th

Today we will be playing catch! At least until other designs are finalized we will test out our catcher and catapult. In other news, we have begun machining and assembling the choo-choo launcher. The CAD for the winch shooter should be finished by Saturday.

Friday, January 16th

Design review

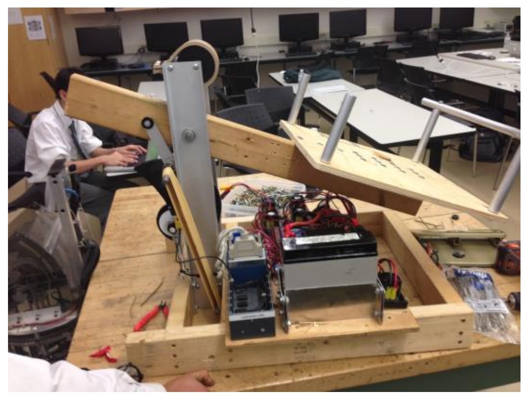
Intake:

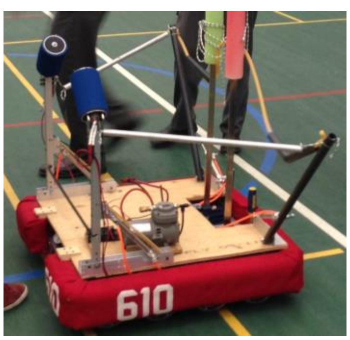


Issue of someone breaking the intake, prototype of a bendable arm, that will absorb shock if hit from the side. We aren't using tubing on the outside of the arm because it would be outside frame perimeter. Mr. Lim suggested a gas shock on the inside of the tubing that would always be pulling to keep it straight. Moving the rollers a bit closer together to help alleviate the dead spot. We could also remove the side wall of the tubing to allow it to flex either way, might reduce intake efficiency so we need to think about that.

Shooter

Cam shooter is working! The biggest problem was that the cam follower was causing the plastic cam to diverge, we were able to get a pretty consistent shot from 14ft. We tightened it and will test again. For the lone wolf strategy, the shooter angle would be too shallow to catch it. We will be investigating a deflector to steepen the angle, enabling us to catch the ball





Catcher

It can't interfere with other system, must have the weight for it. Trying to minimize the footprint. In the cad, we have a telescoping arm that will extend as the bars lower. The ball can't get under the crossbar so we don't need a net. Using surgical tubing instead of a telescoping arm would not work because it doesn't fold back in very well

Winch

Mr. Stehlik doesn't like it. 350:1 gear ration, Piston + dog gear. Rope is always tensioned. Cons: hard to pull out a dog when it's under a large load.

We also discussed whether the intake should be relative to the direction we shoot, and how to use the battery to balance the force. Our only option is to have a rear intake. The battery should be generally away from catapult tower, however it might be off center to allow the catapult basket to dip lower. We talked about a great strategy, shooting over the truss to the human player, then being re-fed. As well as a deflector to get it over the truss and pass to another robot. A deflector that can double as a blocker by extending to 5ft.? There are a lot of decisions that still need to be made.

Week 3

Saturday, January 18th

Today the Choo-Choo shooter continued to be built, The Catapult went through extensive tests and the Catcher parts began to be machined. The pivot point of the catcher was decided on.

The energy systems division rewired set up pressure sensor, added a spike on pneumatic, mounted intake and pneumatics. Jacob Found the force required to fire piston. The intake can get balls over a 19in bump from the ground so we'll be able to get it into an elevated tray.

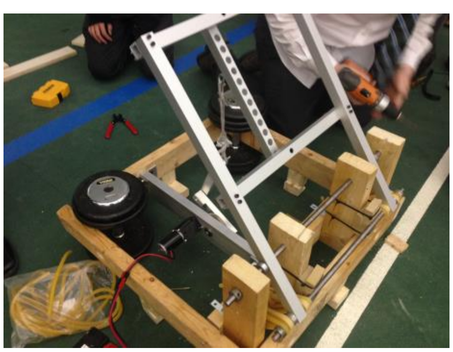
Monday, January 19th

The troops rallied together to build and assemble the high goal for testing the catapults. This is crucial for testing our prototypes. We also:

- Finished the choo-choo shooter
- Tested both shooters
- Cam performance: Needs a new ball tray!
- Choo-Choo performance: Scored first goal, but needs a lot of tweaks!

Finally, we answered the question: How many coyotes does it take to CAD a part? Turns out, the answer is 7!

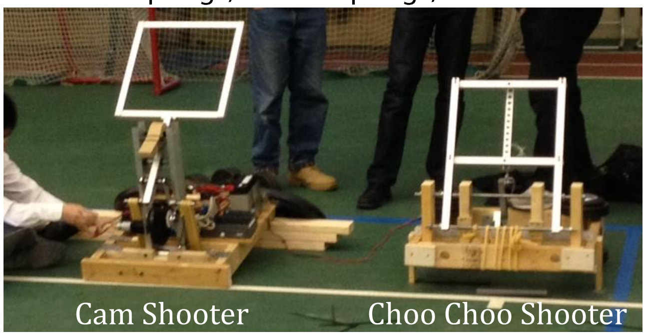
Tuesday, January 20th



Parent teacher interviews today! This means we have a skeleton crew in the lab working on our prototypes. Even with the small team, we were able to get a ton of work done! We tested both catapults. Neither shooters are consistent enough for our liking, so we'll be looking on increasing structural stability of our prototypes, and possibly even making a new prototype. Our mentor suggested a shot-put-style launcher that may prove more consistent.

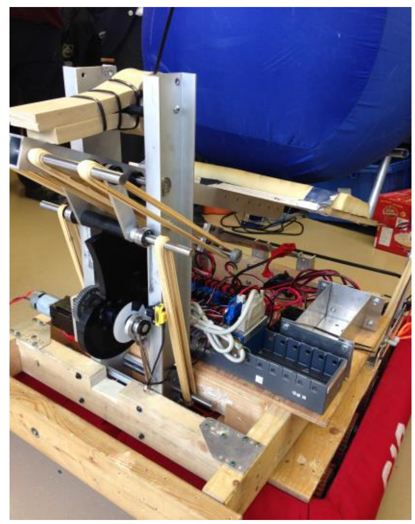
Wednesday, January 30th

Intake is going through a few different iterations. We've gone through gas springs, extension springs, torsion springs, and electrical tubing, still working on this. We had a discussion about which shooter we should move forward with, starting with a list of pro's and con's. We decided to go with the Cam because the Cam is more consistent in the sense that it does the same action every time. To improve the cam shooter's consistency, we'll use the choo-choo shooter to help determine optimal shooting angles and trays to hold the ball. A problem we saw on high speed video was that the ball is leaving the catapult before it completes its range of motion. The basket should be designed to prevent this - we tested memory foam to absorb this



Thursday, January 23rd

Today we began to talk about Passing Ideas. Since this game has such a big teamwork aspect passing is very important. We discussed and began working on lobbying ability for ball (passing techniques).Catcher CAD was finalized for design review. Even though we decided against the Choo Choo shooter we still used it for testing. We mounted Choo Choo for ball pickup and drop testing. Thomas continued to work on the sizing of the basket for Catapult.



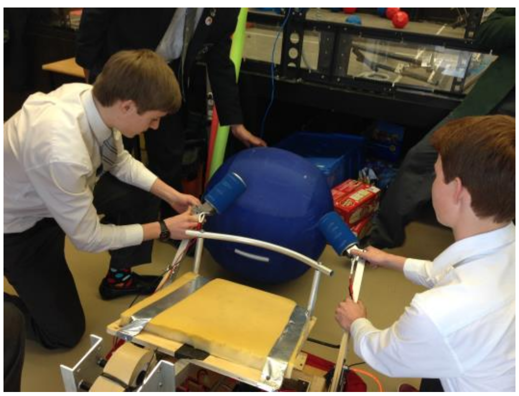
Friday, January 24th

Design Review

- Moving Pivot on arm
- Flex mechanism to have the arms absorb the shock and bend in.
- Gussets attached to 1:1 aluminum shafts to pivot
- Surgical Tubing for a spring back motion
- We talked about the electrical board spacing
- 2d Sketch of smaller catapult
  - We moved the cam offset to side
- Spring design
- Pivot height is 11
- Release Height is 32 inch from the drive train
- We're using a continuous potentiometer on the catapult
- Auton Plan to start robot in center test HOT goal shoot drive back to starting position pick up second ball shoot second ball in same goal
- Add flat backstop for ball to roll up into the basket from the intake

Week 4

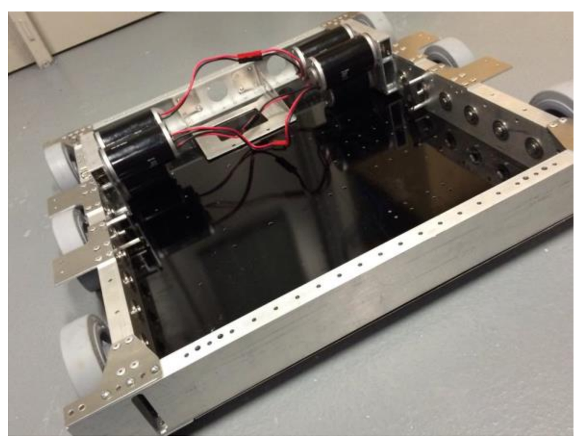
Saturday, January 25th

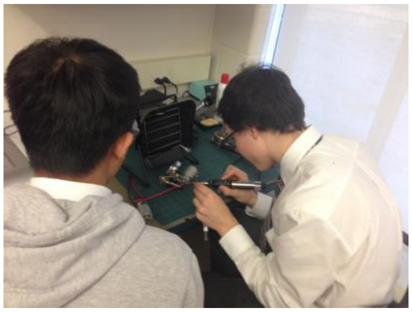


Today we attached a bike wheel cover to the catapult as a makeshift basket until we finished the basket for the catapult. A Grade 10 began the CAD for the final basket that goes on the catapult. Our eager coyotes (Gr.9's) worked on gearboxes for various parts of the robots. With the makeshift basket on the Catapult we put it through extensive testing. Testing angles, accuracy... Testing every prototype is a huge part of the process. The Intake team worked on measurements for the final Intake design.

Monday, January 27th

Another parent-teacher interview day! Meaning another skeleton crew. This was primarily a CADing day. Taran made modifications to his catapult in Solidworks, while Jake made some modifications to his intake. Thomas continue the CAD for the final basket for the catapult. Mr. Stehlik changed the angle on the catapult. We'll be testing it tomorrow to see how it fares. Matthew Lang worked on affixing components to the drivetrain belly pan. The drivetrain was assembled and handed over to electrical for wiring.



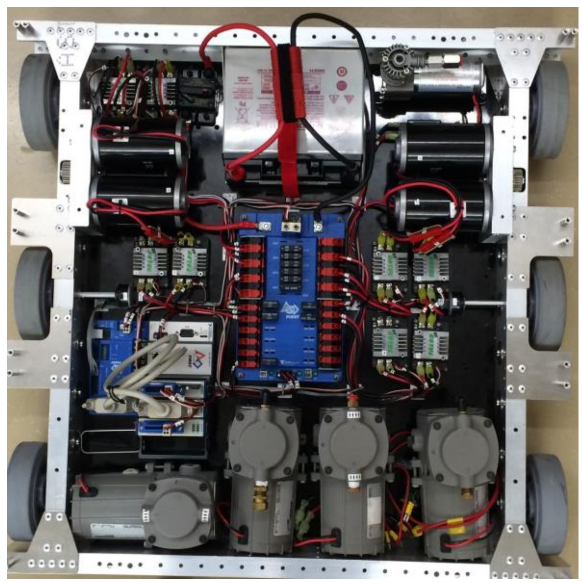


Tuesday, January 28th

Today the electrical team began wiring drivetrain & driver stations. This includes drawing out an electrical plan and implementing it. Jake and Jacob finishing the design of the new intake and are beginning to build it. Taran worked on the CAD of the final catapult. Jonathan Pierce finalized catcher the new catcher design. Matthew Reilly work on the CAD for the brace arms and the supports for the catapult arms. Programming began setting up the drive movement of drive train. Strategy continued to work on the playbook.

Wednesday, January 29th

Today, energy systems was hard at work to make sure the drive train is driving by the end of the day. The Intake group finalized the CAD, and began machining the parts. The catapult team adjusted the CAD so that it matches the shooter we've been testing. We tested the catapult and got the 14-18ft sweet spot, motor bike catapult basket.



Thursday, January 30th

Our competition drivetrain is driving because of the amazing efficiency and dedication of Matthew Lang and his merry electrical men. We also continued to build the final intake. Shooter group tweaked the hard stop to shoot 8ft and 4ft from the goal but, we decided to edit the hard stop to make lobbying easier. We are also going to try to get a steeper range to make catching easier as well. Finally we, did more catapult testing.

Friday, January 31st

Today Energy Systems took charge and put in the pneumatic system for the various parts of the robot. We continued to build The Final intake pieces were being manufactured for the robot. Jonathan worked on the catcher CAD. The Final Catapult CAD is in its final states.

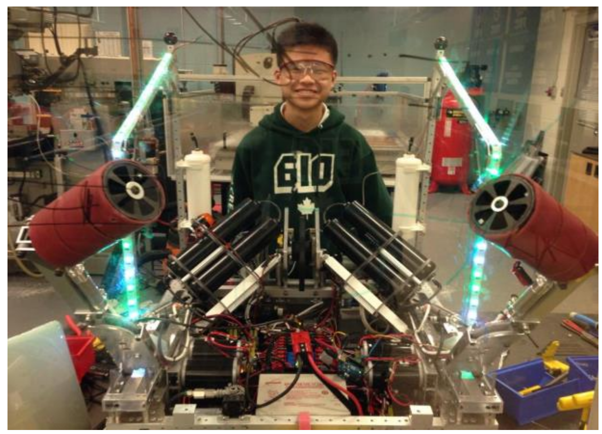
Week 5

Saturday, February 1st

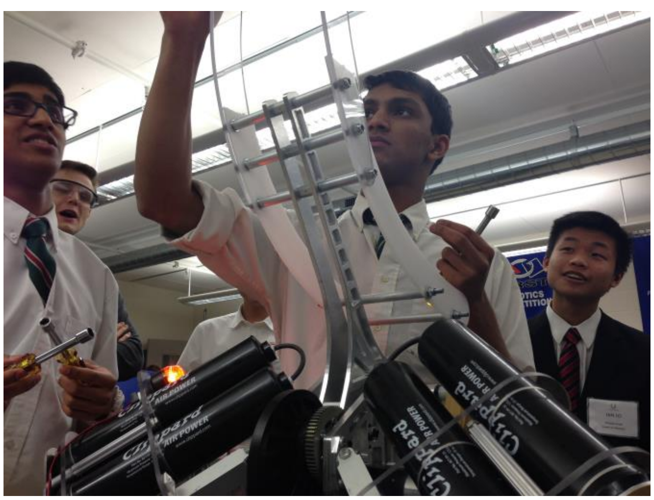
Today, we assembled the intake rollers. The Catapult CAD was finalized. We also began to machine the Catapult. We also attached the intake to the drive train and through testing we realized that when it sucks the ball in it gets flown to far. We need to decrease the force at which the ball gets the suck.

Monday, February 3rd

Today we decided we need a better tensioning system because the surgical tubing on the arm wasn't providing enough force based on the angles. It's a pain, so we're considering making the arm one piece and not have it breakaway at all, and be prepared to replace it if it breaks.



Shooter is being machined, with a few that have to be done on the CNC Mill. We hope to finish machining by the end of Wednesday, with a day and a half after for assembly. Then it's one motor and an optical sensor for electrical. We're cutting it pretty close for the programmers to take over, it will be a fun week 6 for them!

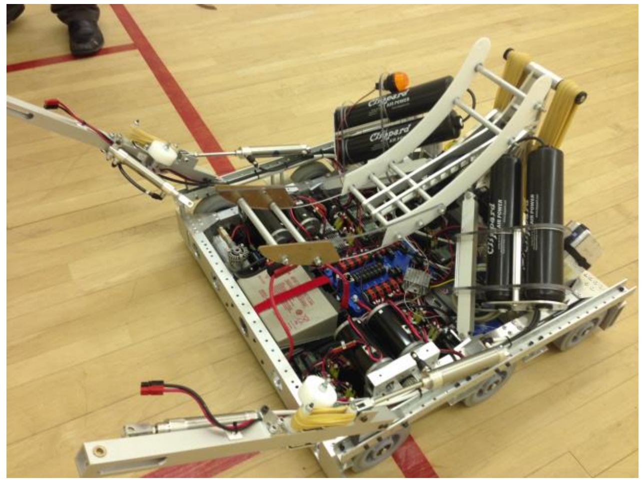


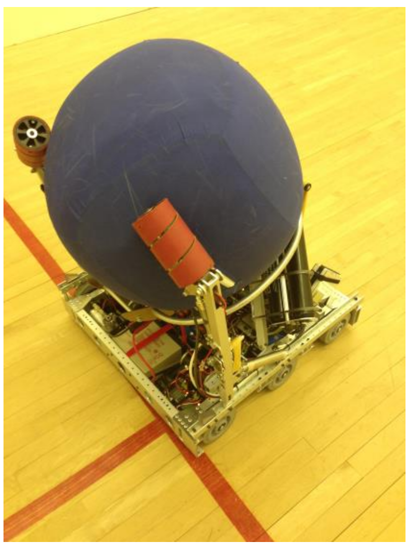
Tuesday, February 4th

We decided that on the Intake Torsion Springs instead of elastic bands. With the entire catapult machined Matthew and Taran began assembling it. Energy systems began to attach a sensor and the radio on Catapult towers for autonomous. They also need to adjust the tubing for the air cylinders so it doesn't get in the way of the rest of the robot. Jonathan Pearce continued to CAD the catapult.

Wednesday, February 5th

Today the programmers demoed the Android scouting app which they've been working on for a while. It's a great interface that will send all the data to a server and give our strategists remote access. It's paperless, it's fast, and it's easy! Tested the intake, rollers were very grippy and powerful, it kicked the ball up pretty high. We are going to regulate the force with which the piston pushes down to absorb some Still have to replace the elastic with torsion springs. We can almost shoot with the intake eyebrows up, need to file away the obstructions. We can spit out the balls when it's in the catapult. We finished assembling the shooter and are waiting on a few





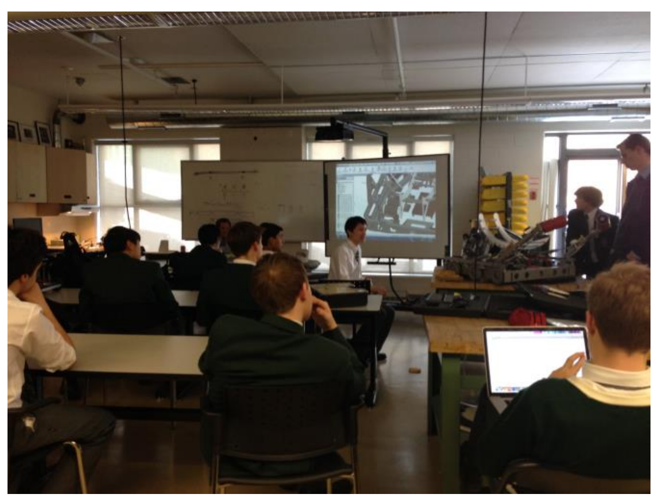
specific screws and small things.

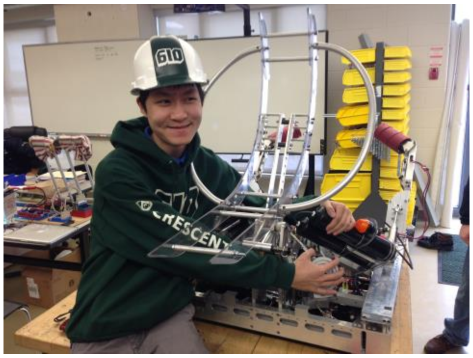
Thursday, February 6th

Torsion springs came so we implemented that on the intake so there is more of a consistent spring out action of the arms when they bend in. Also, we were able to get the plates from bending. Shooter is going on today, and we should be shooting by the end of the day Strategy did a presentation on their Playbook, and mock matches to show where we'd implement these strategies.

Friday, February 7th

- Shooter
  - Final Shooter Testing. Shot too shallow remade some Lexan pieces to raise the arc.
- Energy Systems
  - Power cord for radio
  - Camera
  - Ultrasonic
  - Ring Light
  - Mount camera
  - Tubing





- Catcher
  - Catcher Design-Jonathan Pearce
  - Elevated 8-10 inch above drivetrain
  - 1 inch stroke cylinder
  - Aluminum
- Intake
  - Slowed down
  - Breakaway point or Not
  - Rigid intake that we accept that it can break and replace
  - Or with bend so that we can be hit.
- Drivetrain
  - Replace c-channel with box channel for more rigidity
- Programming
  - Reimaged the CIRO
  - Optical sensor on Shooter
- Strategy
  - We can shoot in Low Goal and High Goal!

Week 6

Saturday, February 8th

Taran

- Tried the change the ball tray
- Lower shot angle

Tam, Pearce

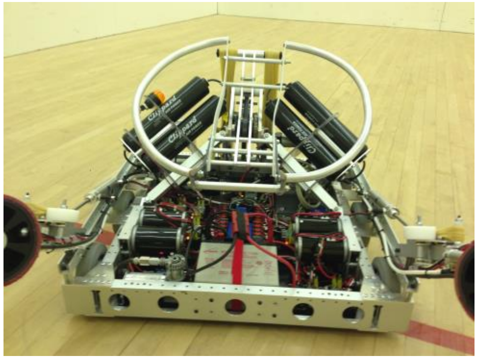
- Finished CAD For Catcher

Shooter Testing - 4-18ft range, with a dead spot due to a high apogee

Programming: Got the Variable hard stop working, going to start on tracking.

Monday, February 10th

Today we will be manufacturing and testing a bunch of different 'fingers' with slightly different geometry to adjust our shooting angle as necessary at competition. Today we got the hot goal LED strips working, we are using an Arduino to switch between strips.

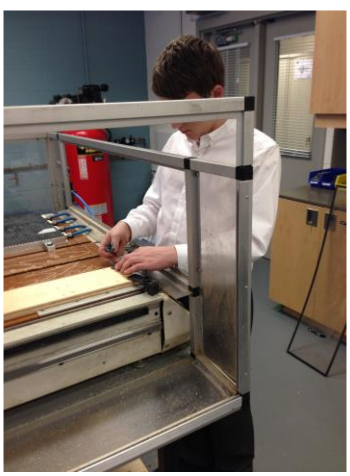


Catcher Design Review:

There were issues with the intake flopping side to side, and some weaknesses with the breakaway point. The 3 by 1 tubing gives a stronger mount on the base, and and the pivoting mechanism was also strengthened.

Tuesday, February 11th

The intake and catcher have parts that need to be machined (like a lot-there's a fat stack of drawings maybe like 20-30 parts most of them X2 or X4 so were talking like 75-100 parts in to total) the stack of drawings is just outside the shop, each drawing has a machine type (mill, router, CNC mill) (CNC mill and router drawings are for stock and so we know how many to make), as well as a quantity. Our team members will grab a drawing and make the part and there will be a bin in the shop for them to put the finished parts. There's a lot of them so Wednesday we'll be making parts.



After the CAD is completed we use this process a lot. We have faith that our team members will see our parts list and know this is the part that needs to be made

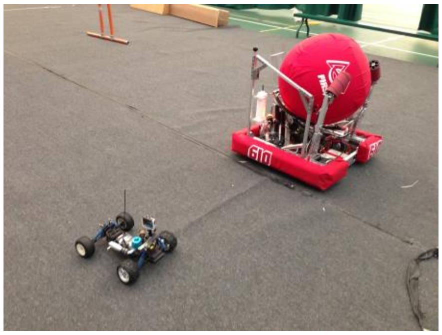
Wednesday, February 12th

The old catcher aided catching horizontally and laterally. David Ferris and Jonathan Pearce worked on redesigning it. We also ran our extensive Human player Tryouts. We make sure we pick the best Human Player possible. With less than a week till Bag day we are putting our robot through extensive shooting tests and driving tests.

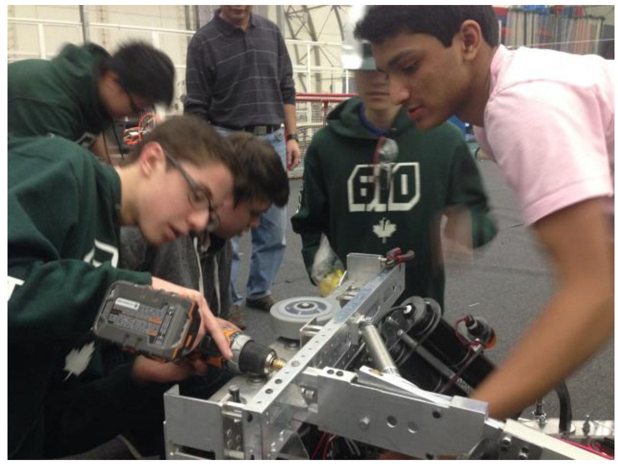
Thursday, February 13th

Today, we finished manufacturing the intake roller changes. Ian Lo worked on Auton our 2 ball Auton. Jonathan Pearce and David Ferris continued work on redesigning the catcher so that it can catch balls in more than one position.

Friday, February 14th



Since this is the last weekend of build season we opened up our field house (home of this year's GTR west) and set up a makeshift field for other teams to utilize and enjoy. Today we worked on the set up on this field. We also began manufacturing the brand new Catcher. After extensive testing we decided to make our shooting arm more consistent. We began to redesign it so we can shoot more accurately.



Saturday, February 15th

We opened our Field House and had an amazing turnout many teams came to practice with us. Our fully assembled drive team were learning how to work efficiently together. The new shooter arm was manufactured.

Sunday, February 16th

New shooting arm is good. No signs of problems, we are shooting consistently again. Jake(Drive Coach) directed the team to do multiple drills; Matt(Driver), Joseph(Operator), Michael(Human Player) are getting a better feel for how to make the cycles as efficient as possible. Ian coded an "auto shooting" using the ultrasonic range sensor. Joseph can hold the button and once the robot is in shooting range, it will fire. Taran replaced the shooter "C" arcs because we found cracks after the morning drills. New one is more robust and the issue has disappeared. More practices in the afternoon (with light to aggressive D played by Henson and Ian.) 2-on-1 and 1-on-2 scenarios. Shooting on the run is very helpful. Fade-away shot is especially efficient because we don't have to slow down to come back to accept new ball. We wrapped up the day with a couple of 2-balls Auton (both hot).

If we have the right springs, we might add some power to our shots to give us three more options. (More reliable fade-away shoots, better angled shoots and 3-ball Auton). If we have the added range, we can win most qualification matches running lone-wolf. The intake arm is showing some stress fractures, Tam is looking at it. Ian is looking to add a 2nd ultrasonic sensor to have a backup reading if one is blocked by another bot. And an optical sensor to detect ball presence. Cover sheet for electronics has been built and attached. Some known burning smell was noticed. Need to investigate.

Monday, February 17th

We finished up build season by running extensive tests and games. Today we filed down edges and made our robot perfect for Bag and Tag.

Tuesday, February 18th

The last day of build is upon us, and we are hosting our reveal tonight for our brand new robot named "Stingray." At this event we host annually we invite parents, alumni, sponsors and students to celebrate the hard work all of our team members' success. At this event we played the release video made by our students and then we demo the robot. After this event we do a short Q&A followed by a reception. At the end of the night we bagged and tagged the robot.