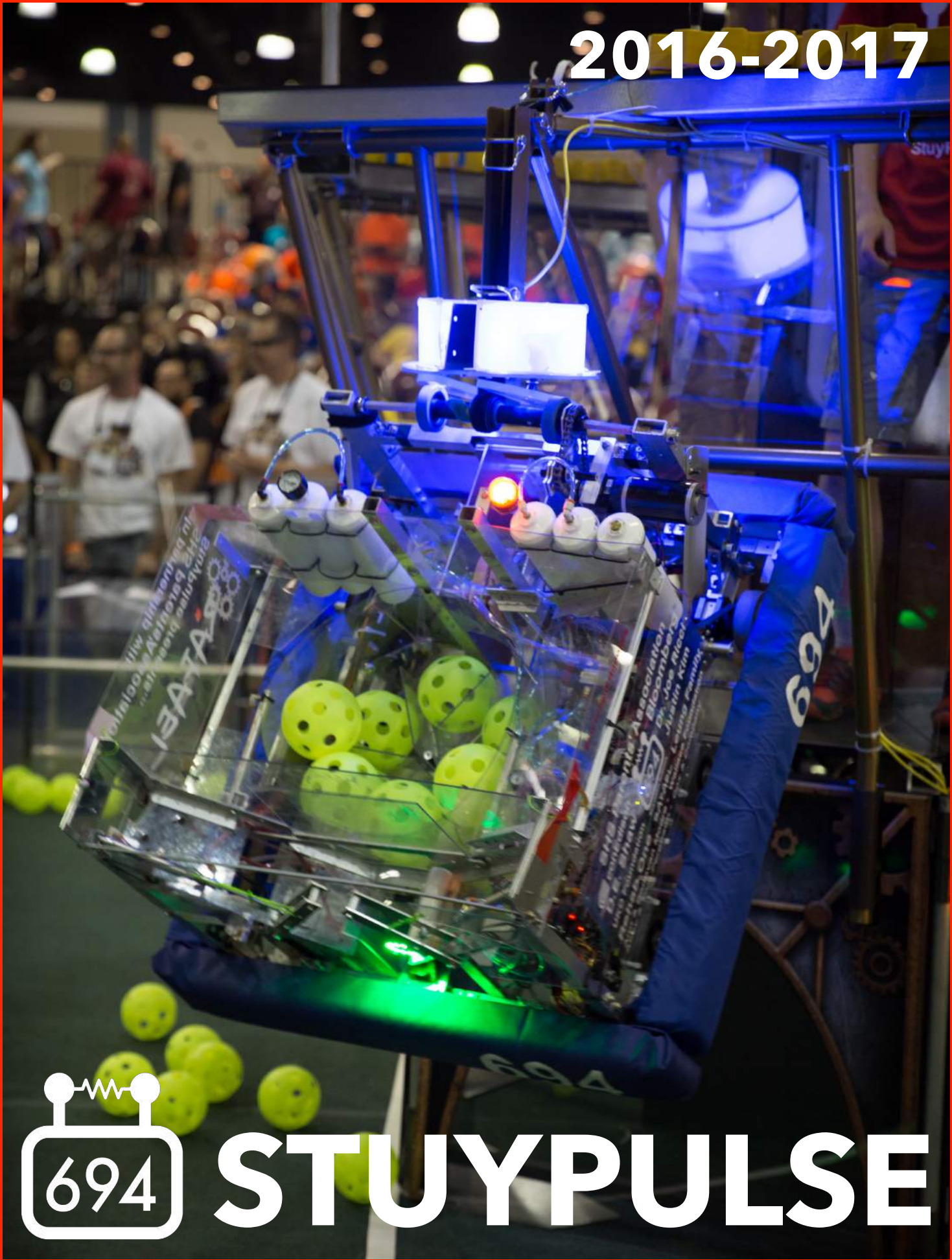


2016-2017



STUYPULSE

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2016-2017 Magazine  
Created by StuyPulse Marketing

*FIRST*  
*FIRST* Robotics Competition  
*FIRST* STEAMWORKS<sup>SM</sup>

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# MEET OUR BOARD!



Jonah Sachs-Wetstone  
*President of Engineering*



Courtney Chiu  
*President of Marketing*



Wilson Berkow  
*President of Software Eng.*



Levi Olevsky  
*Vice Pres. of Engineering*



Lamia Bushra  
*Vice Pres. of Marketing*



Adris Jautakas  
*Vice Pres. of Software Eng.*



Anthony Zeng  
*Director of Electronics*



Brian Leung  
*Asst. Director of Electronics*



Arpita Abrol  
*Director of Lab Op. & Safety*

# MEET OUR BOARD!



James Smith  
*Director of Procurement*



Meredith Hu  
*Director of Field Construct.*



Anya Keller  
*Primary Machinist*



Christopher Sherling  
*Director of Strategy*



Piotr Milewski  
*Asst. Director of Strategy*



James Wang  
*Webmaster*



Winne Lin  
*Director of Finance*



Dana Yang  
*Director of Operations*



Yedoh Kang  
*Director of Public Relations*



## ENGINEERING

Engineering is responsible for designing and building the robot. Every build season, Engineering divides up into smaller groups, at least one of whom is a veteran member. These groups focus on individual parts of the robot such as the drive train, electronics and mechanisms. There is often more than one mechanism group either focusing on different parts of the robot, or competing against each other for the better design. To keep track of all these groups, we have a President and Vice President of Engineering. It is their job to make sure that all of engineering runs smoothly. We also have many directors to help out different tasks in the lab.



## SOFTWARE ENGINEERING

The job of the programmers is to write software which controls the robot's logic and motion on the playing field, as well as to ensure that the electronic systems are running smoothly. Essentially, they breathe life into otherwise lifeless metal. The programming team is also responsible for making sure all of the old robots have working code so that they are prepared to perform for demonstrations. Because most incoming members having little or no programming experience, we take it upon ourselves to teach everyone to program using the Java language. Teaching a large group of students to program a robot is no easy task, given our painfully short time frame. The pressure and patience pays off, however, when we see our code being executed by a 120lb robot soaring across the field.



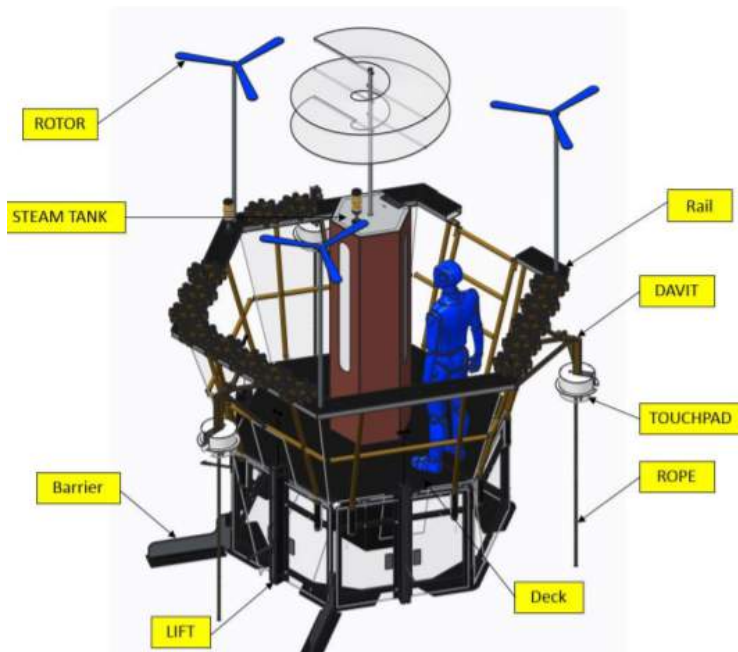
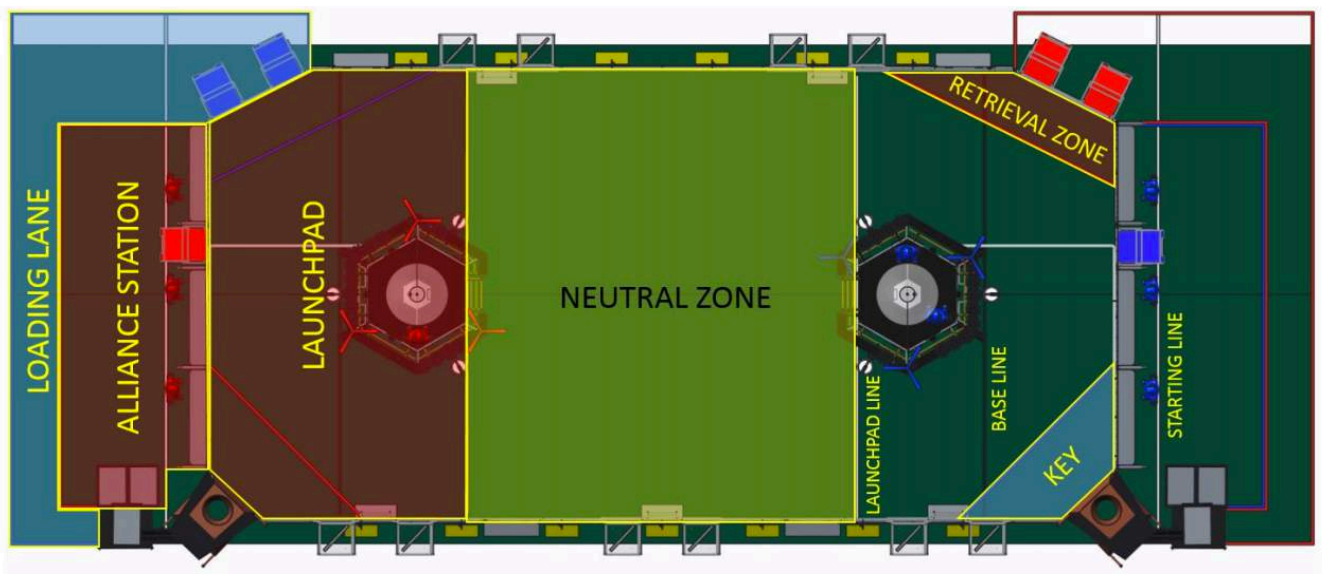
## MARKETING

Our marketing department has a very diverse list of responsibilities. It is in charge of fundraising, branding, logistical work like meals during build season and travel planning, award submissions, outreach as well as any other task that does not fall under the other departments. To make sure all these projects are running smoothly, we have a President and Vice President of Marketing. They are also responsible for being the primary contact for our sponsors. Our Director of Public Relations is responsible for coordinating all of our outreach efforts, which include mentoring FLL, FTC, and FRC teams as well as maintaining a strong presence on the media. Our Director of Finance maintains contact with sponsors and ensures the stability of the budget, and our Director of Operations helps out with the logistics of events and paperwork.

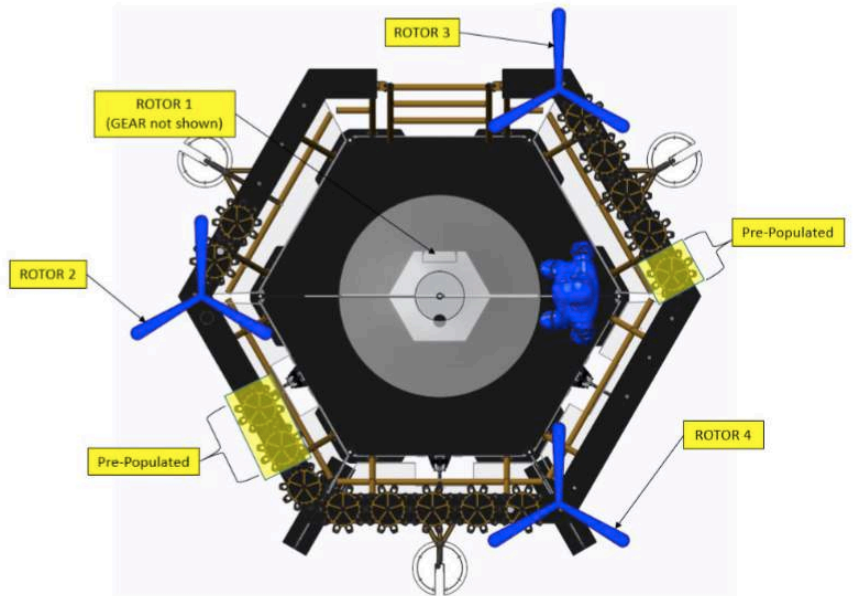
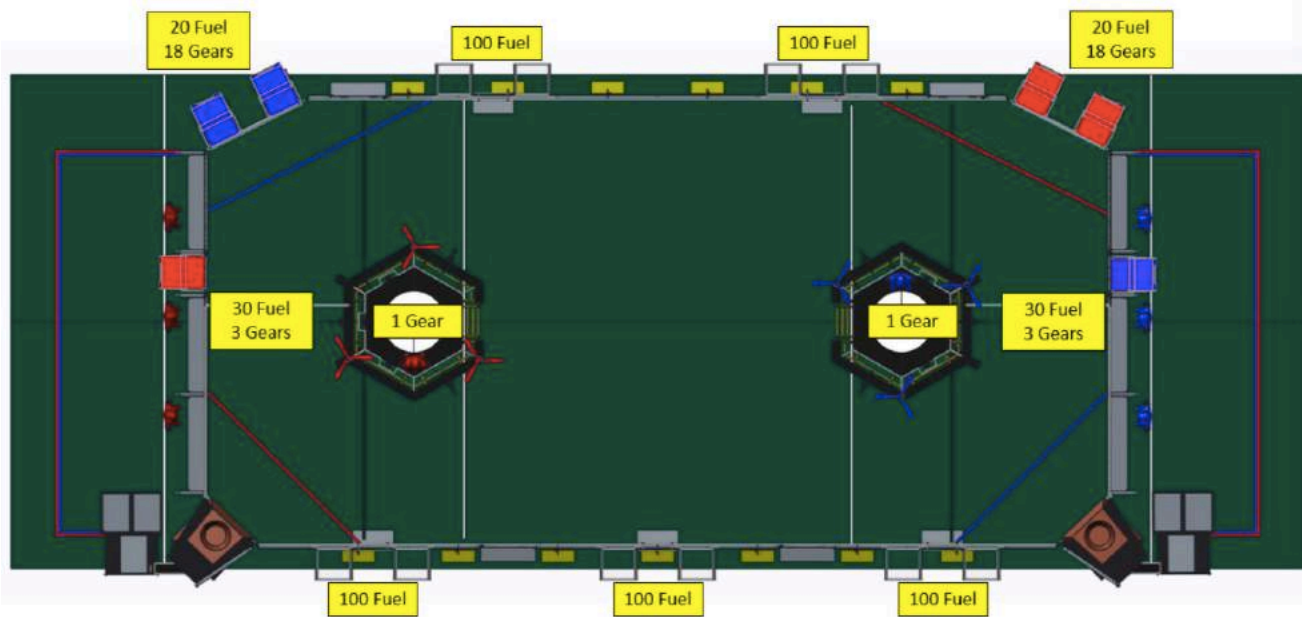


# FIRST STEAMWORKS

This year's game, FIRST STEAMWORKS, is based on a steam power theme, where it "invites two adventure clubs from an era in which technology relied on steam power to prepare their airships for the ultimate long distance race." Two alliances of three teams each compete for the highest score, by scoring fuel into the boiler which generates into steam, placing gears on the peg to spin the rotors, and climbing the airship to get ready for take-off.







# BUILD SEASON

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Build Season is a six week time period used by FRC teams to build a robot based on the FIRST challenge given for the year. This year, it was FIRST Steamworks. During our Kickoff, we immediately begin to discuss new strategies and robot designs. With fresh new faces and the expertise of our older members, along with our helpful alumni and mentors, we dive headfirst to build a robot that will win us the first place prize. Each week of build season is spent planning, making prototypes, and building the robot.

## WEEK 1

During week one, members began to construct the practice field. Our Engineering department started work on a shooter mechanism and a blender mechanism. Software engineers made progress on their computer vision and began to test commands for controlling the drivetrain.

## WEEK 2

The team finished the CAD for the robot, named Rafael. The design for the bot was modified and more tests were done on the gear manipulating mechanism. The prototype shooter was also completed. Members also wrote and tested code for a gear auton and configured the radios.

## WEEK 3

Parts of the bot continued to be built, such as the chassis for the drivetrain and the gearboxes. The framework for the different subsystems of the robot, like the blender and shooter, were written. The code for the boiler CV auton was written and tested.

## WEEK 4

The drivetrain and the blender was adjusted and completed. The shooter was mounted and tested for inconsistencies. All field construction projects were finished as well. More code for autonomous routines and the code for interacting with devices were worked on.

## WEEK 5

All of Rafael's subsystems have been attached to the drive train and are being tested. The drivetrain was also wired and tested. All of the autonomous code for the robot was written and a lot of progress was made on computer vision.

## WEEK 6

Rafael's subsystems were tested. The gear mechanism was reinforced, and the shooter and minor fixes were made. The tuning and testing for Rafael's software was done. Another autonomous routine for scoring gears was written and tuned.





This year's robot, Rafael, named after our coach, is one of the most ambitious robots this team has ever seen. On and off the field, Rafael lives up to its name.

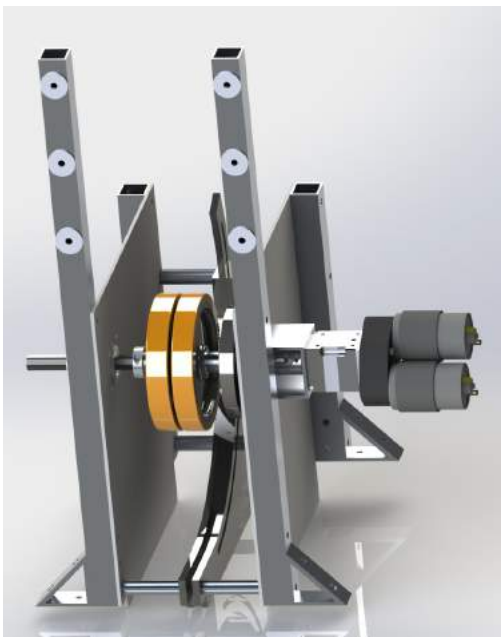


## Gear Mechanism

- Used to handle and score gears
- Wide aperture for easy acquisition from the Human Player station
- Gate holds gear in robot, and opens to release it (2 pistons, 30psi)
- Pusher secures gear and robot, and pushes it out onto the peg (2 pistons, 60psi)

## Fuel Handling System

- *Hopper*
  - 50 ball capacity
  - Side flaps actuate to facilitate acquisition of balls from field hoppers
  - Balls are funneled into the turbine
- *Turbine*
  - Feeds 5 balls per second into the shooter
  - Six bladed agitator spins at 60 rpm (BAG motor, 100:1 reduction)



- Agitator pushes balls into feeder wheel (BAG motor, 4:1 reduction), which forces balls into the shooter

## - Shooter

- 4 7/8" Banebots wheels spin at 2600 rpm, powered by 2 775Pro motors with a 5:1 reduction, an encoder allows precise control of rpm on the fly
- 2 lb flywheel stores energy
- Adjustable hood facilitates fine tuning of shot



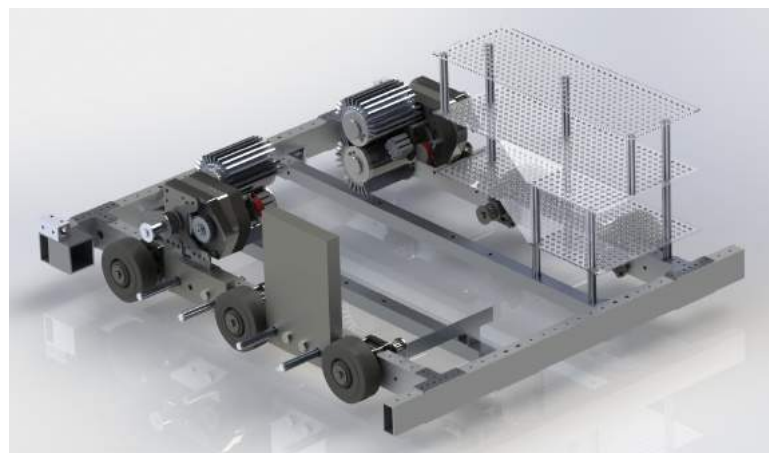
## Climber

- 4" wide drum allows for rapid alignment with rope, male Velcro attaches to female Velcro on rope to pick the robot off the ground. Kevlar ribbon ensures that the rope does not break.
- 1" diameter drum on 7075 axle, driven by a CIM with a 50:1 reduction allows Rafael to climb in under 8 seconds.
- Banebots wheels and Lexan extensions on the drum ensure that Rafael triggers the touchpad every time



## Drivetrain

- 6x 4" diameter coulson wheels (drop center) provide good traction and good turning ability
- 2 CIM Ball Shifter gearboxes on pneumatic shifters allow on-the-fly switching between a 4.71:1 reduction (16 fps, high gear) and 10.71:1 reduction (10 fps, low gear).



## Sensors and Electronics

- IR sensor on gear mechanism detects when gear is in robot, and lights up red LED to inform driver
- Encoder on shooter allows precise control of rpm and PID tuning
- Magnetic drivetrain encoders allow accurate measurement and control of the drivetrain
- Gyroscope/accelerometer allows for accurate measurement of Rafael's rotation and orientation
- Camera allows the robot to visually acquire and target gear peg or boiler

During the build season, the newly trained members worked on the code for controlling the many components and sensors on the robot. Older members worked on computer vision for the robot's autonomous routines. They were intent on applying the experience from the successful computer vision they made in 2016, but it was not easy. The new task was a more difficult problem. To align to a peg, on which the robot would place a gear, required more precise measurements from the computer vision than aligning to the tower in *Stronghold* (2016's game). Also, while last year's robot was built like an ATV—able to cross rough terrain, cross obstacles, and not be pushed by other robots—this year's robot was built like a race car. The drivetrain of *Rafael* is smooth and swift, which meant that aligning the robot precisely, without being controlled by a driver, was more difficult.

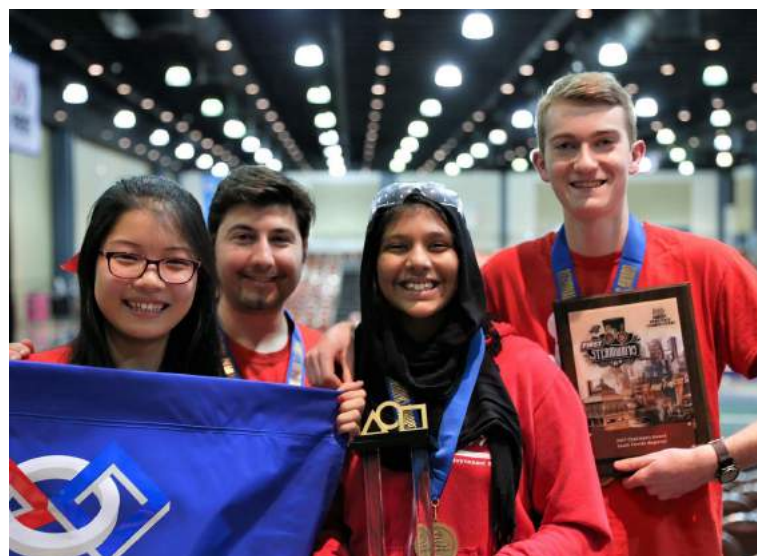
As competition season began, Software Engineering continued testing and tuning *Rafael's* autonomous routines for scoring gears. New members and other underclassmen learned computer vision and worked on side-projects to get experience. Others researched ways to improve accuracy of *Rafael's* autonomous movement, like PID-tuning, and to improve the accuracy of our ball-shooting mechanism with PIDF-tuning. At New York Regional, *Rafael* scored more points autonomously than any other robot.

As the school year comes to a close, older members have been researching methods of making a robot drive along arbitrary paths, and younger members have begun learning to find the physical position of an object in an image.





This year, once again, our team has competed for the Chairman's Award, the most prestigious award in FIRST. It honors the team that best represents a model for other teams to emulate and best embodies the purpose and goals of FIRST. Our team spent many of our meetings writing drafts for the Chairman's essay, scripting and filming the Chairman's video, and picking out the perfect Chairman's team. Our Chairman's Presentation Team devoted all their energy and hard work into making the presentation that would highlight everything that StuyPulse had accomplished for the last 17 years! Their hard work paid off when we were able to win the Chairman's Award at the South Florida Regional!



# NEW YORK CITY REGIONAL

We had another huge success at the NYC Regional, from April 6<sup>th</sup> to 9<sup>th</sup>. Rafael ranked 3<sup>rd</sup> with a match record of 11-7-0, with an OPR of 121.22. We were the Alliance 2 captains, with Teams 333 and 4571 helping us to become Regional Finalists. However, our robot played consistently and well, scoring many gears as possible and climbing the airship throughout tele-op. We fixed the problems that occurred at the South Florida Regional, and continued to work on the robot to make it better.

Our team also won the Entrepreneurship Award sponsored by Kleiner Perkins Caufield and Byers for our outstanding business plan. In addition, our Director of Public Relations, Yedoh Kang, became one of the two Dean's List Finalists, which celebrates outstanding student leaders whose passion for and effectiveness at attaining *FIRST* ideals is exemplary.









# SOUTH FLORIDA REGIONAL

Everyone had such a great time at the South Florida Regional from March 1<sup>st</sup> to the 4<sup>th</sup>! After many tough matches, Rafael, our robot, ranked 8<sup>th</sup> overall, with a 7-5-0 match record and an OPR of 76.65. We became part of Alliance 2 as the first pick, with Team 1744 as the captain and Team 6038 as the second pick. Throughout the competition, however, there were many problems that occurred with the ropes, the gear mechanism, and pneumatics, but we were able to overcome them, fixing them during our qualification matches. Although we lost in our last Quarterfinals match due to a blow of the fuse of the Pneumatic Control Module which cut power to the radio, we were very proud of all the work we had put in for the robot. We also won the Regional Chairman's Award! This award is the most prestigious award a team can receive, as it honors the team that best represents a model for other teams to emulate and best embodies the purpose and goals of *FIRST*. Our team worked very hard for the past 17 years, and we are glad that we were once again recognized for our efforts!









# ST. LOUIS WORLD CHAMPIONSHIP

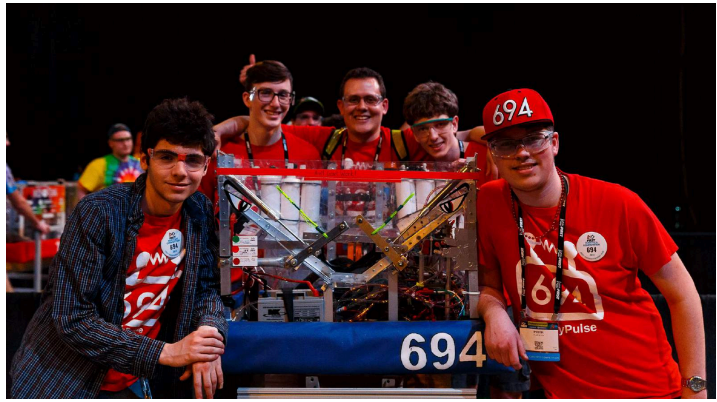
Everyone had such a great time at the World Championship, putting in lots of work and effort, including the Drive Team, the Chairman's Team, and Strategy! Although only four team members arrived in time for the practice teams, StuyPulse worked really hard to ensure the success of Rafael!

Rafael was ranked 30<sup>th</sup> in the Daly Subdivision, with a match record of 5-5-0 and an OPR of 129.12. We were the 3<sup>rd</sup> pick for Alliance 7 with Teams 5690, 2062, and 1806. We didn't get to play in the elimination matches, but we played consistently in the qualification matches, playing tough matches. We worked on our auton routine, while fixing some other problems on the robot, such as replacing the drivetrain motors.

Many of us were even able to make new friends from different teams, and also learned of new strategies, designs, and mechanisms while visiting other teams' pits. Competing with so many great teams was such a good experience, and we hope that we'll be able to qualify next year as well!









# CHINA ROBOTICS CHALLENGE

On August 4th, StuyPulse had the opportunity to fly to Shenzhen, China to attend the third annual China Robotics Challenge (CRC). During the first couple of days, Pulsites were busy helping two rookie Chinese teams finish building, fixing, and programming their robots for the upcoming competition. Afterwards, StuyPulse toured China with other international teams. Upon their return, the team began preparations for the competition by putting the finishing touches on their robot and helping out their fellow competitors. Pulsites made sure to share their experience as a successful robotics team with their fellow Chinese teams and taught them as much as they could in those short couple of days.

The competition lasted from August 11th to August 13th. During the first day of qualification matches, DEStiny shot her first ever CV guided shot into the high goal and for the rest of the day performed without any issues. During the second day of qualification matches, DEStiny's drivetrain gearboxes started to malfunction and after a visit from Andy Baker, the team decided to lock her down in low gear until a further diagnosis could be performed. After qualification matches, StuyPulse became the sixth alliance captain, alongside Team 16 and Team 5308. Our alliance failed to make it past quarterfinals due to mechanical issues, however, Team 5308, managed to win in the elimination rounds excluding all international teams.

After a successful event, StuyPulse is more than ready to attend the 2017 China Robotics Challenge.





# TEAM 6354 AND TEAM 4613 VISIT

A few days before the New York City Regional, Teams 6354 JiaYi Superhuman Strength and 4613 Barker Redbacks visited our team and our school! Many of their students shadowed some of our Pulsites throughout the school day, learning and getting a sense of what a day in the life of a Stuyvesant student is like. StuyPulse also demoed DEStiny, and gave them lab tours and presented workshops. In addition, we were able to talk to each other and create friendships while sharing dinner! Overall, this was a great experience for all of us and allowed us to have a better time at the NYC Regional.





# STUY SPLASH

Stuy Splash was a huge success and a great experience this year! Many teams from the Tri-State area were able to make it, as well as all of our team members, alumni and mentors. The Marketing division worked really hard with others to ensure the success of this annual event.

Like MIT Splash and Columbia Splash, we too, hosted many workshops, led by our own team members, mentors, and alumni. Some examples include: Competition Strategy & Preparation, CAD and its Uses, Computer Vision, Organizing a FTC team, Beta Testing Seminar, Team organization and Marketing, FLL and Mentoring, Using Physics for Material and Motor Choice, and Intro to Pneumatics.

We hope that next year, more teams will be able to come and that there will be even a bigger variety of workshops!



## BOOK SALE

We continued hosting our bi-annual book sale on the corner of Chambers and Greenwich St. In addition to selling books, we were able to present and show our community our love and passion for STEM and robotics through our demos with our robots.

## MAKER FAIRE

We were invited to the World Maker Faire back again, allowing us to demo our robots to visitors to the faire, especially letting the children play.



## MINI MAKER FAIRE

We were invited to the Mini Maker Faire at the local Barnes & Nobles to present our robot and talk about robotics! The kids and parents had a great time, and were very excited to learn more.

## CYBERSTUY

We demonstrated and talked about our robots, and robotics in general to middle schoolers all around the city who are interested in STEM and robotics.

## MENTORING

Many of our team members continued to mentor FLL and FTC teams all throughout the city, and volunteered at FLL and FTC events. We even started an after school robotics program at a local elementary school that teaches kids about the basics of robotics, engineering and coding through the use of Lego Mindstorms.



# FTC TEAM 310

Last year our team, Team 310 Stuy Fission, was disappointed when we were unable to even qualify for regionals. But, we are extremely proud to say that not only were we able to go to regionals this year but we were also part of the winning alliance! It was such a great experience, and all our team members learned so much, had a great time, and made new friends. In addition, we were able to learn from our mistakes from previous years, and better integrated our new members this year into our current projects. We expanded our software department after virtually not having one last year, and now we are on the path to training new members to program our robots. We've come a long way, but there is still a lot to go. Our goal for the next year is to develop our marketing department into a bigger one, and better our Engineering notebook while maintaining and bettering the things we did well this year. By maintaining the same leadership, we are going to be able to improve without having to go through a learning curve. We are trying to better include our members in our decisions and keeping them informed. Team 310 Stuy Fission is hopeful that next year we will go farther than ever before.

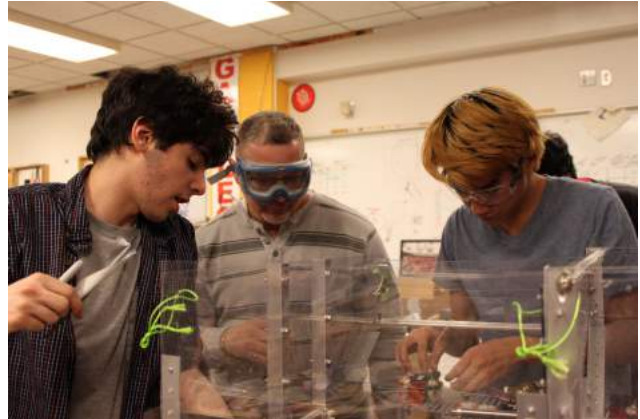


Stuy Fusion 479 started the 2016/2017 season strong, with a team made up largely of second or third year veterans and an ambition to take New York City FIRST by storm. Despite last minute changes, poor planning, and a late start to the build season, we were able to dominate our first qualifier at Francis Lewis High School, beating 310 Stuy Fission in semifinals and advancing to Regionals from being on the winning alliance and from winning the third place Inspire award, largely due to last minute modifications to the robot and an excellent performance by our drive team. While this poor planning and a few encoder issues did lead to an underwhelming performance at New York City Regionals, we surprised a large portion of the FTC community by showing just how functional an acquirer, feeder, and shooter made almost solely out of 1/16" Lexan could be, and we have great hope for the future. With some help from the mentors and machinists at StuyPulse, we were able to come much further than we did with nearly the same team last season, and hope that the trend continues into next year.





Mr. Colón has been an unshakable presence on StuyPulse since our inception in 2000. Year after year, he has worked beyond his paid hours to give us as much time as we need, setting aside his own personal commitments to make time for us. Once in 2003, a blizzard hit the area, shutting down most of NYC. Immediately, Mr. Colón let all the parents, students, and mentors know that he was heading to school to open up the lab so they could continue working on the bot. He has always gone extra steps to make sure that we learn from his guidance and learn lessons through personal experience. Rather than giving us the answers, he allows us to make mistakes and gives us tips until we can solve the problems ourselves. Mr. Colón always tells us, "You come in with ten fingers, you leave with ten fingers." He makes sure that we are completely safe when working in the lab. Before build season, he gives all members a safety lesson and a safety exam. He also teaches new members how to use the machinery and tools, multiple times if he has to. He keeps us organized with pre-meetings and dinner meetings, requiring all divisions to make goals for each day. For Mr. Colón it's not enough to make it past quarterfinals at World Championships; Mr. Colón expects us to go above and beyond his expectations. He tests our limits and pushes us past them. His dedication for StuyPulse has not just been recognized by us team members. In 2011, his dedication to robotics and StuyPulse was recognized by NY1 News, a local news channel, featuring him as New Yorker of the Week. Even outside of robotics, Mr. Colón continues to make an impact on the student body. Aside from being our coach, he works as a teacher at Stuyvesant, teaching computer technology, woodworking, and robotics. Before him, there was no such thing as a robotics course at Stuyvesant High School. When the school administration wanted to downsize the tech department, his passion for robotics and his drive for introducing more kids to the STEM field prevailed as he fought and was able to create two robotics classes and several technology classes for the juniors and seniors. Mr. Colón has become a cornerstone of our team. He works to keep StuyPulse a close-knit group, always telling us that, "It's more than just being a team. It's being a family."



***Thank you Mr. Colón for everything that you've done for us! We'll miss you, and good luck in the future!***



**COACHES**

Rafael Colón

James Lonardo

**PARENTS**

Cindy Sherling

Richard Leung

Ellen Hartman

Igor Olevsky

Andrew Hosking

Brenda Lei

Mary Smith

Fangxia Lin

Susan Khan

Rebekah Laskin

Sherry Sontag

Barry Robertson

Anna Milewska

**MENTORS**

Joe Ricci

Joe Blay

Jeanne Boyarsky

Tom Ferguson

Dan Lavin

Ron Kunicki

Catherine Kunicki

Shelley Grant

Mel Hauptman

Justin Kim

Samantha Unger

Fritz Heckel

Evan Forbes

James Potter

Stuyvesant HS Parents' Association



Ann & Donovan Moore

Abby & Tom Ferguson

Rehab One Physical Therapy PC

Investor's Bank

Dr. Joe Ricci

Leung Family

Justin Kim

Rocha Family