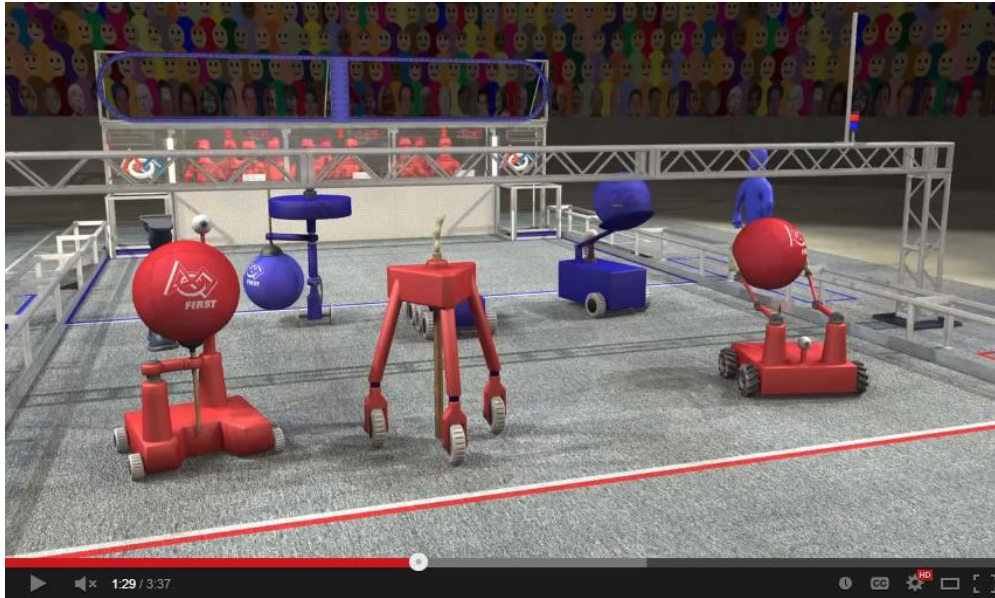


SPECTRUM
***3847***
BUILD SEASON LOG
2014

Sunday, January 5, 2014

Aerial Assist Day 1

Day 1 of Aerial Assist went very well. Here is the animation for anyone that missed it this morning.



https://www.youtube.com/watch?feature=player_embedded&v=oxp4dkMQ1Vo

We worked all day learning the rules and getting familiar with all the ways to play the game. Here is our document with some of our notes about the game.

<https://docs.google.com/document/d/1kHHHsXS8f2SWvJ8VJz-R7RU8aVD7rU9ktbrGgyLCJ6Y/edit>



After we got some quick mock ups of the field elements built, we headed to the gym for a brief little session of Human Aerial Assist.



https://www.youtube.com/watch?feature=player_embedded&v=-NkqpTgLhB0

We tested low goal scoring as well, and it seems like all robots should be able to score in the low goal.



https://www.youtube.com/watch?feature=player_embedded&v=aynl11FRHHk

We started prototyping briefly, but not much to see yet. It's going to be the start of a ball launcher built using several pieces from the kit of parts.



Lots more to do before the first weekend is over.

-Spectrum

"I have nothing but applause for those brave enough to fail, and fail again." - [Seth Godin](#)

Monday, January 6, 2014

Day 2: Prototyping really begins

Today we continued our prototyping in earnest. We had members working on several different launching and collection mechanisms.

Here is our most well developed ball pickup device. It's a simple over the top roller claw using VEXpro and Banebots parts.



Another of our prototypes is the ball puncher. It uses surgical tubing to pull back a shaft and punch the ball. The goal is to use a mechanism like this to punch the ball over the truss and also into the high goal.



https://www.youtube.com/watch?feature=player_embedded&v=srN0vM0xNFo

As you can see this isn't working exactly as we would like but we learned a lot from it. We'll be working on a more traditional catapult tomorrow afternoon.

Here is a sneak peak at another prototype that we should be finishing up tomorrow.



Hopefully everyone is watching all of the great content coming out of [RobotIn3Days.com](https://www.RobotIn3Days.com) and [BuildBlitz.com](https://www.BuildBlitz.com). They are putting out great content to help teams figure out what they want to build, but remember that watching videos and seeing pictures can't replace good hard prototyping, plus it's fun.

-Spectrum

"All great achievements require time." - Maya Angelou

Tuesday, January 7, 2014

Day 3 of Aerial Assist

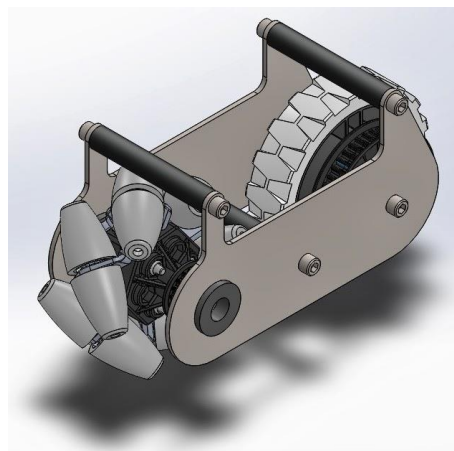
We continued our prototyping today.



https://www.youtube.com/watch?feature=player_embedded&v=KcDMokRtLjw

The improved roller claw is working very nicely. We're not convinced that we will even use a roller on our final design but we are still working on improving it as much as possible. We are tuning it to find out as much about the different variables as we can. We want to know the optimal roller height, roller distance past the bumper, height of the back bar, downward force to press on the ball, etc. All of these little details will make the final design that much better.

We are pretty far along in CADing our drive train for this year. Here is a quick screenshot from our progress.



We have posted some of the details behind this design in our [2014 Design Notebook](#). Our goal is to make it pretty flexible. We believe that catching may turn into an important factor in this game and having the ability to move omni-directionally will make that task much simpler. We also know that there will be times that we need to stand our ground or attempt to move another robot for this reason we are planning to use an Octacatum drive train that can shift between mecanum and traction wheels. We are building in contingency for allowing us to switch from octacatum to a butterfly drive with standard omniwheels replacing the mecanum wheels and also a standard six wheel skid steer drive if we desire.

Several of our other prototypes are still under construction and not ready for even simple tests, hopefully by the end of the week we will have a solid idea of where we want to go with the robot.

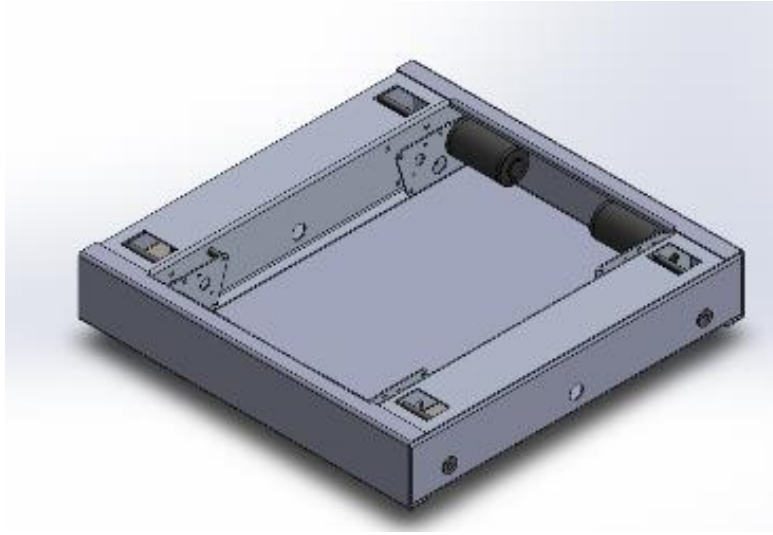
- Spectrum

“Do not follow where the path may lead. Go instead where there is no path and leave a trail.” -
Ralph Waldo Emerson

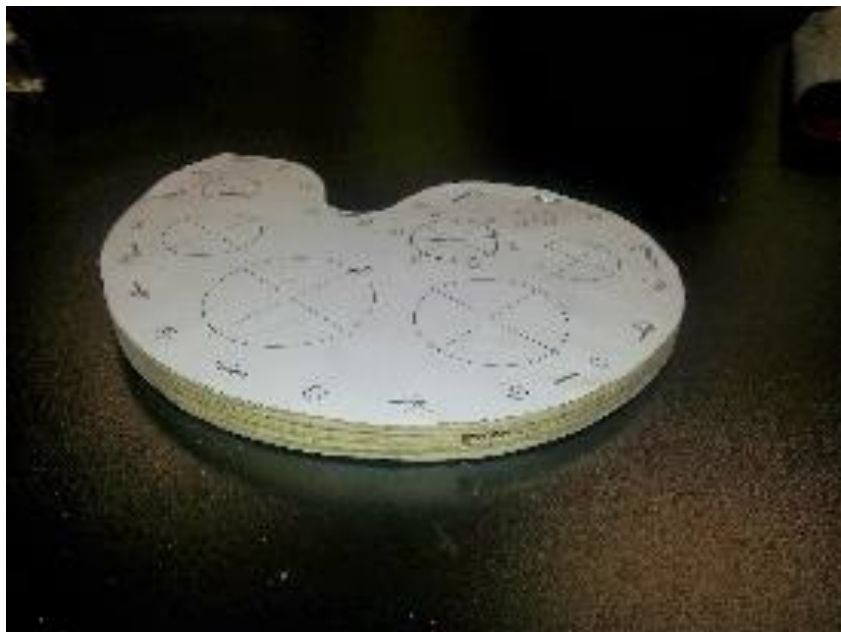
Tuesday, January 7, 2014

Day 4: Inspiration From Other Teams

We have been putting in some serious hours CADing away at the drive train. It may look simple from the screenshot below but there is going to be a lot going on once it's all finished. The modules are heavily inspired by Aren Hill and Team Neutrino's [Butterfly Drive from 2013](#). They were our pit neighbors at IRI and gave us an awesome tour of the robot.



We broke off into a few groups to design some new prototypes today. Started working on a CAM powered launcher. We wanted a CAM profile and weren't sure where to get a quick one to test with, but then we remembered our friends 148 used CAM on their 2010 robot, [Armadillo](#). The CAD for that robot can be found on [FRCDesigns.com](#). We printed out a 1:1 version of it and cut it out of plywood on the bandsaw. Hopefully we will get something going in the next day or two.



While looking for other collector options to test in parallel with our roller claw development, we worked on a version of 118's [Ballacuda pickup system](#) from their 2008 robot.



We don't plan to use any of these systems verbatim, but starting from where someone else has already been allows us to develop solutions much faster. Everything still has to be tested, modified, and tuned for this year's game requirements.

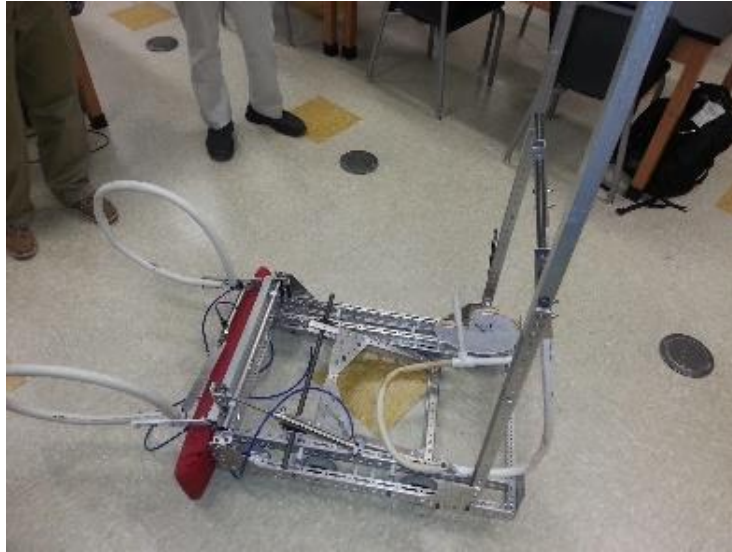
-Spectrum

"Stop waiting for something to happen or for someone to give you permission to do things." - Kate Kendall

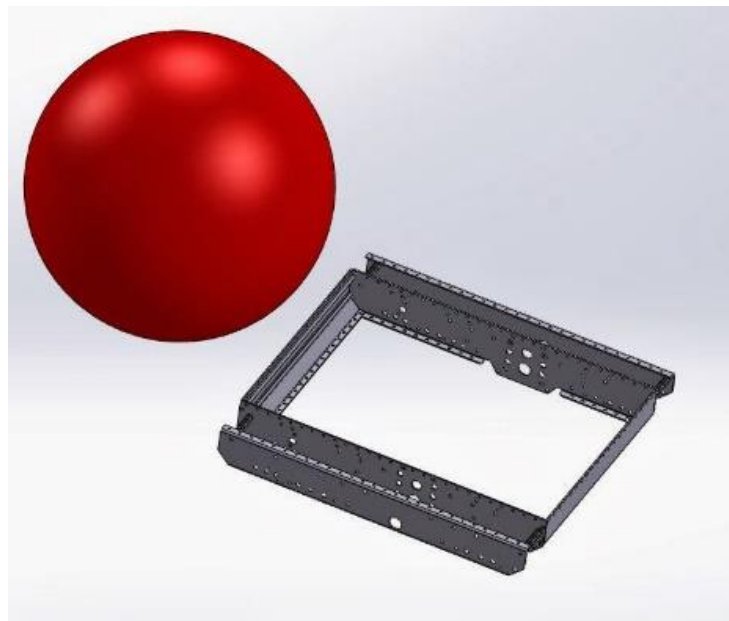
Wednesday, January 8, 2014

Day 5: Prototyping doesn't stop & Square Kit Chassis

Quick update today, we still have a lot of things to prototype before we finalize a design. We're hoping to have a chassis built by next week.



We have a Bootcamp Build day for some of the young teams in the area on Sunday. While working on the CAD files for the AM14U, we mocked up a version that is square 27.5 x 27.5. This was mentioned on Chiefdelphi, but we weren't sure how easy it would be for teams to make. We think it's pretty simple--it's really just making a half-wide/half-narrow robot.



Here is a quick [PDF that shows the cut frame rails](#).
The front and back pieces are both cut to 20.25".

This square version has a non-symmetrical wheel base but it should still work very well. It also allows the 25" ball to easily fit inside of it. Add a plywood base to the inside and you'll have a very nice chassis for Aerial Assist.
- Spectrum

"My attitude is never to be satisfied, never enough, never". - Duke Ellington

Friday, January 10, 2014

Day 6: Need, Want, Wish...

Today was our first design review. We have seen the 72 hour builds, prototyped a little, and played a human version of Aerial Assist. We think we have a good understanding of the game. Here is how we break it down.

Need:

- Drive
- Speed
- Roll ball out of robot on ground or into low goal
- Sturdy/Rugged
- Catch from inbunder / Collect from Human Player / Receive Inbound
- Hold the ball - securely enough to drive around

Want:

- Pushing Power / Torque
- Agility
- Bouncing Ball Control (rebound)
- Catch well from other robots
- Shoot a Pass/Lob Shot
- Variable Power Shooter
- Ground pickup
- Lob to Human Player
- High Goal Score

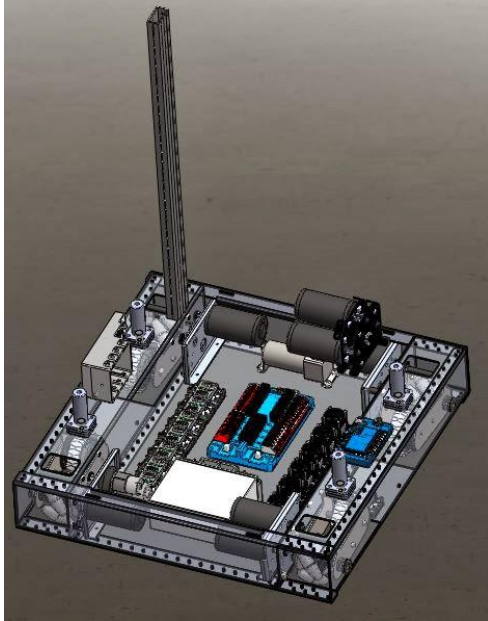
Wish

- Strafe
- Shoot across a zone (lob from back over truss)
- Shoot from zone line (18' shot)
- Shoot from the wall
- 2 ball auton
- Eject ball on power off

Why bother?

- Brake (mechanical)
 - o >5' extension...
- Jump
- Turret
- Scissor lift...
- Ground pickup from sides
- 3 ball auton...
- There might be more aspects to the game but these are all the ones we covered. We'll be dealing with the programming side of things a bit later.

Today's update is a picture of the current state of our CAD Model. It's still rough, but the drive train is coming along very nicely. We are working on the electronics layout, as well as fitting everything else into the robot. (All the CIMs are just place holders, there will only be 6 on the real robot.)



-Spectrum

"Start by doing what's necessary, then what's possible, and suddenly you are doing the impossible." – St. Francis of Assisi

Friday, January 10, 2014

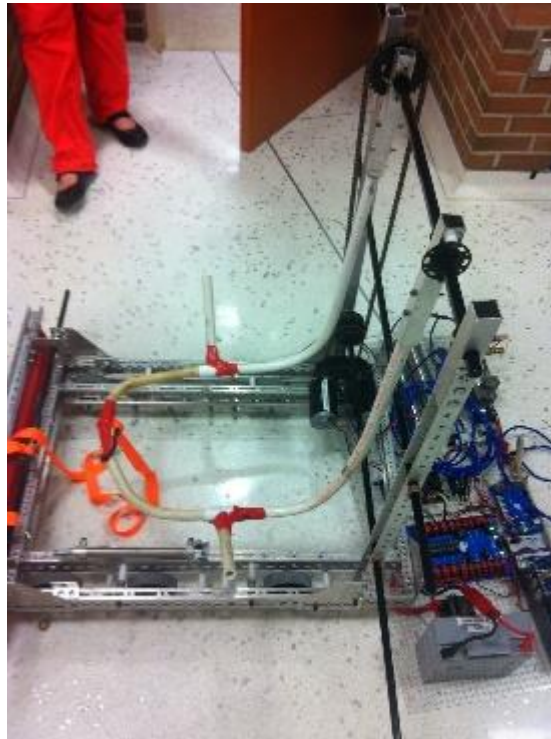
Day 7: It's been a week

We continued improving our prototypes today after our design meeting yesterday. We modified our collector prototype to a version inspired by one of our VEX robots from this year.



https://www.youtube.com/watch?feature=player_embedded&v=d5jkzTCaFFw

We also continued to improve our shooter/thrower prototypes. Lately we have been working on a thrower that runs off two mini CIMs and throws the ball over the back of our robot. So far we have been trying to improve the range.



-Spectrum

"Success consists of going from failure to failure without loss of enthusiasm." Winston Churchill

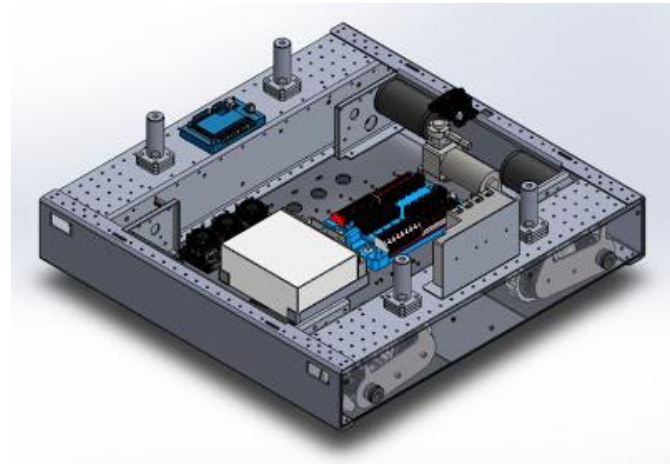
Monday, January 13, 2014

Day 10: Back to Blogging

Sorry we missed a couple days. We had a Bootcamp build day yesterday where we helped 5 teams get their AM14U up and working.

We were back to work today, we have several prototypes still in development and we haven't finalized our robot design.

We worked through the electrical and pneumatic design, and we should be laser cutting on Wednesday after we do all the drawings tomorrow night.



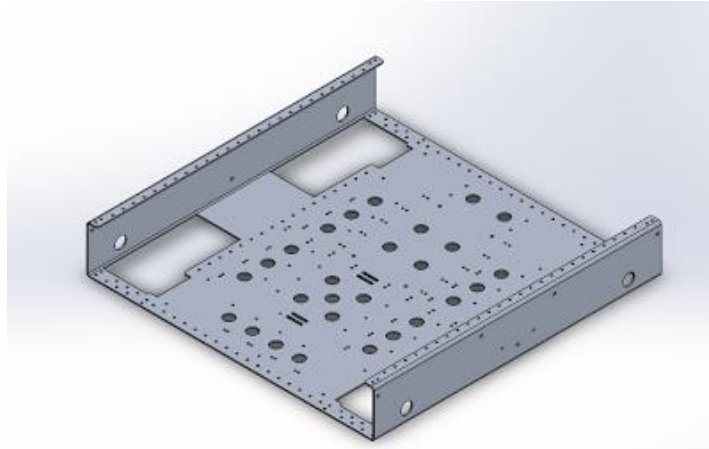
-Spectrum

"Even a mistake may turn out to be the one thing necessary to a worthwhile achievement." - Henry Ford

Tuesday, January 14, 2014

Day 11: Drive Train CAD Complete

We finalized the CAD for the drive train today. We are cutting a heavy version for our practice bot that doesn't have a lot of holes that will be in the real version, which will save us some time. Here is the belly pan. It has mounting point for 16 victors/talons, and although we won't be using all of them, it's nice to know we have them.



The prototype shooters still need some work but we have started designing the final version of our intake. It's heavily based on the intake rollers from VEX robots. We also will be able to outtake the ball from its stored position using only the rollers so we can score in the one point goal.

We started construction on our bumpers yesterday. This year we are going to make our bumpers early and we are spending time to make sure they are done very well. Last year we had some issues with the pool noodles sagging a bit after a few competitions, but we don't think that will be a problem this year.

- Spectrum

"Little by little we human beings are confronted with situations that give us more and more clues that we are not perfect." - Fred Rogers

Wednesday, January 15, 2014

Day 12: Trussing

Tonight we finally started having success with one of our shooting mechanisms. We were able to score in the high goal and truss with this shooter.



https://www.youtube.com/watch?feature=player_embedded&v=ft2t9sXYnZI

This shooter is heavily inspired by Dr. Joe Johnson and the [Boom Done Robot in 3 Days team](#). It currently is running 3 CIM motors in a VEX single speed (5.33:1), a 15t to 30t sprocket reduction, and a final 12t to 22t sprocket reduction. These are just the items we had on hand, and we will hopefully be optimizing this over the coming weeks.

We have been working on this for over a week now, and we strongly believe that having a shooter with multiple shot trajectories will be key to making good clean passes over the truss.

Our chassis is going to be laser cut and bent tomorrow. Our sponsors had a big project that they had to get finished tonight so we couldn't get any time on the laser, so tomorrow one of our students will go to Solarcraft and run the laser and press brake to make all of our parts.

We are finalizing the "Sipping Bird" collector. It's based off [this](#) version, but now all of the motors will be contained inside the robot and both roller assemblies are independent.

We still have a few other shooter prototypes to test before we make our final decision.

- Spectrum

"It's always too early to quit." - Norman Vincent Peale

Thursday, January 16, 2014

Day 13: Sheet Metal

We finished the CAD for our chassis and a few other parts yesterday and one of our seniors who interned with our sponsor Solarcraft was able to go to their facility and cut and bend our chassis tonight.



https://www.youtube.com/watch?feature=player_embedded&v=ThERPS9JScI



Collin with the chassis he just cut and bent

We worked on a few more prototypes including a pneumatic catapult and a wheeled shooter. The motor-driven catapult is still the most promising but we have some ideas for the others that may make them win out in the end.

We will have most of the items we need to make our drive train tomorrow afternoon except for a few pieces from VEXpro. This weekend should be full of assembly and more prototype testing; we are working on gathering as much information about the prototypes as we can so that when we build the real version we can know it will work well.

- Spectrum

“For me, I am driven by two main philosophies: know more today about the world than I knew yesterday and lessen the suffering of others. You'd be surprised how far that gets you.” - Neil deGrasse Tyson

Saturday, January 18, 2014

Day 14: Two Weeks Down

After the sheet metal came in today, we started construction on the practice robot.

We set up a test version of our octocanum modules.



https://www.youtube.com/watch?feature=player_embedded&v=GF_CP-9eMDY

The drive train will hopefully be finished early next week once our Mecanum wheels and hex bearings come in from VEXpro.



This weekend will be a big weekend for us. We should finalize our collector CAD and also get much closer to a final design for our launcher.

- Spectrum

"You do not really understand something unless you can explain it to your grandmother."

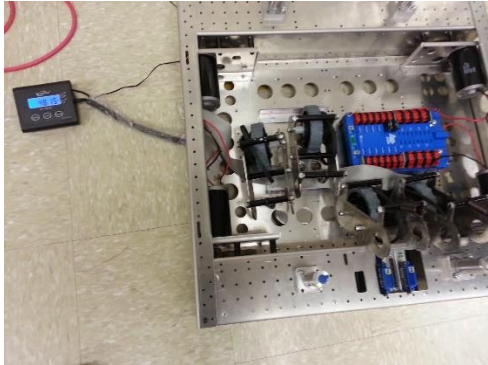
- Albert Einstein

Sunday, January 19, 2014

Day 15: Robots and Rookies

We put together as much of the chassis as we could. This one ways about 50lbs as shown here. The real one will be lighter as some of the main components will be .09 aluminum instead of .125 and we will have more lightening holes.

We pressed in PEM nuts using a hammer and a punch. We're not sure how long these will hold but we're hoping for minor things like speed controllers this should be enough.



Today we hosted team 5287 from Community Christian School in Orange, TX. We helped them put together a model of Ri3D Boom Done's El Toro Collector using scrap material that we had. There students will be able to build their own version now that they've better seen how it's done.



We talked a lot more about our launcher mechanism and how we should build supports for it. We're pretty happy with the concept we have going and should be able to get CAD versions of it put together pretty quickly.

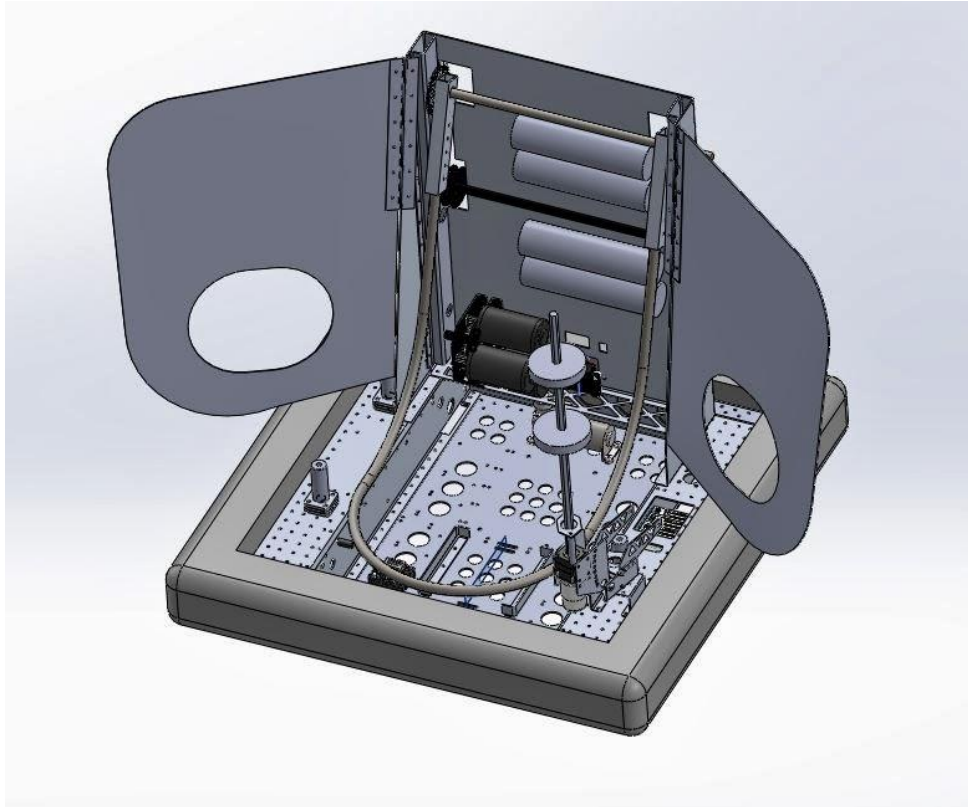
- Spectrum

"The thing I remember best about successful people I've met all through the years is their obvious delight in what they're doing and it seems to have very little to do with worldly success. They just love what they're doing, and they love it in front of others." - Fred Rogers

Monday, January 20, 2014

Day 16: Mechanism CADing

We worked more on CADing up the game specific mechanism for our robot. Most of it is still in draft form but we're pretty happy with the direction it is going.



Note: The flappy things have changed drastically in the last few days, and will continue to change.

Note 2: There is also a second collector pole, it is just not shown in the picture.

We still have some prototype work to do on both the collector and launcher before we are comfortable sending them to the laser, but we think we are getting pretty close.

We're building this with the possibility of up to 14-16 motors. There aren't that many functions, but since the current rules allow for so much power, if you build it in it allows your motors to work in a much more efficient part of their power curve.

Hopefully we will be driving our practice chassis by this weekend.

- Spectrum

“One option is to struggle to be heard whenever you're in the room... Another is to be the sort of person who is missed when you're not. The first involves making noise. The second involves making a difference.” - Seth Godin

Tuesday, January 21, 2014

Day 17: Another Long Work Day

We were off from school for MLK so we had another long work day.

We improved our pneumatic launcher to where it give a nice chest pass. We aren't trying to make this prototype score in the goal or go over the truss, we are going for extremely compact.



https://www.youtube.com/watch?feature=player_embedded&v=Qs7swvXrizU

Along with that we continued the CAD for our launcher and pickup mechanism and continued development of the prototype launcher to better fine tune it.



We heard from VEX that our items should be shipping this week so hopefully we will be driving this weekend.

- Spectrum

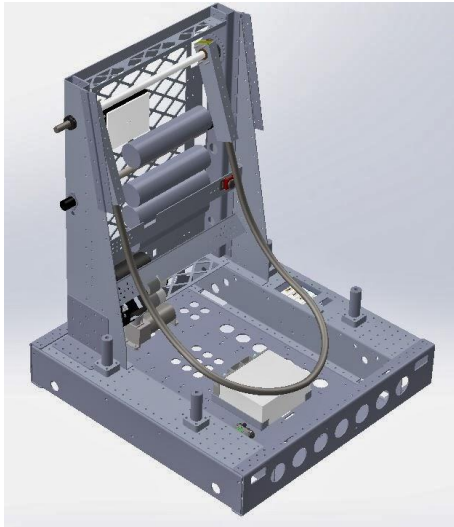
“Action expresses priorities.” - Mahatma Gandhi

Wednesday, January 22, 2014

Day 18: Parts Arrive

After the long weekend we got many of our orders from week two. We had a large amounts of screws, bolts, and nuts from [McMaster-Carr](#) and [Bolt Depot](#). We received our [encoders](#) and [IMU](#) from Sparkfun, and we also got an AndyMark order which contained part of our PDV--it consisted of Talons and stealth wheels.

We also received several VEXpro packages. We finally received our hex bearings that we have been waiting on, and we also received our VEXpro PDV items along with two 2x1 VersaFrame rails. The biggest surprise was the VEXpro order that we placed late Sunday night arrived today; we ordered parts for the real robot already since we expected a week or long lead time, but they got them to us in well under 48 hours. VEX is really stepping up to make everything right with their customers. We're still waiting on 4" Mecanum wheels, but that's our last back ordered item.



This might look like the same picture from yesterday but several hours have gone into improving it since then. Many of the items are very subtle but will make a huge difference when we actually start assembling it. We started the process of changing our CAD model for the drive train from .125 to .09, it takes some time to make sure all the spacing stays the same. We also worked on the second revision of our collector, which hasn't been produced yet, but we are already finding ways to improve it.

The launcher had a very successful test and we should have more to post after we get some video during tomorrow's meeting. (Hint: 2 CIMs and 2 BB775s is 1200W)

- Spectrum

"We are all salesmen every day of our lives. We are selling our ideas, our plans, our enthusiasms to those with whom we come in contact." - Charles Schwab

Thursday, January 23, 2014

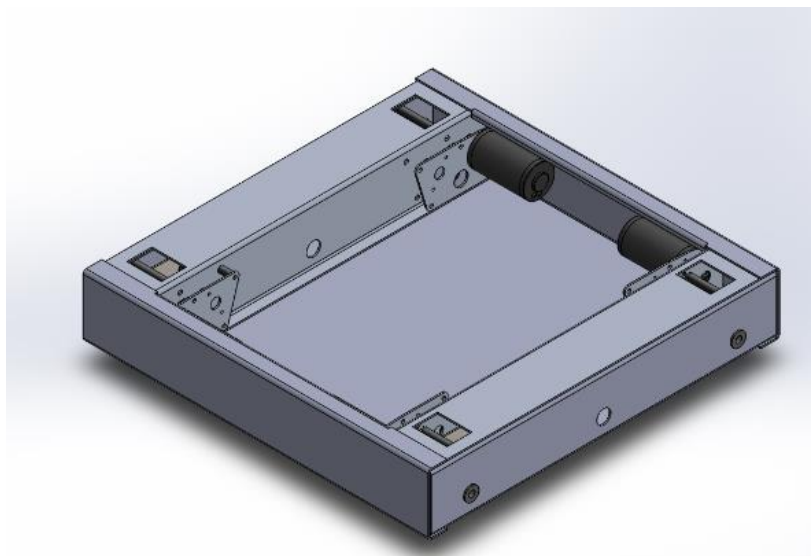
Day 19: Launcher Video and More CAD

We finally have some good video of our launcher prototype. It's performing as we expected, with a wide range of potential shots, some of them we didn't even think about as we were designing it. Again this was inspired by Boom Done and we want to thank them for such a great idea.

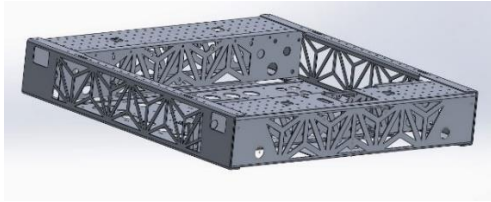


https://www.youtube.com/watch?feature=player_embedded&v=6ry4D57pB3Q

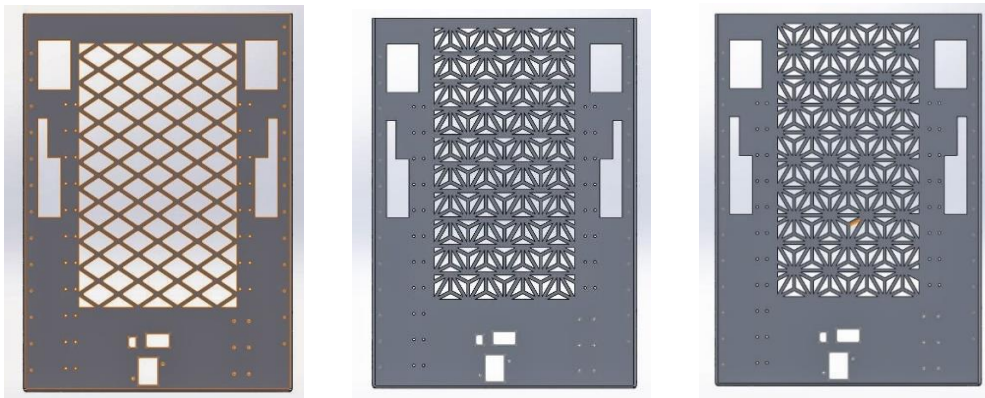
Our original chassis that will be used for our practice bot weighed in at 19.84lbs. It was made from 1/8" aluminum and didn't have much weight reduction.



The new chassis will be made from .09" thick Aluminum and will weigh in at 11.84lbs, It is sliced and diced to cut weight. We know this will add a lot of chassis flex but since we are using Mecanum wheels we're alright with that.



We're also working on the lightening pattern for the back of the robot. Put your opinion in the comments.



Option 1: Standard Diamond Cutouts

Option 2: Spectrum Cutouts Standard

Option 3: Spectrum Cutouts with Reverse

We should be driving this weekend, with or without Mecanum wheels, as the practice robot is just about finished being wired. Our goal is to finish the CAD for all the mechanisms over the next two days and have drawings ready to go to Solarcraft to be cut and bent early next week.

- Spectrum

"Whenever I tackled the impossible or the miraculous, I remembered the magician Rene Lavand, who had only one arm. Poet and extraordinary card manipulator, he baffled fellow illusionists by concluding his brilliant demonstrations with, "What I just showed you can also be done with two hands!" - Philippe Petit, Man on Wire, 2002, p. 236.

Thursday, January 23, 2014

Day 20: Strategy and Tactics

Lots of CAD work today and we worked out some dimensions for our wings that will help us catch the ball and also maintain position of the ball. Not to much to show but instead we wrote down some of the strategy and tactical ideas that the team has been kicking around the past couple weeks.

Questions we're asking ourselves

What percentage of teams will be able to catch a pass over the truss?

How can we make it easier for teams to catch our passes?

How can we avoid defense on our passes?

How can we speed up the truss/catch process?

What killer features will the best robots have?

How can we be better at rebounding? / How can our alliance be better at rebounding?

How can we play smart defense when we don't have the ball?

How can our alliance best utilize its time?

What's the best way to communicate within our alliance?

Some possible alliances in Aerial Assist

Standard FMI

Forward/Attacker/Striker - Last with the ball. Scores in the high goal. Possess in the alliance colored zone. Hopefully can catch a pass from the midfielder.

Midfielder - The ball handler. Takes the ball from the inbounder and is normally the robot that trusses. Should have consistent and accurate passing options and the ability to quickly acquire the ball from another robot. Possess the ball in the white zone.

Inbounder/Defender/Back - Takes the inbound pass from the human player. Hopefully can catch the pass directly but also could take the ball off the carpet. Extremely important to cycle times, must be able to secure the ball quickly and get it to the next robot as fast as possible. Should play smart defense against the opposing teams. Forward once they don't have the ball. Possess the ball in the opposing alliances zone.

This alliance would play the game in a very smooth motion, with all three robots playing critical roles in amassing the most points possible for the team. These positions are possibly playable by many of the same robots so teams can be flexible in which position they play in a given match. The midfielder robot has a lot of options in this alliance; once they pass the ball they can either help the Forward by playing Full Back or retreat and help the Back slow up the opposition alliance.

Super Goalie + 2 Forwards

Super Goalie - This goalie robot is able to play lock down defense against the opposing alliance while also taking the inbound passes and goalie kicking them over the truss to one of its two alliance forwards.

This requires a very unique robot, but it could give a big advantage the alliance that can pull off this formation. The super goalie is able to move the ball half way down the field in the air and

has the potential to throw to two different robots making it much harder for the defending alliance to predict the location of the throw. The forwards will have to learn to pass to each other if they want to maximize their cycle points.

A similar system could be played by the standard alliance if their Back robot has the ability to truss the ball at all.

Super Star + Double Back

Super Star- Take the inbounder's pass, throws to itself over the truss, & scores in the high goal.

This alliance will definitely exist at events, especially in matches where alliances might be shorthanded and only playing with two robots. If the Super Star robot can truss and high goal 3 times as fast as the opposing alliance can cycle they are guaranteed to at least keep pace with the other alliance. That's no easy task but when the other alliance has to deal with two defending robots it might be possible.

There will be plenty of other alliance structures, post your ideas in the comments.

- Spectrum

"Tactics mean doing what you can with what you have." - Saul Alinsky

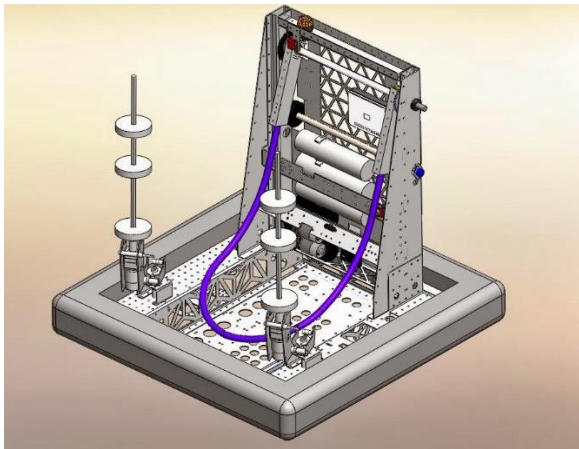
Saturday, January 25, 2014

Day 21: Ice Day low of 28 degrees in Houston

We had an ice day today so no school. Many of the Houston overpasses were iced over this morning. This only happens every 2 or 3 years, but when it does we overreact a bit, especially compared to what most people from the northern half of the country deal with for several months out of the year. We still met after school since by then the roads had thawed out and much of the traffic had gone down.

We learned that our Mecanum wheels wouldn't be getting to us till Monday so we decided to put the drive train together using Omni wheels instead for a Butterfly type drive train. We definitely understand why some of the powerhouse teams (148, 217, etc) have used this drive train in the past. It is so smooth and practically anyone can drive it well. Hopefully when we get drive centric control working with the mecanum wheels we will like that even more.

We'll have video up tomorrow of the robot driving around. Here's the latest CAD file, and you can see the collection mechanism CAD is coming along nicely.



- Spectrum

"When given a choice, choose the thing that scares you a little. If it's 100% safe, it is holding you back." - Jeff Atwood

Sunday, January 26, 2014

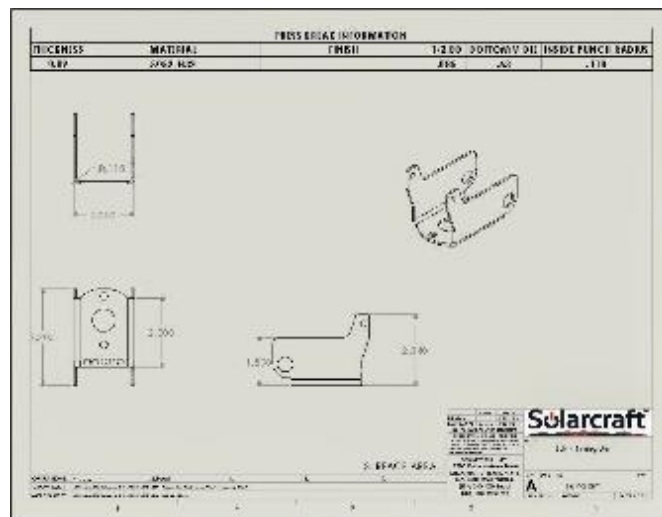
Day 22: Zoom Zoom

Here is the the video from our Butterfly drive test. This looks really good and is just a lot of fun to drive. If the omnidirectional drive doesn't work out we will very quickly switch back to butterfly.



https://www.youtube.com/watch?feature=player_embedded&v=n5HwDDkIXAq

We finished up the drawings for our launcher and our collector. Every part that we cut at Solarcraft has to have a drawing that goes with it so that you know how to bend the part after it has been cut. Here is what one of the drawings looks like. They outline how long the flanges are on the sheet metal so that we can program the press to bend the part at exactly the right spot.



Another very important system was prototyped today: handles. We got this idea from team 610 in this [CD post](#). All it takes is some steel cable, a couple cable crimps, and pneumatic tubing. A lot of teams probably already have this stuff in their shop. Crimp a loop in the cable then slide over the tubing and crimp a loop in the other end. Rivet/bolt this to your chassis and now you have convenient light handles that can just fold into your frame perimeter. This should work really well on the AM14U Chassis, put one bolt on the outside plate and one on the inside plate. Make one for each corner of your robot. Your drive team will thank you a lot for having handles, and you lower the risk of someone doping your robot.



Speaking of team 610, one of their students, Ryan Tam, put together an [awesome design tutorial and parts library](#). If you ever wondered how the World Champions train their team to design high-quality, reliable robots, now's your chance to find out. We highly recommend taking some time to read over this; our team will be using this to help train new members in the future.

- Spectrum

“You can't use up creativity. The more you use, the more you have.” - Maya Angelou

Monday, January 27, 2014

Day 24: Octocanum on the ground

Sorry for not having a post yesterday, we were hanging out with a few young teams at the Houston Bootcamp build day round 2. We were working on getting their electrical systems worked out and finalizing their build plan for the last half of the season. We'll have some of them over to our shop this weekend to work on bumpers and to continue improving their robots.

The Mecanum wheels finally came in today. We were able to get them on our chassis and we had them driving around. The code still isn't 100 percent and we don't have driver/field-centric control yet, but once we do we think this drive train is going to be very fun to drive.



https://www.youtube.com/watch?feature=player_embedded&v=igaGWIMFdSw

We also had one of our senior students, Collin, working on laser cutting and bending our next round of parts. Here is a video of him bending one of the pieces for our collector.



https://www.youtube.com/watch?feature=player_embedded&v=uXqnYHNqrV8



Tomorrow we should have parts back, and we have already talked to our powder coat sponsor about getting the parts in to them this week. If all goes to plan we might have two running robots at the end of week 5. (Though by saying that out aloud we've all but guaranteed that everything will not go to plan.)

- Spectrum

"Spoon feeding in the long run teaches us nothing but the shape of the spoon." - E.M. Forster

Wednesday, January 29, 2014

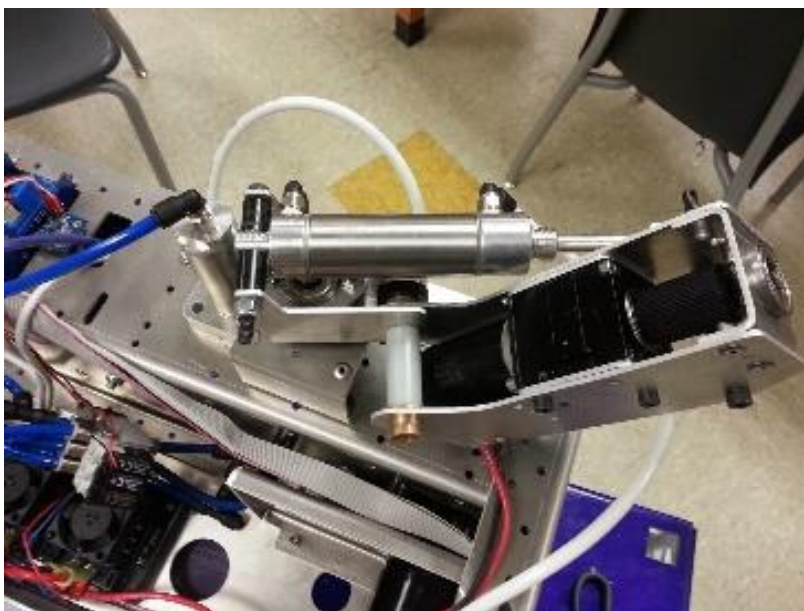
Day 25: Sheet metal Everywhere

We just got our second run of laser cut parts back from our sponsor's facility. One of our students was there till almost midnight getting everything cut and bent for the team. In total of 125 individual parts were produced last night.



We had another "ice" day today so there was no school, but since the roads were clear and the storm advisory was over at noon we decided to have an optional meeting.

We were able to get a lot accomplished since we got the sheet metal back and had things to assemble.





Above are pictures of our right collector and our launcher + back panel for our robot. These were both completely CADed and have a lot of details in them.

The collector is mounted on the practice robot and we were able to do a few stationary tests, but the real test will be tomorrow when we can drive and collect at the same time into our launcher. The launcher isn't complete because we are missing a few parts that will be in later this week and a few 3D printed parts that we need to make, but it is in a state that we can test fire it and we should have some video of it mounted and firing tomorrow.

We cut all the parts for the competition robot yesterday as well, and we are confident in the launcher design and we know that we can make adjustments to the collector quickly. We will be taking all the competition parts to Royalty Metal on Thursday for powder coating.

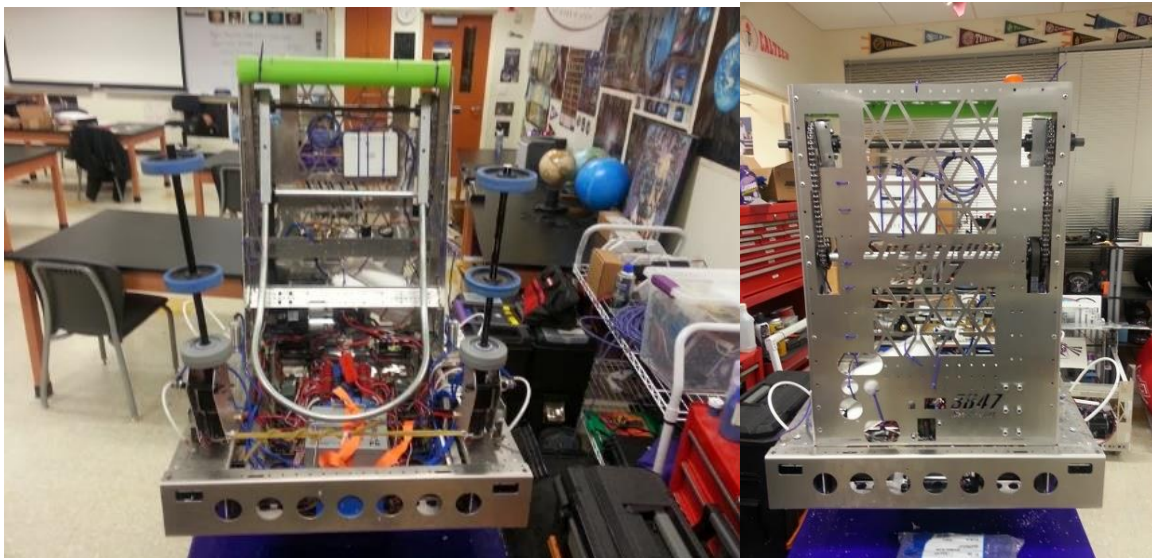
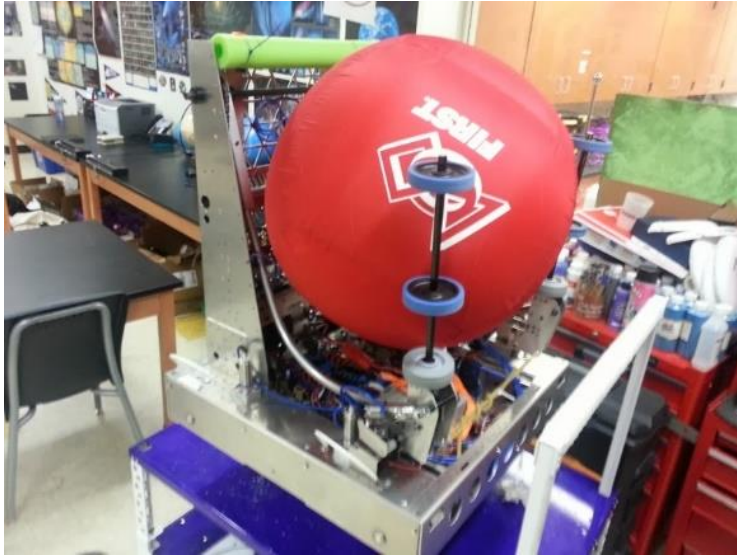
- Spectrum

"True happiness comes from the joy of deeds well done, the zest of creating things new." -
Antoine de Saint-Exupery

Wednesday, January 29, 2014

Day 26: It looks like a robot

Lots of robot pictures today. We got the back panel mostly constructed and the collector mounted. The robot in this configuration weighs 117lbs with the battery. That means we should still have weight for MiniCIMs and the catching wings on the competition robot.





We did get a little bit of testing done on the collector and shooter but nothing really video-worthy. Hopefully over the next few days we'll have full system integration and testing video to upload. We also got the competition parts cleaned up and ready to be taken off to Royalty Metals for powder coat tomorrow.

- Spectrum

"I'm a greater believer in luck, and I find the harder I work the more I have of it" - Thomas Jefferson

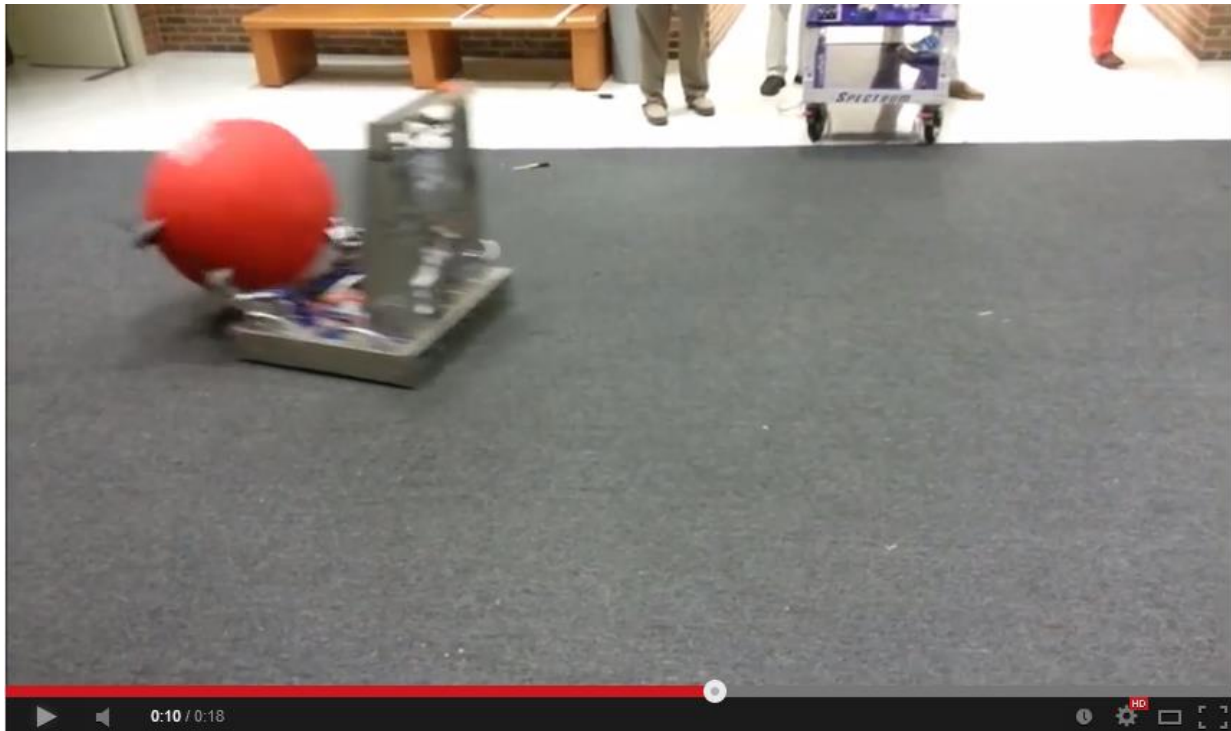
Friday, January 31, 2014

Day 27: More Power + Collection Testing

We received our 4 MiniCIMs from [West Coast Products](#) today. VexPro was out of stock but R.C. over at WCP was able to get us what we needed. They also have great calculators on their [resources page](#) to help you figure out belt and gear spacing or calculate your drive trains final speed.

We mounted the 4 MiniCIMs and added 4 talons to our practice bot so we now have 8 motors on our drive train. We didn't do much driving, but from the little testing we did the acceleration is much nicer now and feels a lot more like our 6 CIM drive from last season.

Our collector testing is still underway; we found some bugs last night that needed to be corrected and we worked on that for most of the day. Here are some clips from tonight's tests. We still don't have all the variables right but it's collecting much better now.



https://www.youtube.com/watch?feature=player_embedded&v=MrT8De0Sn98

We found a problem with our pneumatic wheel switching at the end of the meeting. For some reason the modules aren't keeping themselves off the ground like they should be in traction mode. We're using 4 1.0625" bore pneumatic cylinders at 60psi, which should be enough to hold up to about 200lbs but that math doesn't seem to be fitting reality. It probably means we didn't account for something in our math. We'll investigate more tomorrow.

Parts were dropped off at Royalty Metal to be powder coated and should be back sometime next week.

We have also been working on getting an IMU setup to give us orientation of robot at all times. We had the first successful serial transfer today of quality orientation data. The IMU has 9 axis

of measurement so it is able to reduce the amount of error that you would see from just using a standard gyro.

- Spectrum

"It's not what you don't know that kills you, it's what you know for sure that ain't true." - Mark Twain

Saturday, February 1, 2014

Day 28: Full Robot Demo for FLL Team Visit

We started the day off with a visit from one of our local FLL teams, from The St. Thomas More School. These students were all 5th through 7th grades and they were all very interested in the robot. Surprisingly some of the questions took a very technical turn and we started talking about the difference between an FPGA and a general purpose CPU. One of the students even told us about his favorite Linux distribution and was pleased to hear that we would be switching to developing in Eclipse next year.



Here is some video of the robot collecting and shooting for the students. Our practice area only has 10ft ceilings so we couldn't shoot very hard but you can get an idea of what the competition robot will hopefully be able to do.



https://www.youtube.com/watch?feature=player_embedded&v=Glb3n3taBJs

After the demo we started investigating the problem we found yesterday with the pneumatics on our octocanum modules. We believe we didn't account for the lever action of the module and the amount of force we put on each cylinder. Our plan is to move to 1.5" bore cylinders but that will take a bit of rework on the mounting, though not too much. Luckily we have a working robot this early so we can catch major and minor problems before we get to competition.

We worked on adding our wings to the robot, which will help us secure the ball while driving, prevent it from slipping out while collecting, and allow us to catch passes. The current wings are made of hardboard but we are planning to move to corrugated polycarbonate. The [corrugated polycarbonate](#) was suggested to us by our friends James Tonthat and [Scott Rippetoe](#) from Texas Torque FRC#1477. It's apparently used very often in greenhouses but you can get it at a variety of plastic distributors. It's rigid like 1/4" Lexan but much lighter.

We are working on an extremely cool way to hook up an [IMU](#) to the cRIO to get an accurate heading. When it's all said and done it should only take a single PWM cable hooked up to a digital input pin on the cRIO. We'll have more on this later.

The last thing we did for the day was work on improving our collector more. We found that it had a lot of wobble because the CAD model had the wrong size holes for the bushing we were going to use. We ended up drilling out the holes for bearings and then packing them with a little bit of electrical tape to stop the wiggle. This fix will not be on the real robot but sometimes you have to do things like that to get your prototypes testable. There is still a very long list of variables that we don't have solved for our collector, here is just a sample.

- Wheel type & diameter (we might move to a roller system instead of wheels)
- Number of wheels and spacing
- Speed
- Angle to deploy down
- Angle to hard stop the rotation in and out

There are plenty more too, all of this will get tested and iterated until we find the setup that collects best. We will probably keep changing some of these throughout the entire season. Week 4 has come and gone and we're left with 17 days to build the competition robot and hopefully find answers too many of the variables in our robot.

- Spectrum

"An expert is a person who has made all the mistakes that can be made in a very narrow field." - Niels Bohr

Sunday, February 2, 2014

Day 29: Mama said there'd be days like this

This is a hard post to write. It's just been one of those days where nothing goes well. We had some problems yesterday but we were pretty optimistic we would be able to fix them without too much trouble. Things didn't get better today.

From bad crimps to breaking a handle on the robot to diagnosing a drive train problem for 40 minutes only to realize it was a dead battery, nothing went our way today. We would try to improve things only to make them worse. The current state of just about every subsystem is markedly worse than it was 36 hours ago.

The biggest problem of the night came at around midnight when we were testing our latest change to the collection system and getting ready to test driver centric control. We were driving along fine, we strafed right and then when we went to strafe back left we saw the robot sort of dip and then just completely stop moving. We strafed back and it sort of worked but in a big arc. We thought we might have unplugged a speed controller or gotten something jammed in a gear. When we turned the robot on it's back to see the drive train we discovered that we had broken one of the rollers clean off our VEXpro 4" mecanum wheel.





We haven't done much to these wheels at all, we have only had them for 6 days and have driven less than an hour and half on them on FRC carpet only. They haven't been put up against other robots or had any pushing tests done with them, we have just driven around and tested collection for the most part. After looking at the broken wheel we found that the roller didn't spin at all, we checked all the other wheels and have found at least five other rollers that either don't spin or are very tight.

The six of us that were still at the shop at midnight discussed it and unless there is some very strong reasoning by the rest of the team to stay with mecanums, we will be switching to butterfly for this year's drive train. If this were to happen during a match we wouldn't be nearly as effective and the ability to strafe isn't worth the risk or breaking wheels and having to make repairs.

To top off the day of everything going wrong, on our way down from the third floor where our practice area is to our lab we ended up on the first floor. Our lab is on the 2nd floor, literally nothing went right today.

Tomorrow we'll change the wheels back to omniwheels, and we'll halt development on holonomic control and sensors. This may turn out to be a good thing, without worrying about mecanum wheels and holonomic control we'll have more time to focus on other systems. That's at least how we're going to spin it.

15 days left to get it right, tomorrow should be better since we get to watch the Superbowl as a team and have some fun.

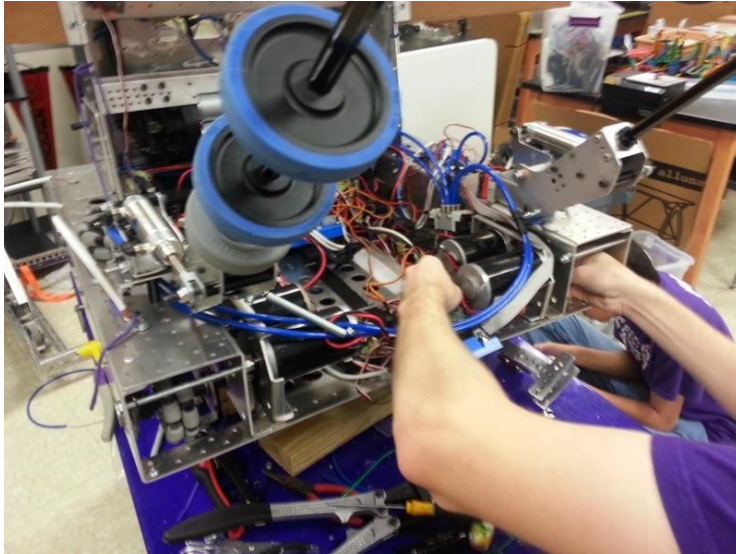
- Spectrum

"Sometimes adversity is what you need to face in order to become successful." - Zig Ziglar

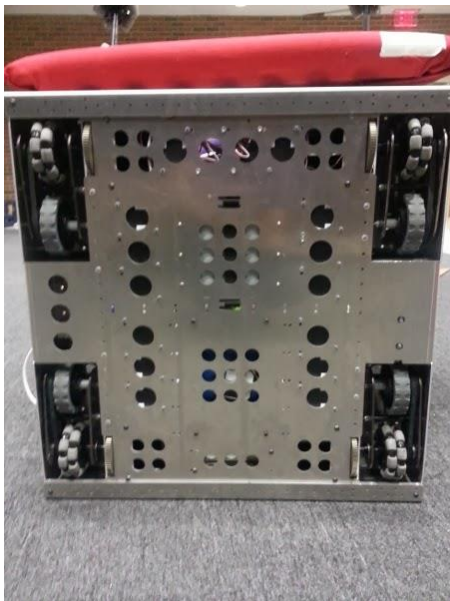
Monday, February 3, 2014

Day 30: When life gives you mecanums

Well today was interesting. We started the day by taking off the mecanum wheels from our drive train and replacing them with the omniwheels.

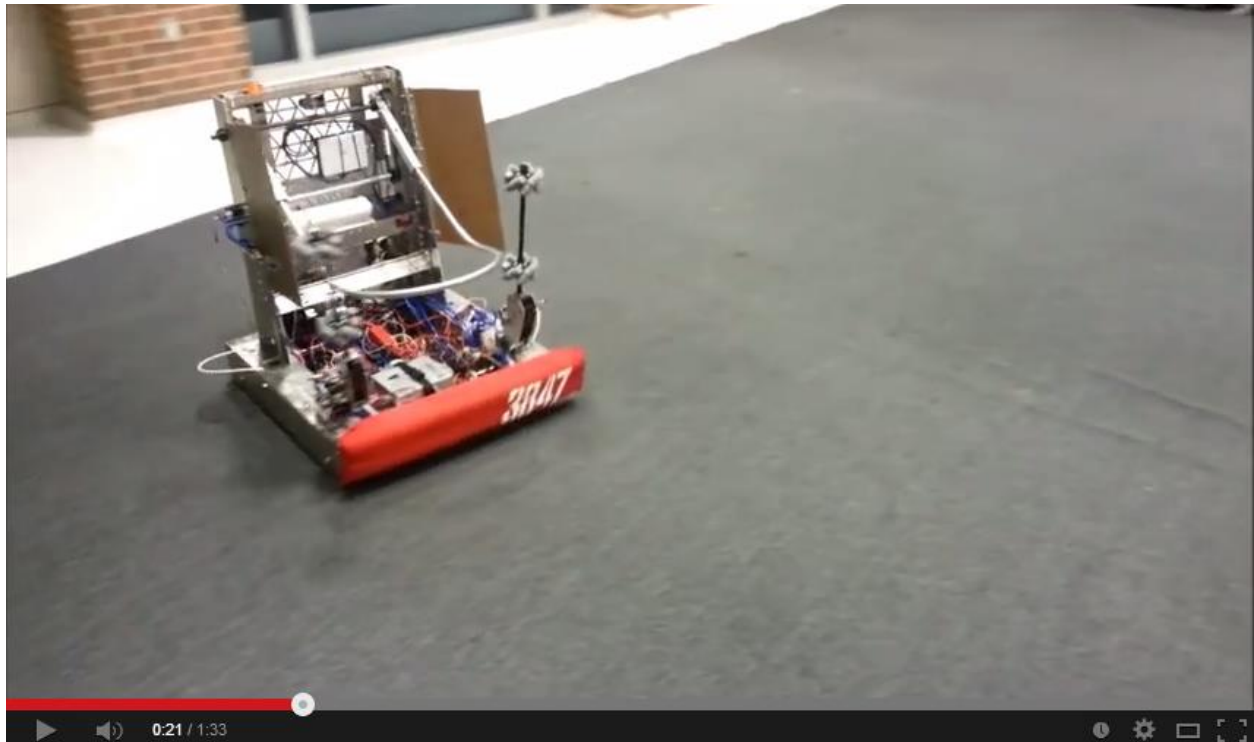


We have the robot set up so that we can remove the end caps of the chassis easily to work on certain parts of it.

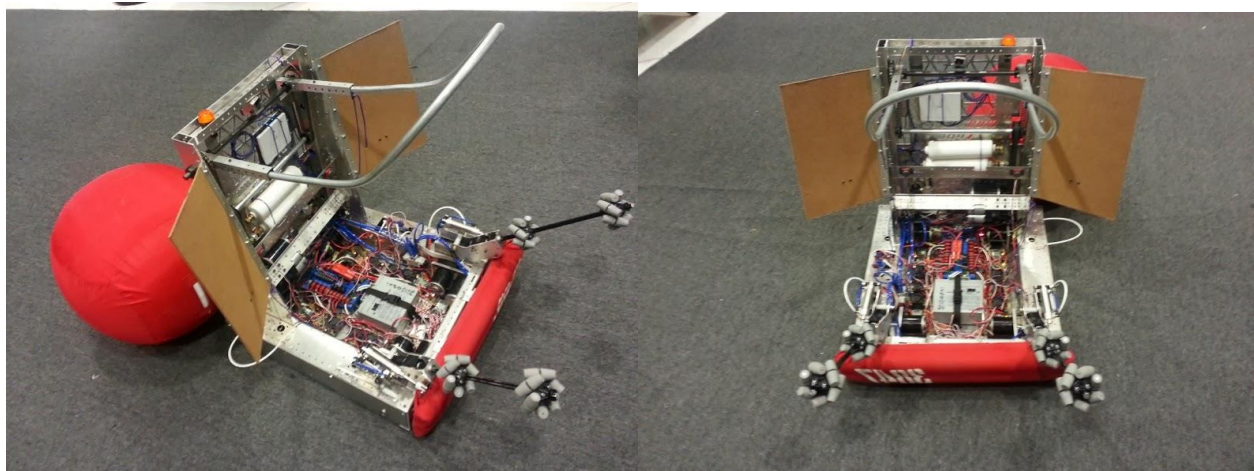


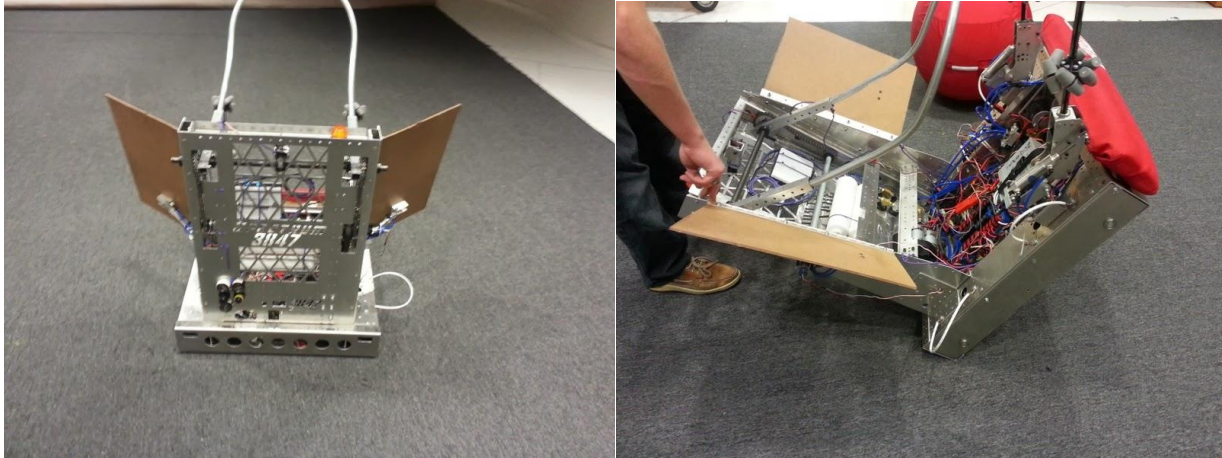
We also made our collector not pivot outwards. Originally we thought the collector would need to expand to allow the ball through, but after testing we started reducing the swing more and more. Now we think we can build in enough flex and compress the ball enough that the system won't need to expand. This will eliminate a degree of freedom and make the system much simpler.

While doing this we decided to test different wheels for collection. We tried the set of the mecanum wheels that we had taken off the drive train, because we're trying to make the most of the items we have on hand. Even though they were intended for a much different purpose, they worked surprisingly well. The mecanum wheels are very grippy on the game ball and they are actually making the ball go into our robot better than some of the other wheel choices. We still have a lot of testing to do before we decide on a final roller, but mecanums are currently in the lead.



https://www.youtube.com/watch?feature=player_embedded&v=7-boVCkTp5I





That last shot shows our backwards tipping point on this robot, so we don't think we'll have a tipping problem. The wings are still very rough, but they are doing their job. We put the potentiometer on the launcher today and should be able to get the encoder on in the near future. The plan is to use the encoder as a velocity sensor and the potentiometer to set the release point. We added an encoder to one side of the drive train and may add one to the other if we find a need for it.

- Spectrum

"You may encounter many defeats, but you must not be defeated. In fact, it may be necessary to encounter the defeats, so you can know who you are, what you can rise from, how you can still come out of it." - Maya Angelou

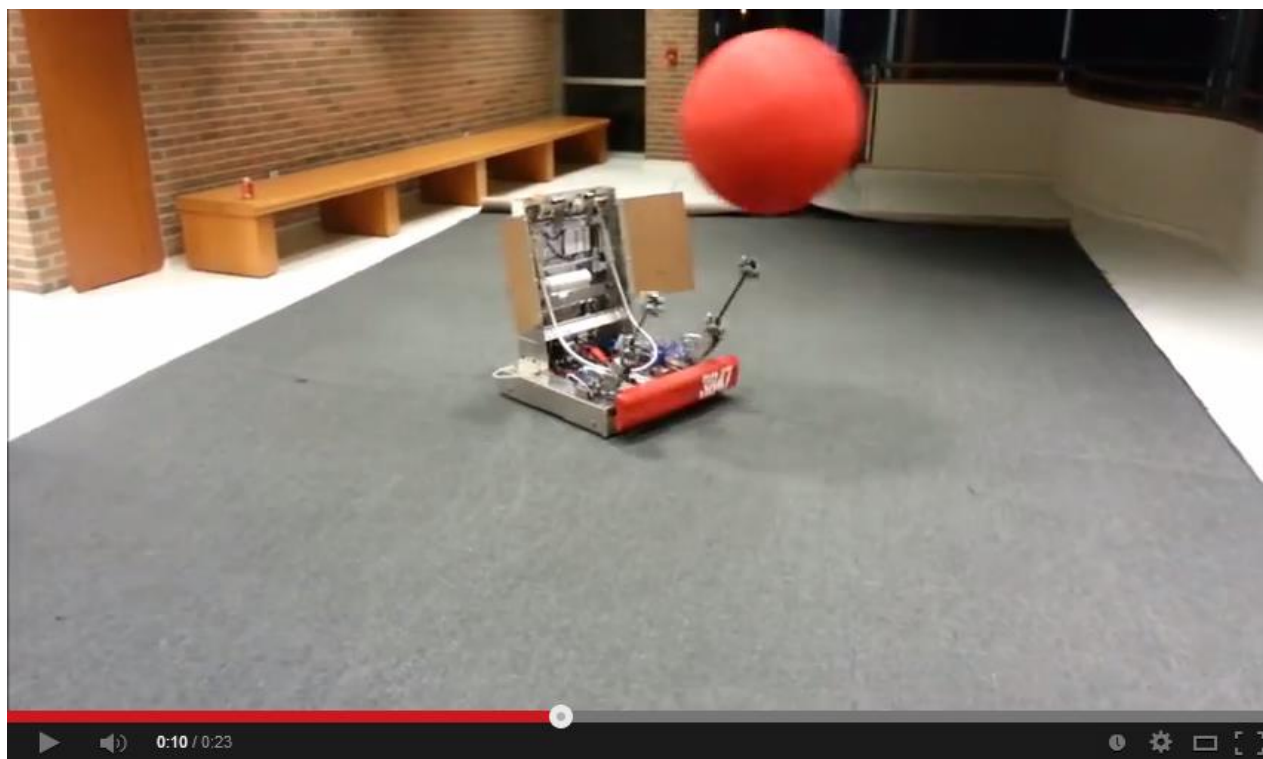
Tuesday, February 4, 2014

Day 31: More mecanum news & catching video

This morning we got a call from VEX explaining that they had intentionally shipped the incorrect rollers with the 4" mecanum wheels so that they could get the product out faster to teams. The rollers they shipped are for the 6" wheels and thus don't provide a completely smooth motion. This is why we were able to break one since 100% of the load ends up on the tips of the current rollers during part of their revolution.

We worked more on collection today. We strongly believe that collection will be more important than shooting in this year's game. Having a fast and reliable collection system alone will allow you to play in eliminations.

Here is some quick video of our robot catching bouncing balls. We're hoping to be able to chase down balls that are bouncing anywhere on the field and catch them instead of having to collect them, which should be faster.



https://www.youtube.com/watch?feature=player_embedded&v=x_GPEJK73qo

We're still using the mecanum wheel collector. We tried to build one out of 1/2" schedule 80 PVC but the mecanum wheels out performed it by a lot. We're going to keep trying different wheels and rollers but right now the mecanum wheels are working really well.

- Spectrum

"The best creative solutions don't come from finding good answers to the questions that are presented. They come from inventing new questions." - Seth Godin

Thursday, February 6, 2014

Day 33: Fixing our mistakes

Sorry for no post yesterday, we had a really short meeting since there were parent-teacher conferences. Mostly worked on chairman's award stuff.

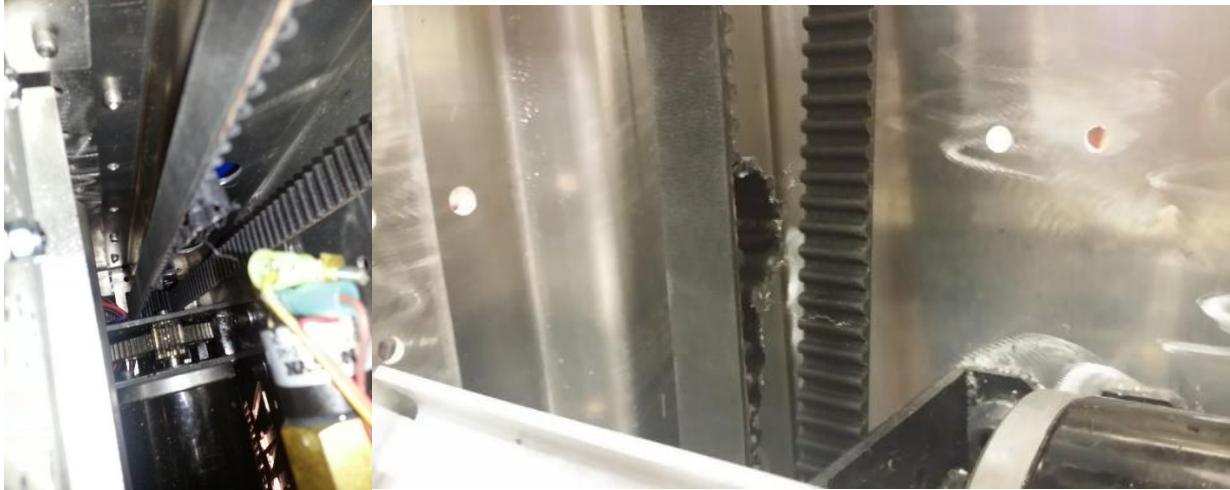
We'll start with a video today of us doing some catch testing. We're not really planning to catch that often but we think we're pretty decent at it. If there is defense it might be a different story, which is why we might not be catching very often.



https://www.youtube.com/watch?feature=player_embedded&v=uZFwGVfxVW0

We also received our new proper 4" mecanum rollers today. We're still not sure if we will be switching back to octocanum or not but the new rollers look a lot nicer than the ones for 6" wheels. We'll probably do some side by side tests once we have the competition robot up and driving.

Our shooter has been slowly getting worse since late last week and we weren't really sure why. We had been making some changes on the upper assembly, but no one really looked down at the first couple stages because we figured well, how could those be breaking? We were very wrong.



That is a picture of the belt that drives the first stage of the launcher. Apparently you really shouldn't ever allow your belt to ratchet since you can just rip the teeth clean off the belt backing, we now know that from experience. We moved the belt around to where the bad section wasn't engaged during launch and we got all our distance back. The ratcheting was happening when we didn't have limit switches or other sensors installed on the launcher and we were running it into a hard stop. Now that we have more sensor feedback we shouldn't have this issue anymore. We still might move to chain just to be safe.

We received our bigger bore cylinders, 1.5" bore x 1" stroke, today for our drive train. Somewhere in the design of our drive train we forgot to do some basic math on the leverage needed to lift our robot and now we're paying the price by having to redesign to fit the larger cylinders. Had we just moved the point on the modules that the cylinders push down, we wouldn't be in this mess. We made a pretty poor system today which will get us through some testing, but we'll have a more complete fix ready for the competition robot.

We spoke with our powder coat sponsor and they say it will be done by Friday or Monday. We're hoping for Friday but we know we can assemble the robot in the last week if we have to. We've fixed most of the problems that cropped up over the weekend and we're happy with where the competition robot should be once we get her built.

- Spectrum

"The willingness to share does not make one charitable; it makes one free." ~Robert Brault

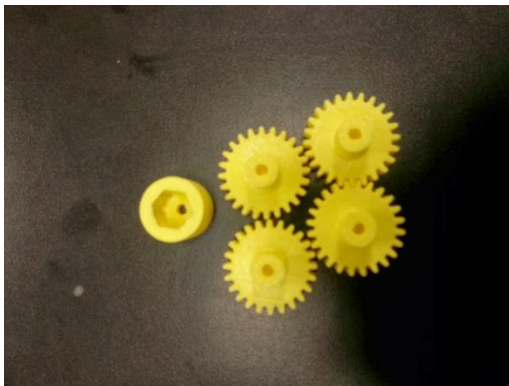
Thursday, February 6, 2014

Day 34: Withholding allowance and 3D printed parts

We're sort of just waiting on the parts to come back from powder coat at this point. Lots of little things going on but not much major work. We're reworking the launcher and have added springs to make it easier on the motor to accelerate to top speed. We still have a lot of programming to do before we're sure we can make all the shots we need.

We're also making sure that we will have all the parts for the competition robot ready to go once it comes back.

We also discussed our "artist formally know as the withholding allowance". The GDC has changed the rule to 45lbs due to inclement weather around the country. We actually weren't planning to withhold that much this year, but with the new rules we probably won't be bagging our collector and launcher bar. We'll have a full drive train and tower in the bag, but we should be able to make lots of modifications to the other parts of the robot.



These are some of the 3D printed parts that we have been using this year. There will be a few more as well. We're finding lots of interesting ways to make parts with the 3D printer this year.

- Spectrum

"So often people are working hard at the wrong thing. Working on the right thing is probably more important than working hard." – Caterina

Saturday, February 8, 2014

Day 35: Launching Better

We spent the day gathering all the parts for the competition robot. We still don't have the sheet metal back yet but that should be Monday. We want to have everything else ready to go when we get it back, and it should go together like a big Lego set.

We also replaced the belt on our shooter with sprockets and chain. We now have 2 CIMs and 2 BB775s driving a 5.33:1 VEXpro gearbox, that has a 12 tooth sprocket driving at 26 tooth sprocket that share a shaft with 2 15 tooth sprockets that drive 26 tooth sprockets on each arm of the shooter. Our final gear ratio is right at about 20:1. With the chain we have to be much more careful not to stall the motors into a hard stop.

We also started testing different release angles by adding a bar to the launcher arm at different points. This dramatically alters our shot trajectory and can provide us a much further shot. We're going to play with this more to find the optimal position.

A few minor things as well, we got more air tanks and the real mounting brackets from Pneuaire, we mounted them on the practice bot and had to modify the mounts slightly to make them work the way we wanted. We also put on the 3D printed pot adapter for the launcher and that didn't work as well as the makeshift one we had before. We'll have redesign a bit to make sure that it's very robust. We changed the outward angle of the wings by adding a small spacer to the cylinders, which prevents them from pulling any further out.

Here is a quick video of us testing the ability to drive with two balls. I wonder why we would want to do that?



https://www.youtube.com/watch?feature=player_embedded&v=fGPI7qRoZpc

- Spectrum

"When in doubt, always err on the side of generosity!" - Ping Fu

Sunday, February 9, 2014

Day 36: Programming, Friends, and Fundraising

We did a lot of work on programming today.

We added in our IR sensor to detect the ball. This allows us to automatically stop our collection and catch commands once the robot sees that we have the ball. This makes catching and collecting much easier. It's extremely simple code; basically if the sensor sees something within a certain distance it just stops doing the commands. Very simple but should be very beneficial.

We added in our PID position control for the launcher arm. We have added about 60lbs of constant force springs to our launcher so it no longer rests in the down position. We might be removing a couple of those to fix this but we still needed a way to force the launcher to return down after we fired. We do have a potentiometer on the arm so that it know how to return to the stowed position.

We finished turning several of the pieces for the real robot, mostly just standoffs and spacers but they're very crucial for proper alignment.

We had a few friends over today. Team 4280, N-GEN from Sam Houston Math, Science, and Technology came by and we helped them with some electronics and worked with them to get their bumper frame built. We had team 3666, Bolton Bear Bots, from Alexandria, LA come by to get in a little bit of practice on real FRC carpet. We have been working with them on several items this season and generally just sharing ideas. It was very cool that they had the chance to drive all the way out here work with us today.

At the end of the night we got to do some shooter tests in our gym. It's working very well. Our 18 ft shot still needs a bit of work but we're confident we can get it consistent soon. Here are a few of our test shots over the truss.



https://www.youtube.com/watch?feature=player_embedded&v=YOtEIUmcWJE

On a different note Team 987, The High Rollers, have started putting together an absolutely amazing video series on how their team operates. They have been consistently one of the best teams in FRC on a robot and organizational level. Here is the [thread about the series](#) and the first video is below about fundraising. Thank you 987 for putting these together, many teams will benefit.



https://www.youtube.com/watch?feature=player_embedded&v=5x-LWgGcLA4

- Spectrum

"Synergy — the bonus that is achieved when things work together harmoniously." - Mark Twain

Sunday, February 9, 2014

Day 37: Everything is ready

We prepped all the parts we needed for the construction of the final robot. Every little spacer is ready to go and should make final assembly very quick.

We had more friends over today. This afternoon we were joined by the Discobots at our build site. They ended the day by getting some good test shots out of their robot.

We did a bit more programming today and worked on the vision code that will allow us to detect which goal is Hot in autonomous mode.

We worked a bit more on the launcher but never got the consistent 18ft shot we were looking for. It's not crucial for our strategy so we'll be stopping the pursuit until we can ensure the rest of our priorities are accomplished.

We finished up the CAD models for our week 6 laser run. It will include a few new parts for our collector and also some replacements for our pneumatic cylinder mounts on the drive train.

The Chairman's essay is now finally under 10,000 characters but it's always a struggle to keep it that way. We have so much to say and so little space.

- Spectrum

"Trust your passion, identify your dreams, and find the courage to share them with others, no matter how many times they call you a fool." - Bill Strickland

Tuesday, February 11, 2014

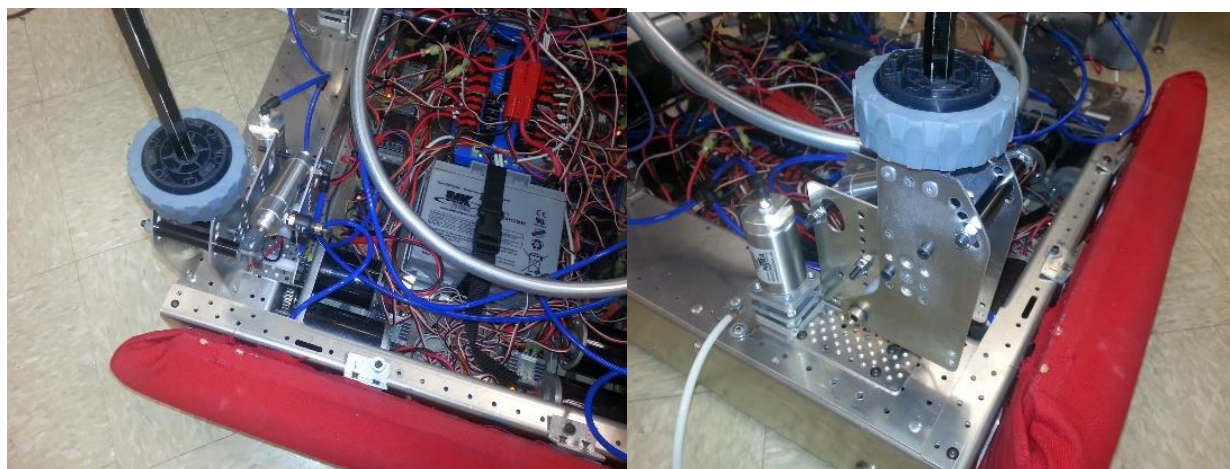
Day 38: New Collector but no powder coated parts

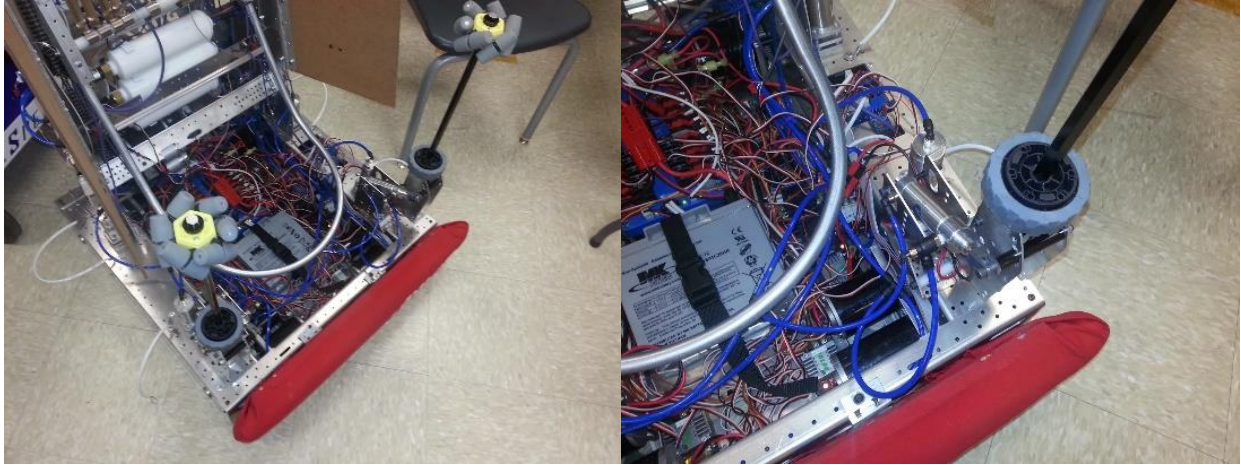
We didn't get our powder coated parts back today. We have been assured tomorrow. The assembly should only take 3 days but it would be nice if we had all weekend to work with the robot.

We did however get our last run of laser cut parts. Included in this run was some plate hex hubs, some mounts for the pneumatic cylinders in the drive train, and some new collector parts.



Here is the new collector mounted in the robot. It may look the same but it's designed not to rotate anymore. We also finally moved to using 775s on the collector which was the plan all along. The 775s have nearly twice the power that the BAG motors do. That puts our motor count this year up to 6 CIMs, 4 MiniCIMs, and 4 BB775s. We really like our collector for a few reasons, particularly because we don't have to stick anything out past our bumper except for the wheels and hex shaft. We're still a bit worried about bending the mounts but we are working on ways to prevent that. The pneumatic cylinders are very low on the pivot and allow the shafts to be pushed back very easily which means they don't bend or break if we run them into a wall. We can also collect when the ball is off center and we can easily eject the ball forward out of our robot to pass or score in the low goal.





Tomorrow should be basically all assembly and more chairman's award work.

- Spectrum

"If your actions inspire others to dream more, learn more, do more and become more, you are a leader." - John Quincy Adams

Wednesday, February 12, 2014

Day 39: Parts are finally back

We got all the parts back from the powder coater today, sadly there won't be any purple powder coat on our robot but the white still looks good. There will probably be a few purple spray painted items as well.



We started final assembly and have gotten pretty far along. We have the full drive train complete and waiting for electronics. We have most of the back panel assembled just need to add the two launcher shafts.

With the 45lb withholding allowance we won't be bagging a collector, wings, or launcher arm so we'll have plenty of time to work on those before our first event, Week 3 in Dallas. All of those mechanisms are very modular and should be very fast to reattach at the event.

- Spectrum

"I have seen many people become good at copying, but then never think to apply what they learned to their own drawings. Applying something from what you study tests you to see if you actually understood what you copied." - John K

Friday, February 14, 2014

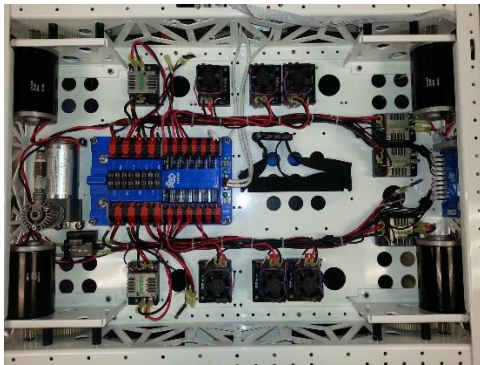
Day 41: Five Days Left + Chairman's Award

Spectrum 2014 Chairman's Entry

That's our 2014 Chairman's entry for this year. We have put in a lot of time working on it and way more working on the activities that we talk about it in. The Chairman's Award is FIRST's highest honor and something all teams should strive for.

Sorry for not having an update yesterday, nothing really exciting has happened. We're assembling the competition robot, putting some of the bumpers together, and getting ready to spray paint some of our parts.

Here's a quick picture of our wiring for the competition robot. We're still not as good as some of the west coast teams (254, 968, 1538, etc.) but we're pretty happy with it. This is still missing pneumatics, sensors, the main breaker, and a few other things, as well as three talons, which will be withheld with our practice bot and the MiniCIMs that attach to them.



- Spectrum

"I hope you're proud of yourself for the times you've said 'yes,' when all it meant was extra work for you and was seemingly helpful only to somebody else." - Fred Rogers

Saturday, February 15, 2014

Day 42: The Last Push

Today was the first of 4 straight 12+ hour days for us. Our school's schedule works out very well and we always have a 4 day weekend for presidents day.

We spent most of today wiring; we won't know for sure if this is our best robot till it plays some matches but we can already tell that this is our prettiest robot. Lots of little details are getting hammered out, not many major changes, though we did change the location of our solenoid mounts.

We are moving to VEXpro traction wheels with rough top tread along with our omniwheels in our Butterfly drive. We tried the new Versawheel DTs but sometimes you shouldn't mess with what works. The 2" wide traction wheels have far more traction than the versawheels, it's not even close. When combined with our 8 motor drive train the acceleration in low gear makes it look like our robot is going to take off. We'll be adding some ramping functions so the drivers can keep the front wheels on the ground. The traction wheels are actually about 4.25" diameter once we mounted the tread on which caused some issues in our wheel wells so we had to turn down all of our standoffs to 7/16" instead of 1/2".

We had Discobots in the house tonight and they'll be working at our place all weekend. We'll also have at least a few more teams over for the Houston practice session. We don't have much of a field this year, but this game is sort of like soccer: all you need is some carpet and a ball and we should be able to practice.

- Spectrum

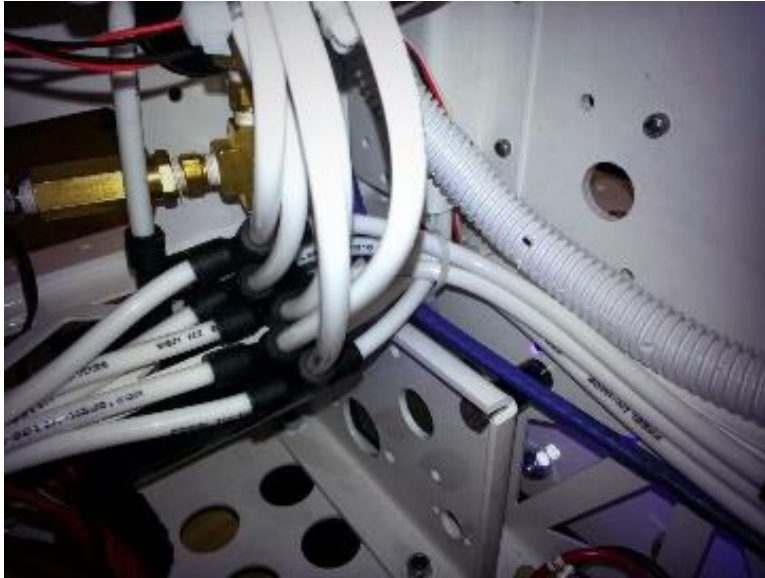
"Do the best you can until you know better. Then when you know better, do better." - Maya Angelou

Sunday, February 16, 2014

Day 43: It's really pretty

We have spent way more time making sure that everything on this robot is in the right place and looks good this year. Last year we had a lot of little issues because something would come unplugged or get plugged in to the wrong place. That won't be happening this year.

We're also doing 15 hour days today and tomorrow. Last little bit of time with the competition robot before we put it in the bag.



That's just a small corner of the robot, the theme this year is #AllWhiteEverything

We're pretty sure we are going to be slightly over weight like 121lbs after we add the MiniCIMs and 2" wide traction wheels to the robot at our first event (we're withholding them so we don't have to buy spares). So we are going to have to go on a small diet and remove some less needed things here and there.

The first day of our open lab / practice day was a very big success. We had two rookie teams and three veteran teams in our shop today working on their robots. Some of the teams need help with construction and others just need a place where they can stay late to finish their robot. We're happy to help either way. The last weekend push is hard no matter what, and we're happy to make it a little easier for some teams.

- Spectrum

"If you can dream it, then you can achieve it. You will get all you want in life if you help enough other people get what they want." - Zig Ziglar

Monday, February 17, 2014

Day 44: The robot is complete (except for all the iterations we still have to do)

We had the competition robot driving and shooting today. At first the robot was doing something very interesting: it was shooting straight up in to the air. The ball would actually land back in the robot. This was not the intended result. We figured out that our launcher bar for the competition robot wasn't bent at the correct angle and it was just a little shallow. We bent it a few degrees more and it's shooting better than the prototype. Collection is about as good as we could ask for. We have over a 180 degree window for the ball to hit the collector sticks where it will still collect.

Tomorrow will be spent programming and filming our reveal video.

We also talked about strategy and scouting again today since we were able to watch some of the webcast from the scrimmages from around the country. One of the main points of debate was what is important in this game. In most games shooting percentage and shots taken are two of the most important stats; last year you wanted robots that could get Frisbees in the goal. This year it's different since each alliance only has one ball; we have to use stats that are more similar to traditional sports like soccer, basketball, football, and rugby. In basketball a very important stat for point guards is your assist to turn over ratio, which basically says how good you are at setting up your team mates for points with the ball in your hand. We think that a similar stat in Aerial Assist can be Assist Generated to Lost Ball ratio, we want to compare how often a team generates an assist by passing to a team mate to how often they lose the ball. Lost Balls can occur in many ways: dropping the ball while driving, missing a shot, throwing a truss pass that isn't quickly secured by a human player, team mate or the same robot, or any other way that the ball gets out of control of that team. Lost balls are going to be time killers for teams and cycle time is the most important thing for an alliance. Ball recoveries may be another important stat because you want teams that are able to recover a lost ball quickly and reliably. We're also going to be keeping track of things like inbound catches, tackles, deflections and much more. Since not every team needs to score, advanced metrics will be even more important this year.

We wrapped up our practice open lab today by having 4 teams in our shop working, practicing, and getting ready for their events.

We have had people working 41 hours over the last 3 days. We have another 10+ hour day ahead of us tomorrow.

- Spectrum

"The losers are the ones caught up in that afternoon rush hour. The winners drive home in the dark." - Neal Boortz

Tuesday, February 18, 2014

Day 45: Filming

We started the day trying to get through a few problems that have crept up on the competition robot. Nothing too major there was a popping noise in one of our drive modules that we have discovered was a bearing rocking in it's seat. We also had some issues with getting as a consistent shot as we want but found a few options to make that better.

We filmed most of our reveal video today. We'll film a bit more tomorrow afternoon before we bag and should have it up sometime on Wednesday.

Around 8pm we received a call from a local team, 4155 SHARC, because they were having trouble getting their cRIO to image after breaking the sidecar. We actually had them bring their electronics board to our shop and we found that one of their students had mistakenly wired their cRIO to 12v instead of 24v. Surprisingly it will still work pretty well, except it won't take an image and will have other random errors, but it does boot and the imaging tool can find it. Once we found the cause of the problems, we got them squared away and they should be practicing again tomorrow.



For one reason or another this photo was taken during filming of the reveal video.

- Spectrum

"You should bring something into the world that wasn't in the world before. It doesn't matter what that is. It doesn't matter if it's a table or a film or gardening — everyone should create. You should do something, then sit back and say, "I did that." - Ricky Gervais

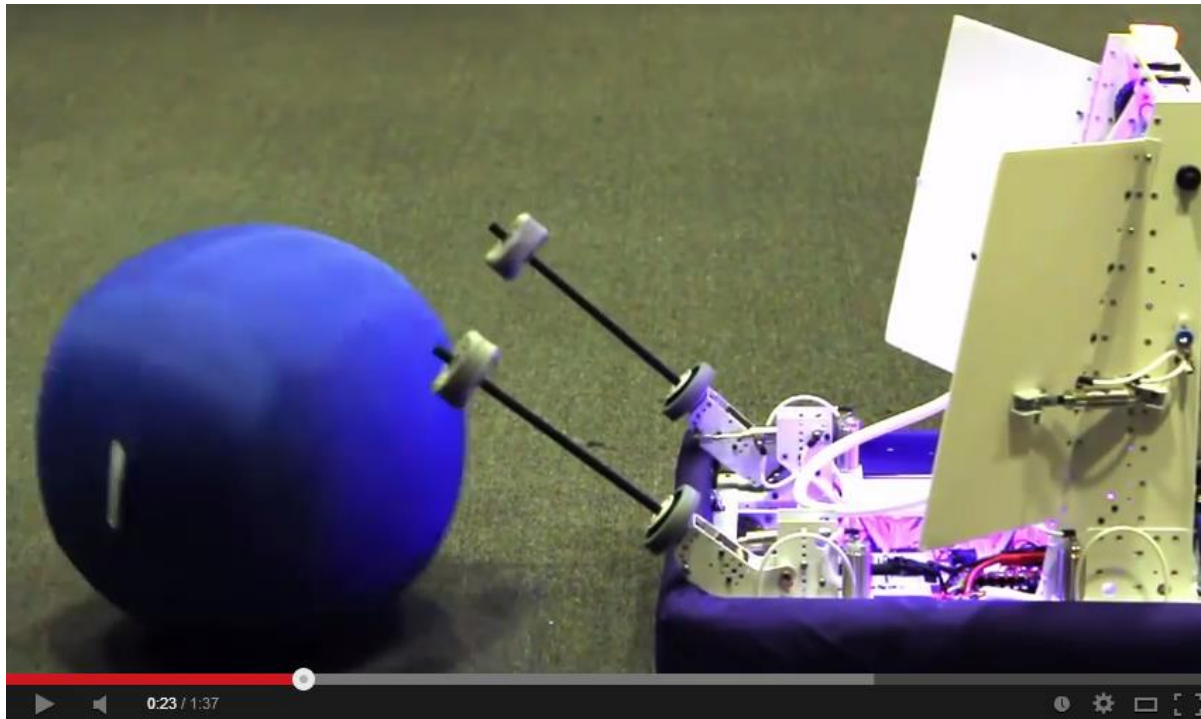
Wednesday, February 19, 2014

Bag Day: Infrared

Infrared



Reveal Video



<https://www.youtube.com/watch?v=aHeQXjTpmSc>

Reveal Photos

To discuss the robot head over to our [CD thread](#).
It's in the bag.



The handles even work when it's in the bag.



We withheld the collector, the launcher bar, the traction wheels, and a few other things. Lots of things to iterate over the new couple weeks.

- Spectrum

"When I am working on a problem I never think about beauty. I only think about how to solve the problem. But when I have finished, if the solution is not beautiful, I know it is wrong."

- Buckminster Fuller

Sunday, February 23, 2014

Day: 51: Inspiration

We took a short break after bag day and didn't meet on Wednesday. We met Thursday but only really looked at reveal video and did a little work on the practice bot to reattach some of our withholding weight for testing. Friday and Saturday were spent volunteering at the South Texas VEX Championship. We helped setup the event and then we were referees, score keepers, and part of the field reset crew. With over 60 teams there it was a huge event. We had four fields running at once with a single division. The winning alliance was led by teams from Galveston.

Inspiration

There is currently [a thread](#) on Chiefdelphi.com about inspiration and generating new ideas from old ideas. We want to take this time to acknowledge a few of the places we gained inspiration for some of the features on Infrared.

Ri3D Boom Done Team: If you look at our robot, you can see the overall structure of the systems is inspired by Boom Done. Dr. Joe Johnson and his team put together an extremely effective robot in only 3 days. We were really impressed by its versatility and that it had the potential to meet nearly all of our design goals. We had been building prototype catapults and punchers but we were worried about being able to implement systems to provide a wide variety of shots and passes. We also wanted an open top design with a back panel that would allow us to easily catch balls from the human player and possibly other robots. Boom Done's overall structure met these goals. We also knew there were a lot of places for improvement after all it was designed in 3 days and we had six+ weeks. The collector was one of highest priorities; we wanted to be able to get the ball off the floor as quickly as possible. We also knew that leaving the collector deployed would increase the risk of it getting damaged and it wouldn't allow the ball to be secured. We went through at least 4 major iterations on the collector before we got to the non-pivoting independently dropped down, Mecanum collector that we have today. We added wings to the side of the tower to help with catching and to secure the ball even more than we drive. We also knew that the launcher could be improved, because its motor powered we figured that if we added more motors we could increase its acceleration and thus increase the balls exit velocity again giving us a wider variety of shots. We prototyped the shooter using a 3 CIM gearbox that we had used on our previous year's drive train. We replaced one of the CIMs with two 775s to give us even more power. We have been experimenting with constant force spring on the launcher bar to help with acceleration even more but there are some draw backs, such having to lock the launcher down instead of just having it rest at any point. Our drive train is also different but that was inspired by another team.

Team 3928 Neutrino and Aren Hill: We didn't use the choo-choo mechanism that many people are so fond of that Aren Hill demonstrated this year but we were inspired by a drive train that he helped design last season. Neutrino's butterfly modules were extremely impressive when we were pit neighbors with them this summer at IRI. The simplicity of just pushing down on the module and having it sprung up on its own was very cool. Our original plan was to use their shifting concepts in an octocanum configuration but we ended up back at butterfly after a few problems. We modified it to allow us to add MiniCIMs to each module and also include 2" wide traction wheels. Another difference is we put our omni-wheels to the outside of the frame which makes our traction drive a little less stable but it does allow it to turn better.

Sheet metal Designs of 148, JVN, and many others:

We have been learning about sheet metal design for the past two seasons. When we first got into it we looked really closely at the Robowrangler robots from previous years, like [Raptor](#) and [Tornado](#). We also had a huge number of our questions answered by JVN. Since then we have been improving and had a student learn to run the laser and the break to cut and bend all our parts. These [two threads](#) on chiefdelphi provided a huge amount of advice on solid drive train design. Thanks to the mentors from 971, 973, 488, and others.

610 Helpful Tips:

We posted about this earlier but this thread on [Helpful hints for all](#) is a great read. Because of it, we added an attached velcro strap to our SB50 Battery connector, we stood off our Power Distribution board from the belly pan to allow us to mount things under it (Radio power inverted and lights), and we added wire rope and pneumatic tubing handles (These might be the best feature on our robot). In a different [thread](#) Mr. Lim of 610 led us to these [potentiometers](#). They are continuous rotation single turn pots, and we use one on our launcher and they've been great.

[On board volt meter](#) from team 1818:

This is one of the best features we have put on a robot-- it weighs almost nothing and just plugs in to our terminal strip for the lights. It couldn't be simpler. We bought ours from overseas but Adafruit and others sell them. We expanded this concept to the entire back panel of the robot, which is the central display for all the information on the robot.

[VEXpro](#):

Our last two robots have relied very heavily on VEXpro products. Nearly all the gears, sprockets, and pulleys on Infrared are from VEXpro. Their Versaplanetary gearboxes allow for some extremely nice designs because of the reduction you can get in such a small package.

Thank you to all the people that have inspired our design choices and more than anything taught us cool things-- that's one of our favorite parts about the FRC community.

- Spectrum

"It's a great thing, for someone to feel that they can draw inspiration from you." - Chloe Sevigny

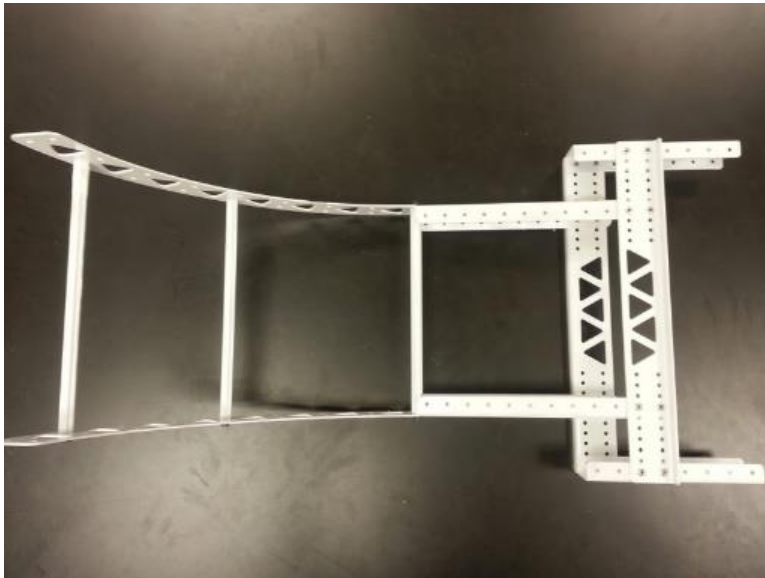
Monday, March 10, 2014

Day (not counting anymore): Dallas Regional starts on Thursday

We have been quiet the past couple weeks but we have been very hard at work.

We got the chance to practice with a few of our local teams this past weekend and we are very pleased with the practice performance. Hopefully it will all translate to the competition robot.

We have a few additions to add in to our 45lbs withholding allowance including an entirely new shooter bar assembly. The bent conduit was giving us some inconsistent results at times, so we iterated and now we think we won't have any shots going straight up into the air.



After watching weeks 1 and 2 of competition we also made a few minor tweaks to the way we hold the ball and also to our planned strategies. We're very excited to get Infrared on the field in a few days and see how she handles Aerial Assist.

- Spectrum

"Strive for continuous improvement, instead of perfection." - Kim Collins

Tuesday, March 18, 2014

Dallas Regional Recap

We competed in Dallas this past weekend. We finished with a 9-7 record overall and made it to the semi-finals. We were the 4th overall selection for eliminations and we got to play on an alliance with our friends FRC#231 and FRC#2950.

Here is the [YouTube playlist](#) for all of our matches this year.

Here is one of our favorite matches of the event.



Our launcher gave us problems all weekend. We practiced with 118 before the event and had very little problems with consistency or accuracy. When we were on the practice field at Dallas we could make shots just fine but when we would go out for a match our consistency was nowhere to be found. We will be working on changes to improve the shooter before Lone Star.

We also submitted for the Chairman's Award at this event. We had a great presentation but the award was eventually given out to our friends from the Woodlands FRC#1477 Texas Torque. They are one of the best teams in FRC and have deserved to be recognized for their efforts for many years. Below are our poster from our presentation and our feedback form from the judges. We have a lot of stuff to change before we present again at Lone Star in week 6.

SPECTRUM 3847

Our Team

- Profoundly talented team
- Proven academic track of our members
- Proven track record
- Proven track record of awards
- Proven track record of awards
- Proven track record of awards

Impact on Students

- Proven track record of awards
- Proven track record of awards
- Proven track record of awards
- Proven track record of awards
- Proven track record of awards

Robotics Outreach

- Proven track record of awards
- Proven track record of awards
- Proven track record of awards
- Proven track record of awards
- Proven track record of awards

Assisting FRC Teams

- Proven track record of awards
- Proven track record of awards
- Proven track record of awards
- Proven track record of awards
- Proven track record of awards

PRISM

- Proven track record of awards
- Proven track record of awards
- Proven track record of awards
- Proven track record of awards
- Proven track record of awards

Media

- Proven track record of awards
- Proven track record of awards
- Proven track record of awards
- Proven track record of awards
- Proven track record of awards

Community Outreach

- Proven track record of awards
- Proven track record of awards
- Proven track record of awards
- Proven track record of awards
- Proven track record of awards

School Partnership

- Proven track record of awards
- Proven track record of awards
- Proven track record of awards
- Proven track record of awards
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- Spectrum

"Failure is a detour, not a dead-end street." - Zig Ziglar

Tuesday, March 18, 2014

Inside Infrared: Bumpers

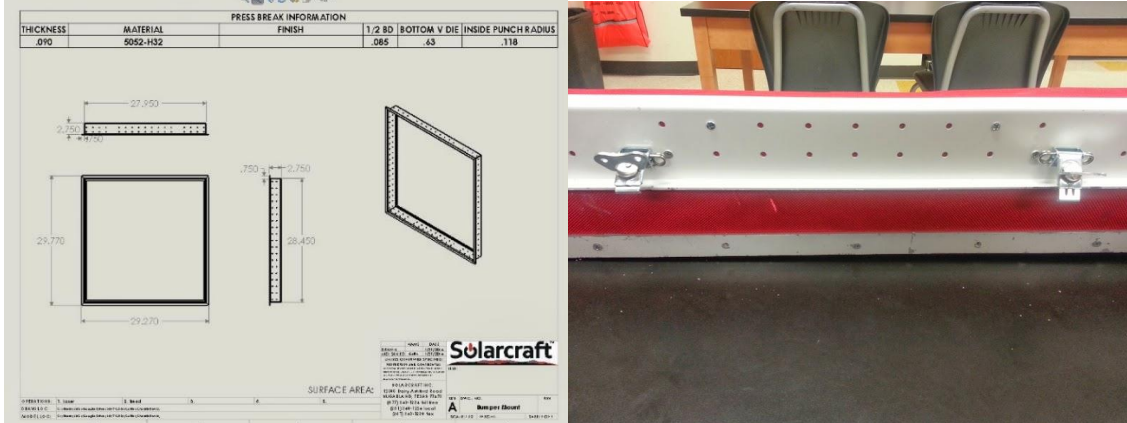
We are going to start our Inside Infrared series with something that seems pretty easy, our bumpers. Teams have been iterating bumper designs for a long time.



Here are our bumpers for this season. The blue set is 19.5lbs and the red set is 18lbs. Each bumper is made from a 10ft piece of 1x6 which is really 3/4" x 5.5" solid wood. This is much cheaper and easier for us to use since we don't have a table saw.

For our fabric we used 1000D Cordura that we purchased from eBay for about \$10 a yard. We bought 4 yards of each red and blue and will have bumpers for at least 3 seasons from that purchase.

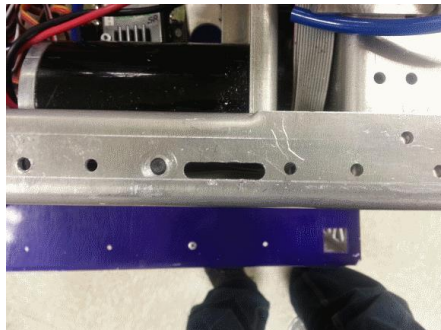
To mount our bumpers we used a sheet metal supporting structure that is inspired by 148's 2011 robot, Raptor. The bumper support goes around the entire robot and it must be put on over the top of the robot. Here is the drawing of what we had laser cut for our mount.



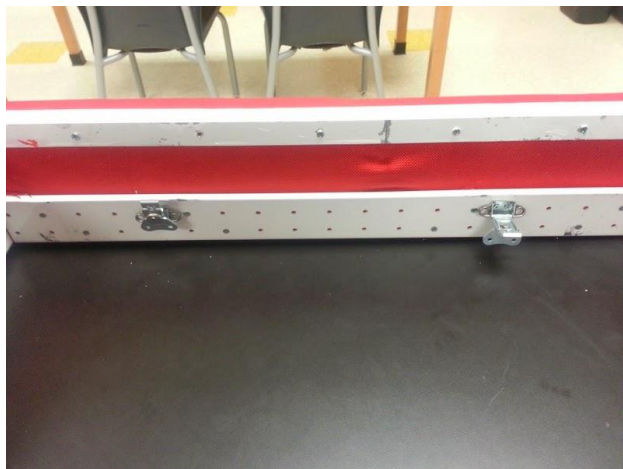
To actually latch our bumpers on to our frame we use butterfly latches that are commonly used on road cases. We found these during the off season and retro fitted them on to our 2013 robot for our off season events. These are great for bumpers since they allow for tool less install and remove of each set. We also purchased these from [eBay](#), they are about \$2.50 each and we use 4 on each bumper set. Make sure to the get the ones that include the springs they make securing the bumpers much easier.



They attached to the robot in these slots that we put into our front and back frame rails.



Along the bottom of the bumpers we attached 1" x 1/8" angle aluminum that secures the bottom edge of the bumpers and also seats them securely against our frame.



For the past several years we have just painted on our numbers. We end up having to touch them up throughout the season but they are easily visible from the stands and last a whole event. We custom make stencils out of manila folders that use our branded font.



We didn't have many bumper problems at Dallas. There were a few matches that we had to pry up on corner of our bumpers because they slipped down past our frame but that wasn't a very big problem, they would only drop about an 1/8" which still keeps us within the bumper zone.

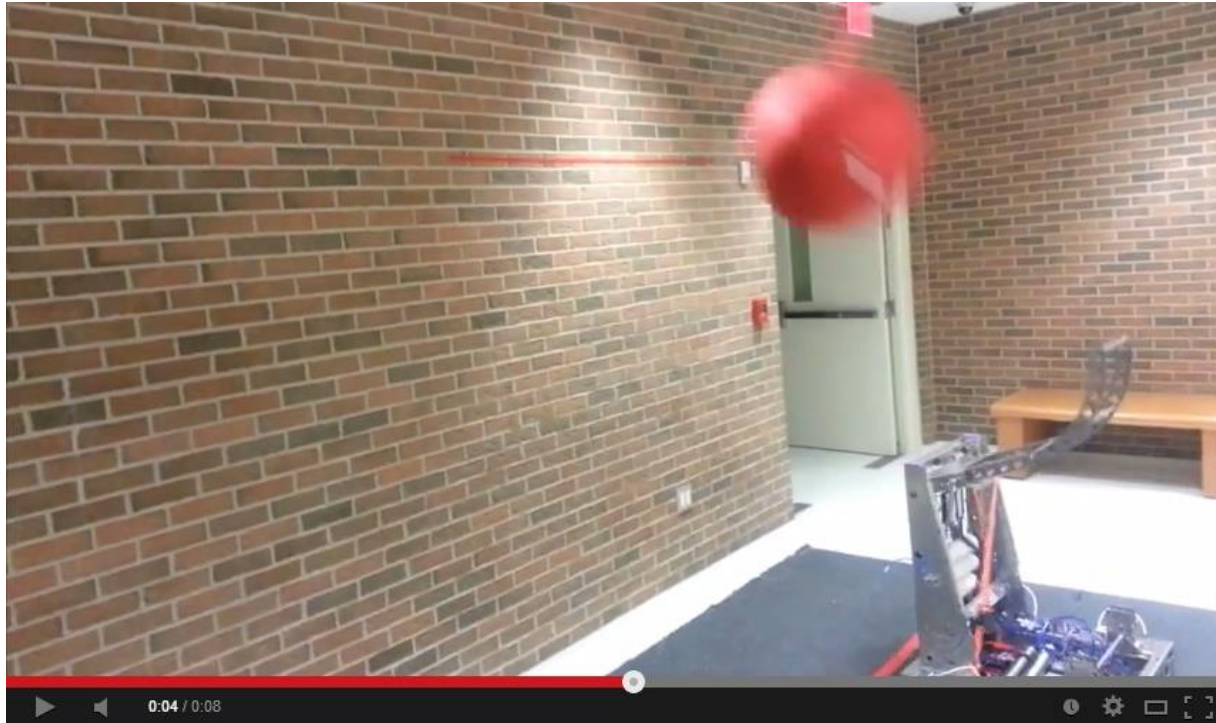
- Spectrum

"In many ways, it's the things that are not there that we are most proud of." - Jonathan Ive, iPad designer, on all the features that are missing from the iPad.

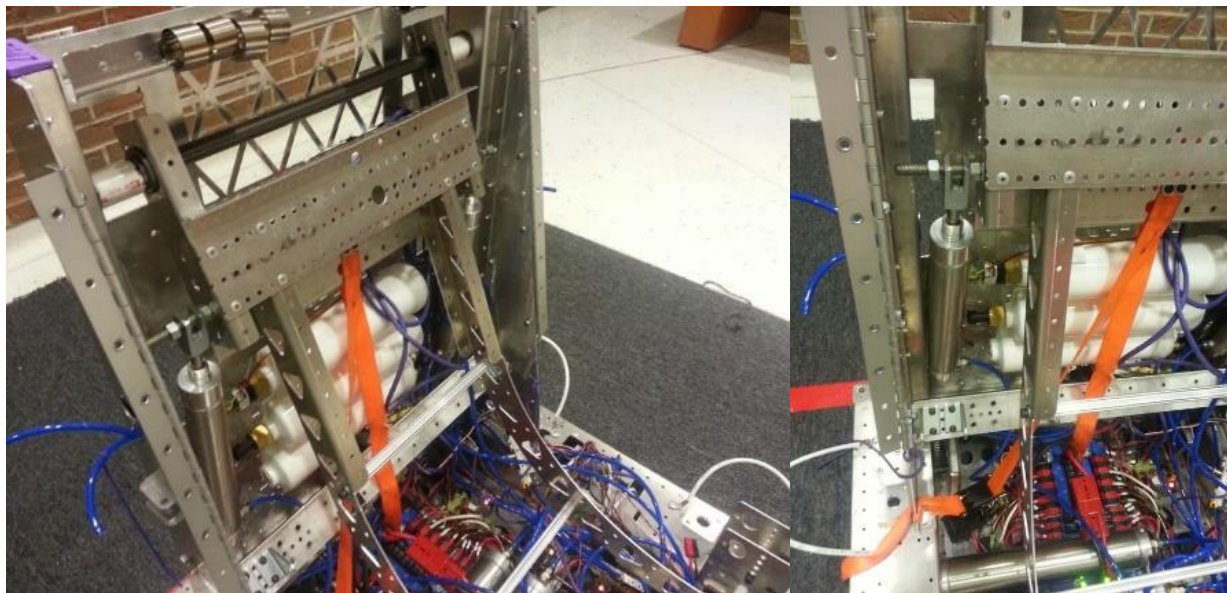
Wednesday, March 19, 2014

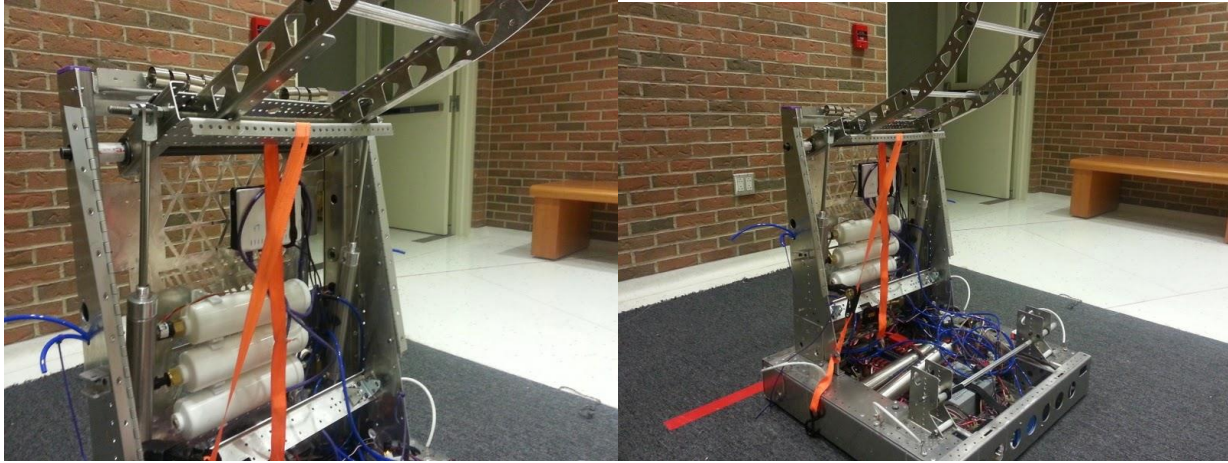
Iterating: Pneumatic Launcher

We have been working on our robot in the past few days since Dallas. We had several problems with our launcher at event whenever you put it out for a real match. It just wasn't consistent.



https://www.youtube.com/watch?feature=player_embedded&v=FHW98onkCDE





It was pretty easy getting the prototype working and we should be able to do the final make over, quickly on Friday at Lone Star. We did have to play around with launch geometry but it wasn't that complicated. We also looked pulse timing and we found we can change our shot pretty easily using it.

- Spectrum

"Perfection is not attainable, but if we chase perfection we can catch excellence." - Vince Lombardi

Thursday, March 20, 2014

Inside Infrared: The Back Panel

One of the features we are most proud of on Infrared is our back panel. It integrates our launcher and all of our pneumatic system. It also has a place for our instrumentation panel.



Starting at the top is location for our launcher bar to mount. Below that is a radio mount that uses the screw mounts on the back of the radio along with Velcro straps to secure it. The Velcro straps also secure the radio power connector so it doesn't come loose.

Below the radio is the second shaft is the intermediate shaft for the launcher it takes the first stage reduction and moves power to both sides of the launcher to keep them even.

Below that shaft is the mounting location for three of our air tanks.

On the right side we have our pneumatic controls, it includes all three of our gauges and both our regulators along with our vent valve. The pneumatic instrumentation is mounted with the regulator mounting nuts.

To the right of the pneumatic instrumentation is our tether port, voltage display and main breaker.

The tether port that we use is a common keystone connector for use in a wall or similar home installation. [We purchased our from Amazon](#). Then there is just a small Ethernet cable that runs up to the router from this panel.

The voltage gauge is a simple two wire voltage gauge that plugs into the same breaker location that use to power our LEDs off of a terminal strip. [We bought them from overseas to get them cheaper](#).



The power switch is mounted on stand offs so it's recessed. It's very easy for a hand to turn on or off the robot but it is nearly impossible for any object or robot to accidentally hit the power switch.

- Spectrum

"Good design is often invisible, but it can contribute to reshaping the way our society works." - John Maeda

Sunday, March 23, 2014

Practice with 1477 & Running Layups

Yesterday we were able to go up to the Woodlands to practice with our friends FRC#1477 Texas Torque.

While there we got to work on our running shot with our new pneumatic launcher.



https://www.youtube.com/watch?feature=player_embedded&v=2E05fpfQI5Y

We also worked on an automated truss shot that ensures we are fully inside the white zone before firing the truss.

- Spectrum

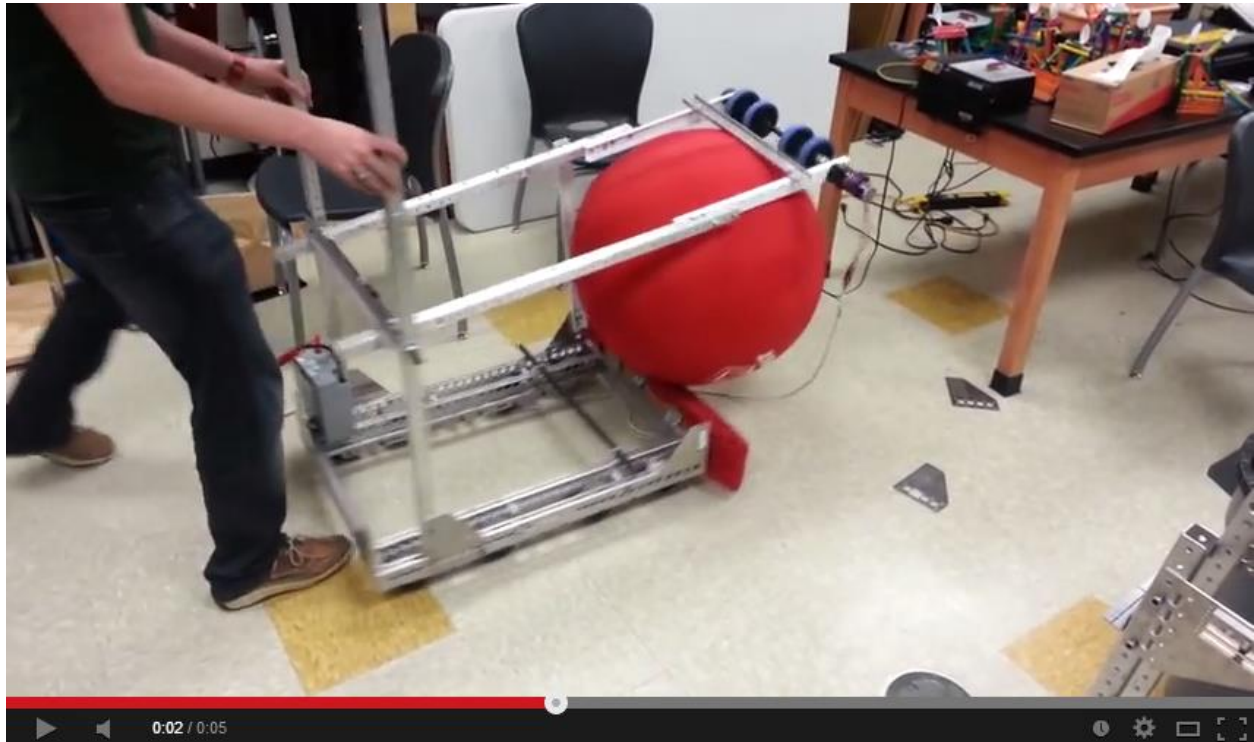
"Nobody made a greater mistake than he who did nothing because he could only do a little." ~Edmund Burke

Monday, March 24, 2014

Inside Infrared: Collector

If you followed along during the build season, you saw nearly all of our collector prototyping. We spent many hours getting to the final version of our collector. This is truly iteration at its best.

We initially took our cues from the 72 hour builds that mostly used over the top rollers.



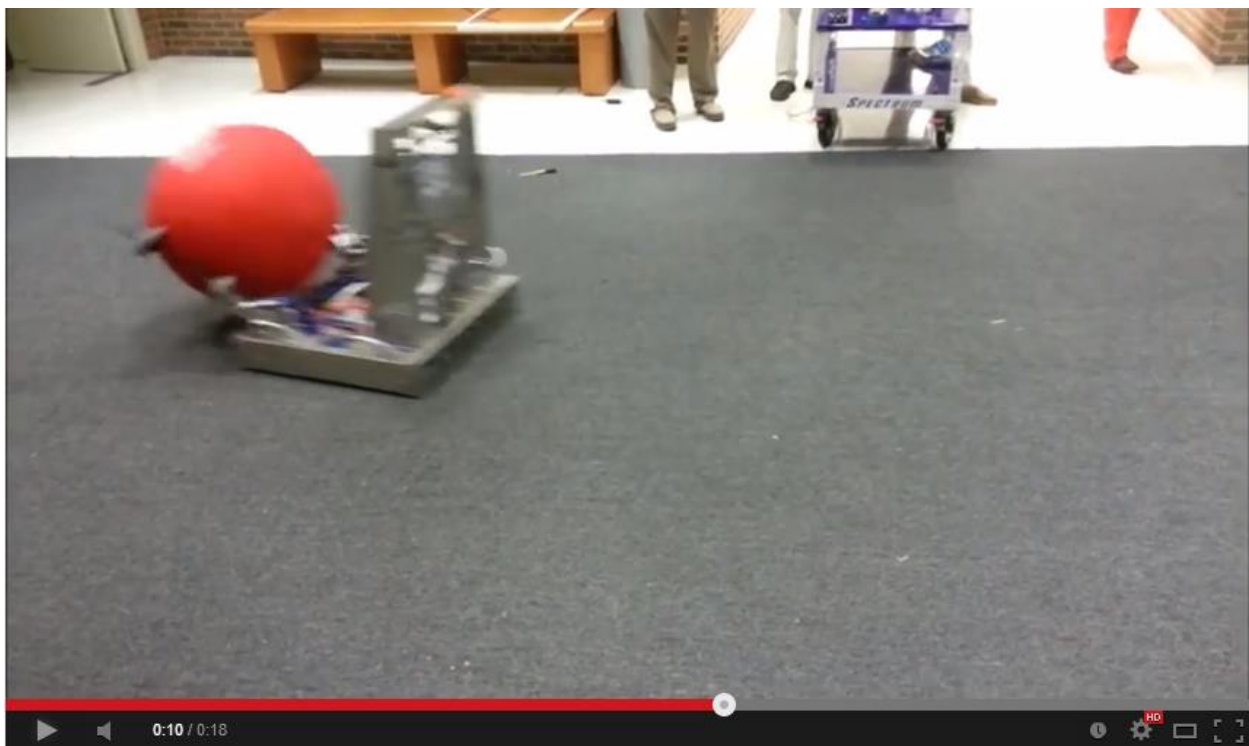
https://www.youtube.com/watch?feature=player_embedded&v=KcDMokRtLjw

After that we looked into a version of team Boom Done's El Toro style collector. We modified the axis of rotation to allow for smoother contact with the ball. This system worked alright but it still wasn't fast enough for our needs. The prototype also had the collector motors out past the bumpers which was the opposite of our design goals. Overall we were happy with the speed of collection and we thought this would give us a wide angle to collect from. We also tried several other failed attempts during the phase including spinning a polycarbonate stick and other solid shaft collectors like Boom Done's original design, we didn't like that they had to expand so far around the ball and thought the wheels would be better.



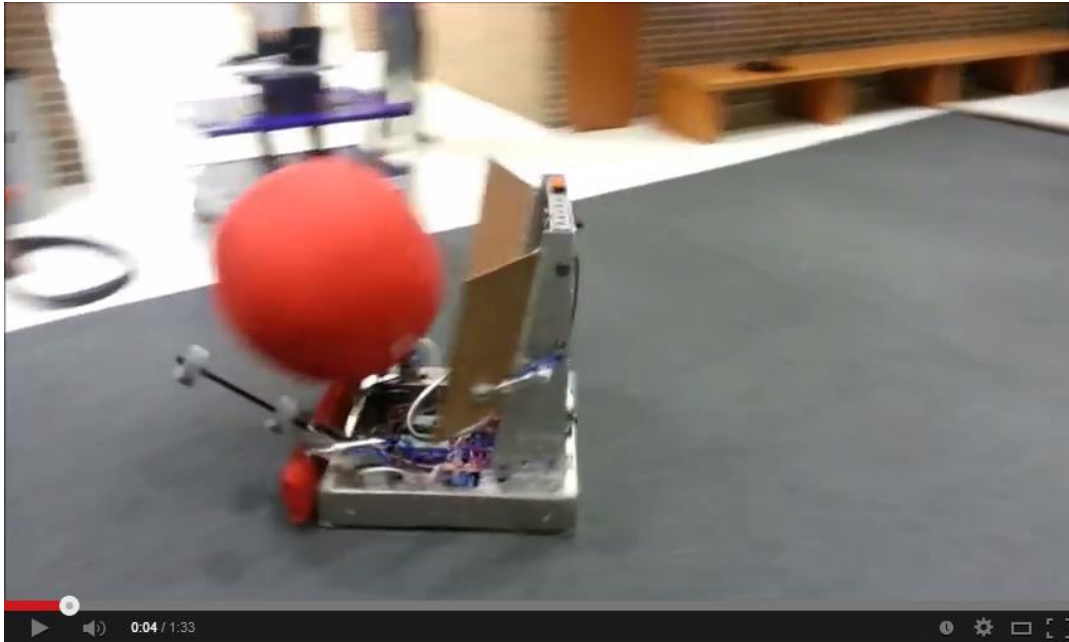
https://www.youtube.com/watch?feature=player_embedded&v=d5jkzTCaFFw

In the next video you will see the first sheet metal version of the collector. It has 3 degrees of freedom being able to move up and down, left and right and spin each collector stick. Again the system worked but we know improving it would be necessary.



http://www.youtube.com/feature=player_embedded

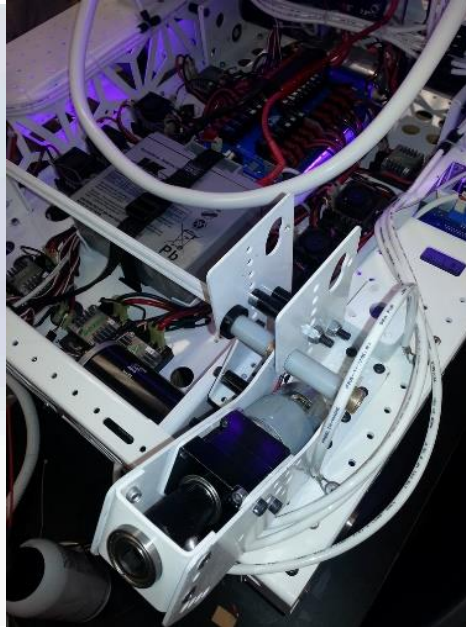
During this process we had found that we kept needing to tighten the surgical tubing that we used to all our collector sticks to pivot in and out. Eventually we realized we could hard mount them and just use the ball compression to allow us to collect them. At the same time we tested the collector wheels (formally known as mecanum wheels) on our collector. They worked very well. They allowed us to center the ball and collect from a very wide area in front of the robot. At this point we were still using prototypes and bolting things down to pieces that weren't designed for it.



https://www.youtube.com/watch?feature=player_embedded&v=7-boVCkTp5I

The final version is actually pretty simple. It uses 2 pneumatic cylinders (1 1/16" bore, 1.5" stroke, double acting), 2 BB775 motors in 10:1 VersaPlanetary Gearboxes with 1/2" hex output shafts and simple sheet metal plates. To extend the hex shafts we used [colson live hubs from 221systems](#). We did have to cut down the hex output shafts from the VPs this allows the coupler to fit right up against the gearbox. Just on the other side of the coupler we mount a hex bearing in a small sheet metal c channel. The bottom wheel is a 3.25" VexPRO versawheel and the shaft is an uncut 18" long VEXpro 1/2" hex shaft.

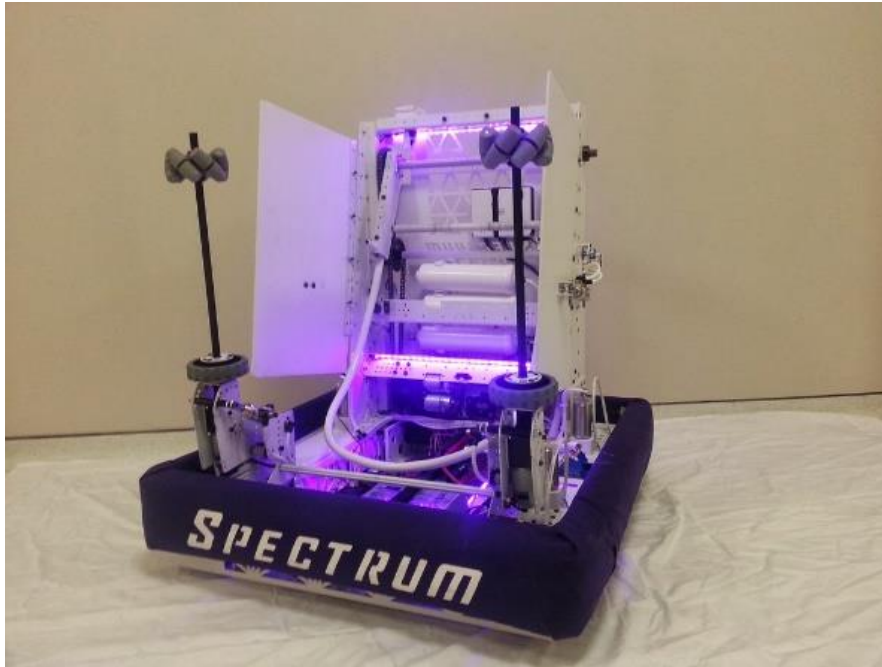
We put together a quick gif showing all parts that go in to the collector mechanism. It really is rather simple.



The spacers in this setup are all [VEXpro tube axle](#) with 1/4-20 bolts going through them.

To stabilize the two structures we have a piece of [AndyMark churro tube](#) that is tapped on both ends with a 1/4-20 bolt screwed into it. We actually use this bar as a hard stop for our launcher bar as well.

We call this collector "Sipping Bird" because we thought it looked like a [drinking bird](#) when it was first CADed. We also didn't know what a drinking bird was called at the time.



You may have seen in our reveal video that we had purple hubs on the collector wheels. Those were 3D printed parts but when we practiced with them we were able to break them when they got caught on the side of the field. They worked fine in compression but once they were in tension the plastic could not take the stress. We moved back to the real VEXpro hubs and had no problems at the Dallas Regional. We did have a small issue when we got entangled with a robot that had a net but that was it. We also had 4" Versawheels in the video and in the reveal but we found the smaller wheels worked much better so we moved to the 3.25" wheels with the hex bore already in them.

The distance between the two hex shafts on the collector is about 23". We compress the ball to have it go through the collector.

- Spectrum

"Anyone who says failure is not an option has also ruled out innovation." - [Seth Godin](#)