BROWNCOATS
Team 7842 Engineering Notebook - Rover Ruckus

Date	Location	Start Time	End Time	Week #
March 1, 2019	AvaLAN Wireless	2:00 p.m.	6:00 p.m.	26
Meeting Goals: Guest visit and receiving donation, Worked on the collector				
Team Members in Attendance:				
Ian, Megan, Joel, Kye, Jalynn				

Tasks	Reflections
Robot Hardware - Intake/Collector	**Megan**: On Friday March 1st, Ian and I put the intake back on the robot, which we'd taken off during the last meeting so we could weigh it. **Ian**: We started the day by remounting the intake onto the robot in preparation for our demo at the Alabama FLL State Championship tomorrow. This was a relatively easy procedure, as the intake is only secured by 4 bolts.
Robot Software - Autonomous	**Ian**: I also tested some upgrades to my autonomous navigation software. Previously, our autonomous routes used a combination of line segments (either forward/backward, or sideways, utilizing the holonomic capabilities of mecanum) and point turns to drive around the field. However, this introduces a significant source of slowdown with a necessary delay between each segmented step. In contrast, these upgrades (in theory) should allow us to navigate around the field in 3 axes simultaneously (these axes being horizontal, vertical, and rotational). In effect, the robot follows an equation driven spline. The spline is defined in software as two points, a start and end point. These are both in the form of (x, y, heading). From here, points are interpolated along the path based on predefined drive constraints (such as maximum velocity and acceleration, wheelbase, trackwidth, etc). The end result is a drive controller that can navigate with continuous paths, rather than very defined and segmented movements. I started by testing a simple path with a start point of (0,0,0) and an end point of (30,30,0) – the x and y measurements are in inches, and the heading measurement is in radians. This path contains translation in both axes, and a rotational component, because the desired end heading is the same as the start heading.

Robot Software - Autonomous (Continued)	**Ian**: The resulting path is approximately resembles that of a standard cubic graph. The navigation software handled this very well, and I'm encouraged by the results! The end heading was 5-10 degrees off of the target, but I think this is due to the kinematic constants (track width and wheelbase, primarily) being slightly off. I likely didn't notice it before now because the feedback controllers generally handle that error in one-dimensional paths, but it's a more important variable now. I hope that this allows us to make more flexible and expedited autonomous routes for the Houston championship.
Engineering Notebook - Meeting Entries	**Jalynn**: Today, I added updates to any meeting entries that needed them. I helped Ms. Cindy and Ms. Jean with lunch preparations for the FLL competition we'll be helping with tomorrow as well. After our visitor left, I tried to finish updating meeting entries but the computer ran out of memory, so Ms. Cindy is going to take it home and clear out some older stuff to make room.
Visitor	**Megan**: We invited one of our sponsors, the National Space Club of Huntsville to come meet with our team and to demonstrate our robot to them, so we could show what we've been doing and how we're preparing for World's. We had a great time talking with them and we couldn't be more thankful for their support! **Jalynn**: We also had a guest come from the National Space Club of Huntsville to give us a generous donation and see our robot.

Mr. Terry Abel of the National Space Club - Huntsville presented the Browncoats with a sponsorship check. Thank you!

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Team 7842 Engineering Notebook - Rover Ruckus

Date	Location	Start Time	End Time	Week #
March 2, 2019	AvaLAN Wireless	2:00 p.m.	6:00 p.m.	26
Meeting Goals: Testing cardboard intake prototypes				
Team Members in Attendance:				
Ian, Megan, Brooklynn, Joel				

Tasks	Reflections
Robot Hardware - Intake Prototype	**Megan**: On Saturday March 2nd, after the FLL State Championship, we headed back to AvaLAN to get in some work for the day. While Ian finished adding the Potentiometer to the robot, Joel, Brooklynn, and I continued working on our cardboard intake designs. Today we focused only on the double wide sorter in hopes of fixing some of the jamming problems we'd experienced previously. First, we made the railing that the balls roll down less of a curve and more of an angle, which seemed to help with speed and some of the sticking we experienced when two balls were fed into it. Then, we made the bottom plate just a tad bit wider–wide enough for two balls to fit side by side comfortably, but not wide enough for three cubes to fit. To our delight, this fixed the problem of a cube getting caught when on the ball side, and a ball getting stuck when on the cube side. We're still not sure if we want to pursue a double wide or a single wide intake, but today we proved that the double wide is definitely worth considering. **Joel**: I made a cardboard prototype of a double-wide sorter. The sorting is slightly different from others, in which it uses a curved ramp for balls to roll down which would prevent the elements from colliding with each other on the way down and causing a jam. We tested it a few times and found one problem which I will fix at the next meeting. **Brooklynn**: I started the meeting off with a quick catchup "this is what has happened" session with Mr. Jeff. Then I went to help Joel with the cardboard sorter of the elements. There was lots of cardboard to work with so we could make a lot of mistakes. Before I went and made another sorter out of cardboard, I helped Joel finish the one that he was working on. At the end of the meeting, we discovered that the edges of the guiders needed to be different.

Robot Hardware - Intake/Arms	**Ian**: After the demonstration, we held a regular meeting to work on the robot. During the week I modeled a few parts that would allow us to mount a potentiometer onto the arm, allowing us to track its position. We printed these parts (which included a pair of gears to transfer the rotation of the arm to the potentiometer, and a template for us to use to mark where holes needed to be drilled. This template allowed us to more accurately modify the plates for the new addition) over the week. With these parts completed, we began work on modifying the plates for the potentiometer to mount to. It went along fairly easily, and the potentiometer was mounted shortly before the meeting ended. With our remaining time, I wired the potentiometer into a REV Expansion Hub and took measurements of the arm at three key points. Those points were the two end-stops, and horizontal. This will allow me to work out some preliminary code over the week.

Team working on intake designs

Brooklynn, Megan, and Joel testing minerals in cardboard dispenser prototype

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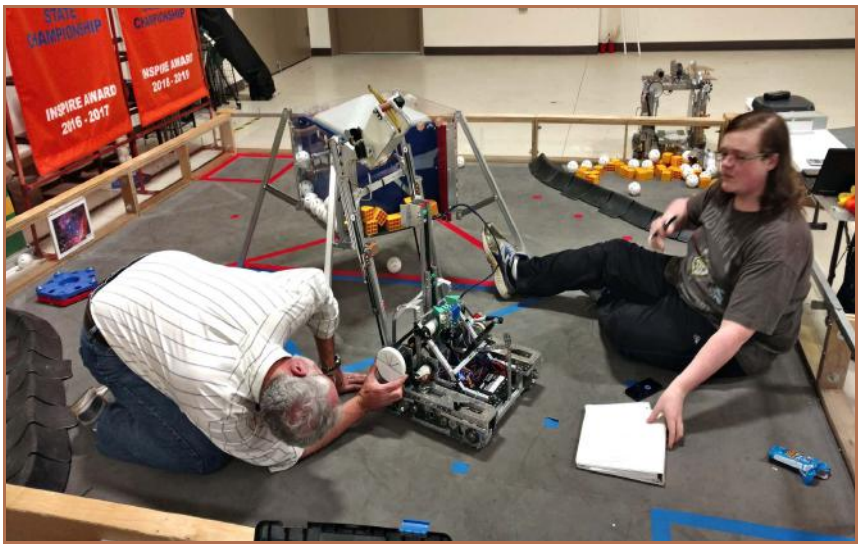
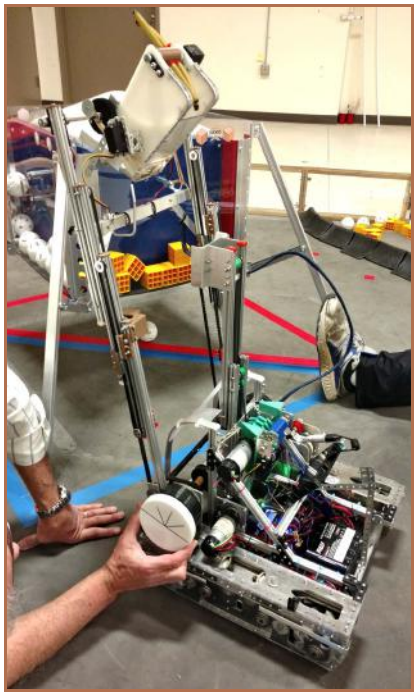
Date	Location	Start Time	End Time	Week #
March 8, 2019	AvaLAN Wireless	2:00 p.m.	6:00 p.m.	27
Meeting Goals: Work on potentiometer control for arm, Slide shows				
Team Members in Attendance:				
Ian, Megan, Jalynn				

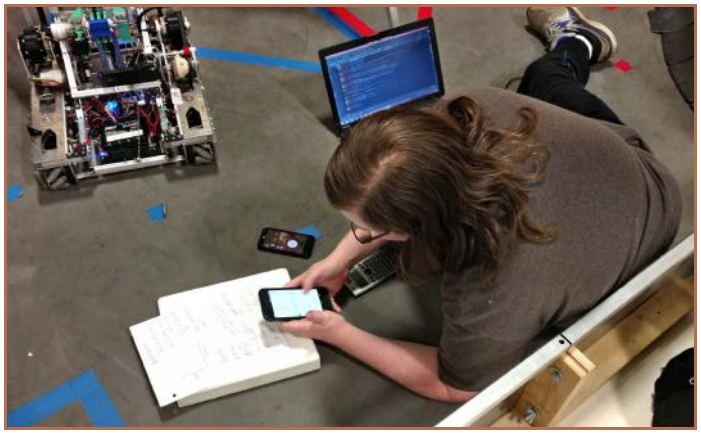
Tasks	Reflections
Robot Hardware - Potentiometer	**Ian**: I spent the day working on preliminary potentiometer control for the arm. I first started by taking more measurements from the potentiometer. My original idea involved dividing the maximum range of the potentiometer (270 degrees) by the maximum voltage of the potentiometer (3.3v) to provide a conversion factor for every voltage across the range of the potentiometer. However, I noticed that there appeared to be a significant amount of drift over the range of the arm. The first 15 degrees or so seemed mostly accurate, but there was as much as 20 degrees of error at the other end. To solve this, we took measurements of the voltage at specific angles (both end points of the arm), as well as a few other points (0, 30, 45, 60, and 90 degrees). From here, we solved for the equation of a line representing the relationship between the potentiometer voltage and the arm angle (using both points measured at the arm end points). We then plotted the other measured points and measured the error at each point (by plugging in the same voltage for each point and comparing the measured angle to the equation's angle) and found that the error for each point was below five degrees. I decided that this was adequate for the application and began preliminary tuning for the arm set points.
Pit - Slide Show **Engineering Notebook** - Meeting Entries	**Jalynn**: During today's meeting I worked on compiling outreach photos for the slide show we want to make for our pit. Then, I spent the rest of the meeting updating and finishing meeting entries.



Ian and Mr. Jeff working on Vera



Mr. Jeff measuring the angle of the telescoping arms



Ian computing the relationship between the arm angle and the voltage from the new potentiometer

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Team 7842 Engineering Notebook - Rover Ruckus

Date	Location	Start Time	End Time	Week #
March 9, 2019	AvaLAN Wireless	2:00 p.m.	6:00 p.m.	27
Meeting Goals: Rebuilding and testing intake prototype				
Team Members in Attendance:				
Ian, Megan				

Tasks	Reflections
Robot Hardware - Intake Design	**Megan**: On Saturday March 9th, Ian and I decided to revisit the single wide intake prototype we'd made out of duct tape and zipties to better test the intake tubing. Because of the duct tape, the system wasn't sturdy at all, so I took off the top wooden plate and replaced it with lexan that I drilled into and then mounted it with screws on the 3D printed side walls. This made the whole system much more rigid. After that, I mounted the two motor mounts on top of the lexan plate, and then put a motor in them. Then, I ran a belt to the axle that held the sweeper in place. After that, it was ready to test! We plugged in the motor to a battery, and then we put it into one of the craters to see how well it picked up the elements with proper belt tension. It was very fast! We added a piece of cardboard to the back of the intake to keep the elements in place without stalling the motor, which would happen if the elements weren't back far enough. So, we came up with the idea of having a ramp of sorts in the intake that would send the elements upwards, so they would get out of the way of the sweeper, but there would also be little risk of three elements fitting in. Ian wants to try modeling a quick mock-up in CAD before we move on with the idea. **Ian**: Today Megan and I rebuilt the intake rig to be more rigid (by utilizing spare pieces of acrylic and screws instead of duct tape and zip ties). We did this so that we could test the variety of tubing that we had ordered over the week. The tubing lengths ranged from extremely flexible to very rigid, all in the same outer diameter (so that we would be able to test with the same sweeper bar). We started in the middle, with tubing that was similar to the previous neoprene vacuum tubing

Robot Hardware - Intake (continued)	**Ian**: we've used in the past. However, this tubing has a much thinner wall, making it more flexible. We were immediately very happy with the results of this tubing. It had an adequate amount of deflection, while still being very grippy. We tested the feasibility of the idea to continuously run the sweeper to retain the elements with this rig. While it had some troubles with two balls, every other configuration was easily retained by the sweeper.
Robot Software - Teleop	**Ian**: With the time remaining for this meeting, I briefly continued working on the arm controls software.

Ian and Megan finishing intake design prototype

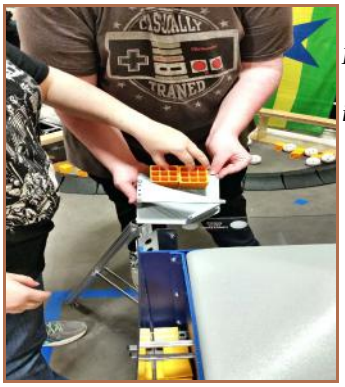
Testing of intake prototype

BROWNCOATS
Team 7842 Engineering Notebook - Rover Ruckus

Date	Location	Start Time	End Time	Week #
March 15, 2019	AvaLAN Wireless	2:00 p.m.	6:00 p.m.	28
Meeting Goals: Assembling and testing intake, Cleaning out storage, Working on pit				
Team Members in Attendance:				
Ian, Megan, Kye, Jalynn				

Tasks	Reflections
Robot Hardware - Intake Design	**Megan**: All of the 3D printed parts for the double-wide intake Ian had modeled were finished and brought to the meeting. Once we put it all together, we tested it. Unfortunately, the beater bar that keeps the sweeper in place was too low, and the balls didn't have enough clearance to make it through. Even so, we tried testing the sorter, but the cubes kept getting jammed on the angled plate, and the ball rail was incredibly slow, though it did work. These, however, weren't the only issues we had with it. We still didn't know where to mount the servo for the gate to keep the elements in, and we needed to figure out where the motor for the sweeper was going to be. Because of all of this, we decided to put the double-wide on the back burner for now, so we could spend our time working on a single-wide, which we were much more confident about. So, we started making a cardboard model of a single-wide intake with the ramp we'd talked about the week before. Firstly, we cut out a single cardboard piece and curved the bottom part of it, but left the top half straight, which created the ramp. Then, we cut two side plates that held the curved plate together and allowed it to keep its shape. Once we finished with that, we cut out a notch in one of the side plates so the balls would have enough room to be filtered out once we added the rail to the system. After that, we added two standoffs to the bottom plate that were a little taller than the cubes, so they could slide underneath the filter rail, which we added next. Then, we added two axles that held the sweeper bar in place. Even though it was made out of cardboard, we were very pleased with the final result. The sweeper was able to pick up the elements with ease, and the makeshift filter worked very well. Our only problem was that the standoff closest to the wall would sometimes catch the cube, so we decided that in our final product, we would take that standoff out and run the rail through the wall and secure it on the outside. At our next meeting, we want to build the model out of lexan and decide where we're going to mount the motor and servo, and we're going to figure out all of the specifics.

Robot Hardware - Intake Design (continued)	**Ian**: Today we assembled a double-wide intake prototype that I had designed over the previous weekend (and we manufactured the components for throughout the week). Unfortunately, there were some very significant issues with this idea. First, the ball filter rail was not steep enough and thus the balls took a very long time to exit the intake. Secondly, the intake sweeper bar was too close to the bottom of the intake and caused an interference with the balls entering the system. I had also attempted to design a single wide intake over the week, but I didn't have enough time to complete it, nor enough information about the minor modifications we've made to the robot. With the double wide intake concept requiring significant changes to function, we decided to instead solely pursue the single-wide concept (this decision was influenced by the single-wide testing rig we built last week, because the intaking speed with that system was extremely rapid, and we felt that was more than adequate). We started by making a cardboard prototype to test dimensions and function. By the end of the day, we had assembled a cardboard mockup of the basic geometry of the system (The filter rail, and the curve for the backboard - since the idea was to have the elements go back and up, instead of directly back.)
Pit - Cleaning and Sorting Storage - Pit Shelf	**Jalynn**: Today, Kye and I helped Ms. Cindy and Ms. Jean sort out our pit for Worlds. First, we went through the boxes of pit supplies and cleaned out any old supplies we didn't need anymore. We also went through the costumes, sorting them and pulling out old coats we could take the Browncoats patches off of. Then, we helped discuss the design for the shelves in the pit. We decided to make it 4 cubes wide and 3 cubes tall, that way we can put the Engineering Notebook between our spinning display boards at eye level without worrying about it messing up the display boards' spinning motion. However, this meant we had to take apart the current shelf so we could rebuild and repaint it, so Kye and I worked on that with Ryan.



Ian testing minerals in our new intake design

Double-wide intake ready for testing

BROWNCOATS
Team 7842 Engineering Notebook - Rover Ruckus

Date	Location	Start Time	End Time	Week #
March 16, 2019	AvaLAN Wireless	2:00 p.m.	6:00 p.m.	28
Meeting Goals: Building the intake/collector, Making robot pin handouts, Analysis from Michael Stewart, Electrical Engineer				
Team Members in Attendance:				
Ian, Megan, Joel, Kye, Jalynn				

Tasks	Reflections
Robot Hardware - Intake/Collector	**Megan**: On Saturday March 16th, Ian and I continued our work with our new model of a single-wide intake. Our original idea was to make the whole thing out of Lexan today, but we decided we didn't know enough of the specifics to make it completely out of Lexan yet, so we made the curved ramp out of Lexan, but then we made two new cardboard walls that we duct-taped to it. Once we'd cut out a new notch for the balls to fit through, we took a thin metal beam, cut a slot in the cardboard wall, and then attached the beam to a standoff on the end of the plate. This acted as our new filter. Then, we remounted the sweeper, however, this time we added a 3D printed pulley for the belt that would run to the motor once we attached it. After that, we took the servo off of our current intake design, so we could test a gate. I took three thin Tetrix plates and screwed them together just to see if the shape was the correct one we needed. We used duct-tape to attach the servo to the bottom of the plate, and then we mounted the motor on the bottom as well. We attached the belt to both the motor and the pulley, and we turned it on to test how well it picked up the elements, and we were rather pleased at the speed of it, and also how well the gate kept them in place. Once we'd finished with all of that, we held the intake over the lander in the approximate position it would be when mounted to the robot, and then we tested the filter rail, and it worked exactly how we wanted it to! Now that we have all of the information as to where to put the servo, motor, gate, belts, etc. we are now ready to move onto the next stage and make it all out of Lexan!

Analysis From Michael Stewart	Mr. Michael Stewart had originally visited us on January 12, 2019 to help us brainstorm ideas on how to handle the persistent static problem. At the time he had asked for a block diagram of our robot. The following is his analysis: Michael Stewart is an Electrical Engineer (MSEE) who has worked in the fields of thunderstorm and lightning research, and lightning protection for 45 years. This has included ground, balloon, aircraft, and space-based instruments for NASA and the USAF, and the design of direct-strike lightning protection for residential and commercial installations. An analysis has been performed for the Browncoat's robot in an effort to mitigate the unit's susceptibility to electrostatic discharge during competitions. When the robot moves over the non-conductive, plastic mats used for competitions, friction causes the buildup of static charge on the robot structure, especially in a low humidity environment. Subsequent contact with another metallic object, such as arena walls or goals, or another robot, a transfer of electrical charge between the two objects will occur. This transfer of charge occurs as a high voltage current pulse. If the mats cannot be made conductive so as to eliminate the charging of the robots, then an attempt must be made to prevent the current pulse from upsetting or damaging the sensitive robot communications and control electronics. When a charge transfer between two objects occurs, charge on parasitic capacitances between the robot metallic structure and electronics (wiring and electronic components) must change and readjust. This can cause transient voltages across the parasitic capacitances that can exceed switching thresholds, or be of sufficient amplitude and/or polarity to cause damage. Additionally, the pulse current can generate magnetic fields with high frequency components that can couple into nearby wiring, resulting in transient voltages being applied to the robot electronics.

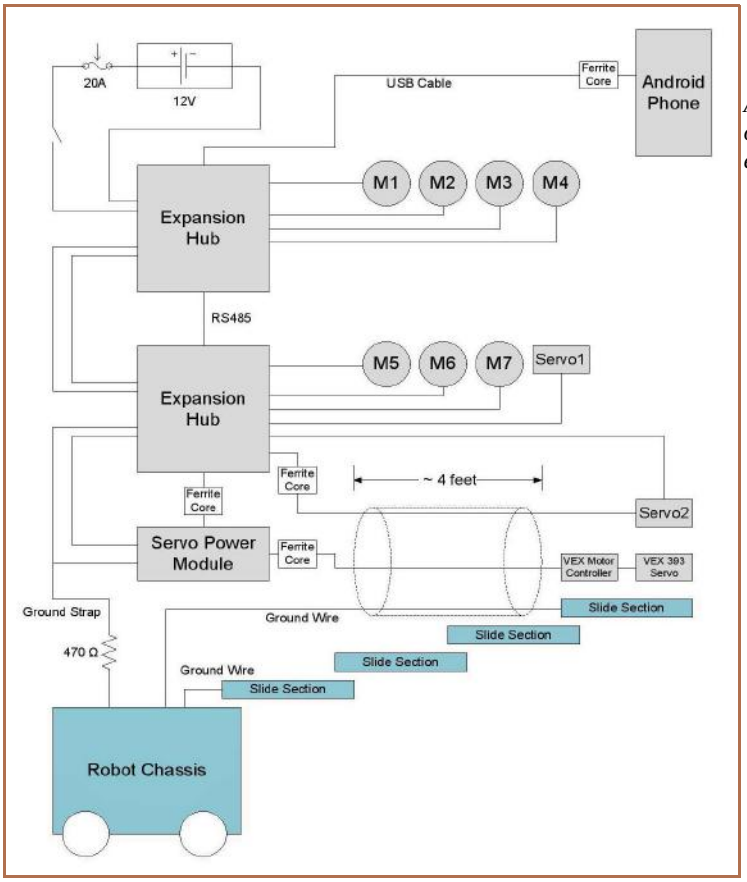
Analysis From Michael Stewart (continued)	The primary side, connected to the 12VDC circuit, is a power circuit with low impedance and can absorb significant transient energy without damage or upset. Additionally, the primary circuitry and wiring has a much smaller physical extent than the secondary, so the parasitic capacitances are much smaller. Connecting the primary circuit to the robot chassis is therefore expected to be ineffective for static mitigation. The main area of sensitivity of the robot is the "secondary" communications and control side of the robot "hubs". Here the wiring is extensive, being routed to all extents of the robot. Connecting the secondary circuitry to the robot chassis shorts out half the parasitic capacitance and the other half can be greatly reduced by appropriate shielding. For long lines, balanced twisted pairs are effective for reducing magnetic coupling.
Pit - Handouts	**Kye**: On March 16, we glued backs to 3D- printed robots, so we can pin them. **Jalynn**: During today's meeting, Kye and I started with gluing pins onto the backs of the 3D- printed robot handouts Ms. Cindy brought. We formed an assembly line where I put the glue on the backs of the robots and Kye put the pins on, which made the whole process go much faster.
Engineering Notebook - Meeting Entries	**Jalynn**: I added photos to any meeting entries that were complete.
Other - Outreach Robots	**Jalynn**: Finally, we took apart our old outreach robot, Hammer-Fred and began thinking of how to rebuild him. **Kye**: We also took apart one of our demo robots, so we could rebuild them better than they were before.

Single-wide intake prototype

Testing the single-wide intake prototype

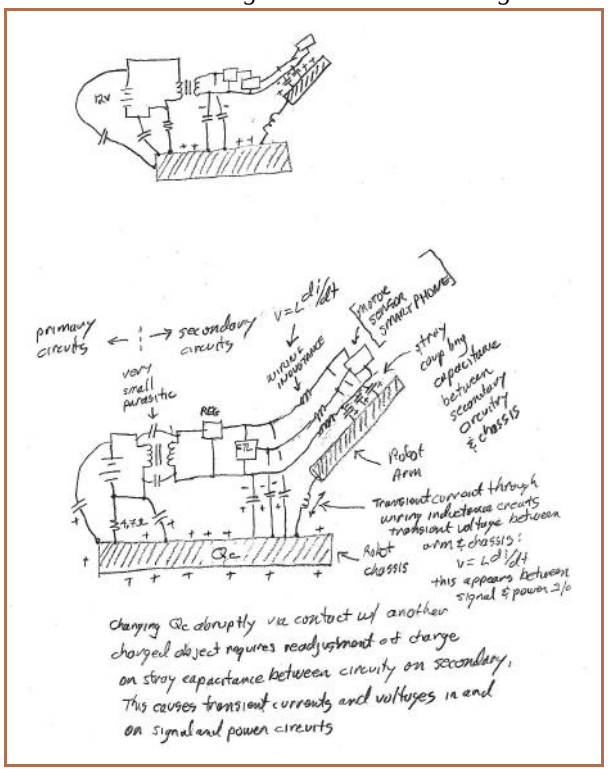
Kye and Jalynn taking apart Hammer Fred so that they can rebuild him

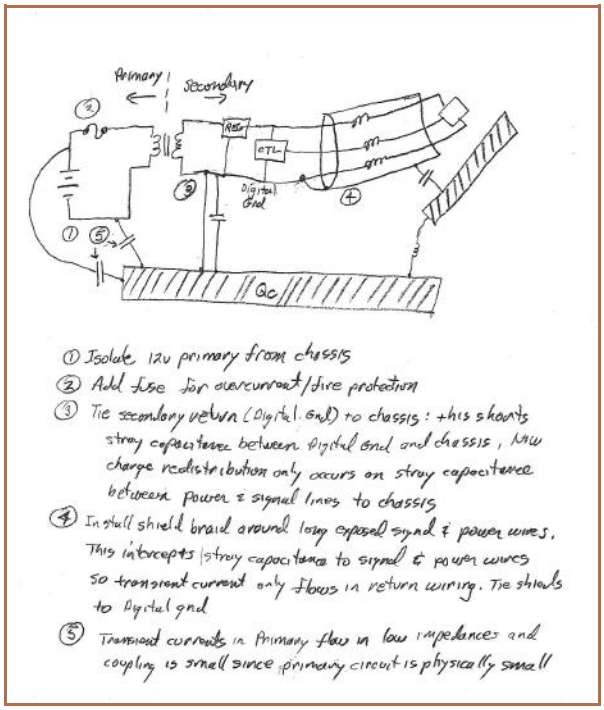
The team listening to Mr. Michael Stewart's analysis on our static problem



A block diagram of Vera's electrical system

Handwritten notes and analysis performed by Mr. Michael Stewart during the March 16th meeting





Also, upon further consideration, the common mode filters, if applied to all the wires in a cable, can help reduce the transient voltages impressed differentially across the signal, power, and return lines. It's the differential transient voltages between signal lines and power/return that upset/damage components. The twisted pairs reduce the magnetic coupling area to reduce the overall coupling, and make the coupling more equal to each wire in a pair, emphasizing common mode coupling rather than differential.

It would also be a good idea to make sure that the secondary power and return wiring is all single-point connected without loops that can intercept transient magnetic fields.

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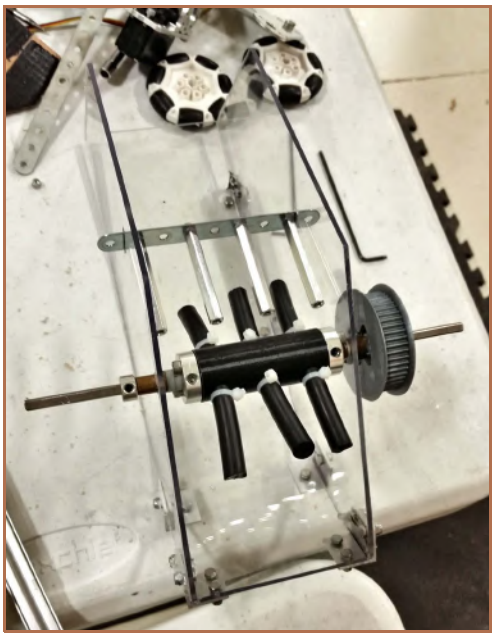
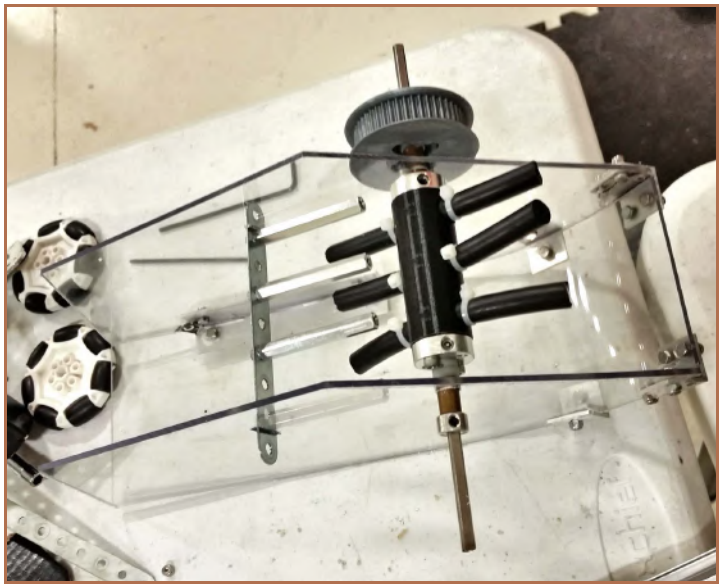
Team 7842 Engineering Notebook - Rover Ruckus

Date	Location	Start Time	End Time	Week #
March 17, 2019	AvaLAN Wireless	2:00 p.m.	6:00 p.m.	29
Meeting Goals: Begin assembling intake/collector, Engineering Notebook				
Team Members in Attendance:				
Ian, Jalynn				

Tasks	Reflections
Robot Hardware - Intake/Collector	**Ian**: We spent today cutting polycarbonate side plates for the intake, using the cardboard mockup plates from yesterday as templates. We then connected these plates to the previously bent polycarbonate backboard using aluminum angle stock. Finally, we mounted the sweeper bar to the plates, and built a makeshift "comb" to prevent the elements from getting launched out of the top of the system. We're going to work on mounting the motor next, as well as beginning work on the filter system geometry.
Pit - Slide Show	**Jalynn**: I worked really hard during today's meeting to get things done. First, I worked on pulling out meeting photos for the slide show.
Engineering Notebook - Meeting Entries	**Jalynn**: After I finished with the slideshow, I updated any Engineering Notebook entries I could and put together an updated list of the write-ups I need from my teammates.
Engineering Notebook - Display Boards	**Jalynn**: After that, I decided to look at the list of things we needed done to see if I could do anything. Seeing that our Vera's Journey display board was on the list, I pulled it out and got to work. I printed out photos and a summary from the Arkansas State Competition and updated the Tennessee State summary. With some help from Ms. Jean, we cut them out and pinned them on. We also fixed some of the pins that were broken or the wrong color to make the board look more uniform. Now the board is almost complete except that it needs a photo of Vera with the new intake on.

Engineering Notebook - Alliance Flyer	**Jalynn**: I also noticed that the To-Do board listed that handouts needed to be done, but I wasn't sure what that meant, so I asked Ms. Jean. She said it was probably what we call our "alliance flyer", which is a short explanation of our robot's abilities that we'll keep in our pit for Worlds. During alliance selection, we can hand interested teams this flyer or, if we aren't in the pit when they come by, they can grab one from our pit. Mr. Monte sent me an alliance flyer from a couple years ago and, with some adjustments, I made a new one for this season. It's subjective to change, but we should have a complete one before Worlds. The funny thing is though, is that even though the alliance flyer was something we needed done, it wasn't what the "handouts" on the board was. The handouts were the 3D-printed robots and other trinkets we intend to hand out at Worlds.





Assembling the single-wide collector

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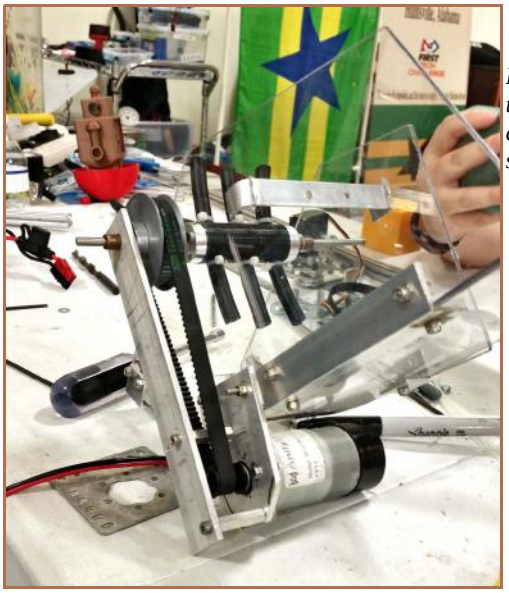
Team 7842 Engineering Notebook - Rover Ruckus

Date	Location	Start Time	End Time	Week #
March 18, 2019	AvaLAN Wireless	2:00 p.m.	6:00 p.m.	29
Meeting Goals: Continue working on intake/collector				
Team Members in Attendance:				
Ian, Megan, Jalynn				

Tasks	Reflections
Robot Hardware - Intake/Collector	**Megan**: On Monday, March 18th, Ian and I continued working on the Lexan model of the intake. Our first business to attend to was the beam that held the standoffs to keep the cubes from flying out. We'd used a heavier material, and we wanted to use a metal plate that was much lighter, so we cut a thin piece of metal, drilled holes for the standoffs, widened the slots in the Lexan plate, and to secure it, we bent the ends to be flush with the side plate. Instead of adding three standoffs like last time, we only added two, as we felt three was unnecessary and two could easily get the job done and keep the cubes from being thrown out. After that, we mounted the motor on the bottom of the intake using a metal plate that we attached to one of the side plates. Then, we ran the belt from the motor to the pulley on the sweeper's axle. Once we ran the motor, we immediately noticed that the Lexan was bending the pulley out of place and pulling on the belt, so we began brainstorming different ideas we could use to fix this. Finally we decided to use a piece of stock metal as a brace. We drilled out holes to mount the plate to the axle, and two more holes for small standoffs that we added to the plate being used to mount the motor. Once we did this, we realized the belt tension was way too tight, and the sweeper wouldn't even move, so we adjusted the positions of the holes so that there was less tension on the belt, and it worked incredibly well! The sweeper was fast, and the motor and the belt stayed in line while it was running. Towards the end of the day, we added a smaller standoff and a larger standoff on the edge of the intake that will be used to hold the filter rail, however, we ran out of time, so tomorrow, we're going to add the filter.

Pit **Engineering Notebook** - Slide Show	**Jalynn**: At today's meeting, I helped Ms. Cindy and Ms. Jean figure out the flooring for our pit. We wanted to have some form of cushioning so that in between matches or on breaks, the team could rest their feet from the hard floors. We took the old foam tiles we've kept in storage and set them up. We had to adjust one tile so it would fit around our trophy shelf, then tested running over it with the cart to make sure it wouldn't slide. Next, I put together photos from our competitions in a folder for Megan for when she's ready to put together the Competition part for our slide show.



Final mounting of the motors, pulley, and metal brace on standoffs

Testing the new motor-driven collector

Cutting floor tiles for the Pit

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Date	Location	Start Time	End Time	Week #
March 19, 2019	AvaLAN Wireless	2:00 p.m.	6:00 p.m.	29
Meeting Goals: Continue working on intake/collector				
Team Members in Attendance:				
Megan, Ian				

Tasks	Reflections
Robot Hardware - Intake/Collector	**Megan**: On Tuesday March 19th, Ian and I continued our work on the intake. First, we cut a slot in the side plate for the filter rail, and then we cut a thin piece of metal and connected it to the standoff we'd mounted the night before. Unfortunately, when we fed a ball through, we decided that the straight piece slowed the process down too much, so we took off that piece and mounted a curved beam instead. Then, we moved on to the servo gate. We drilled holes on the bottom of the intake, and then we mounted the servo, though we weren't sure what to use as a gate yet. We knew we wanted to make it out of Lexan, but we still didn't know which shape we wanted to utilize. While the square worked when I made it out of metal, Ian thought that a C shape might be better and use less material. We both used cardboard to cut out the two shapes, and in the end, we decided on the C, so we cut it out of Lexan and mounted it to the servo. Now that we had the servo and the filter rail in place, we wanted to test in-taking and dispensing. We soon discovered that the tubing on the sweeper wasn't long enough to pick up the cubes, though it did pick up the balls, even if it was a little slow. So, we made the tubing longer, and we mounted the omni-wheels to make sure that the sweeper would be able to pick up elements when it was lifted slightly. Sadly, we soon found out that the tubing wasn't long enough and couldn't get a grip on them. We decided to put the omni-wheels on higher, so the intake would be closer to the ground, but we chose to play with the lengths of the tubing first. We made the fingers longer, and we bent the lip of the intake slightly, so it would act sort of like a dustpan. While this helped a little, it didn't fix the problem entirely, but we ran out of time to do anything else, so we're going to work on it more tomorrow.

Testing the C-shaped Lexan gate on the collector

Also, note the curved metal bar that serves as the filter plate

BROWNCOATS
Team 7842 Engineering Notebook - Rover Ruckus

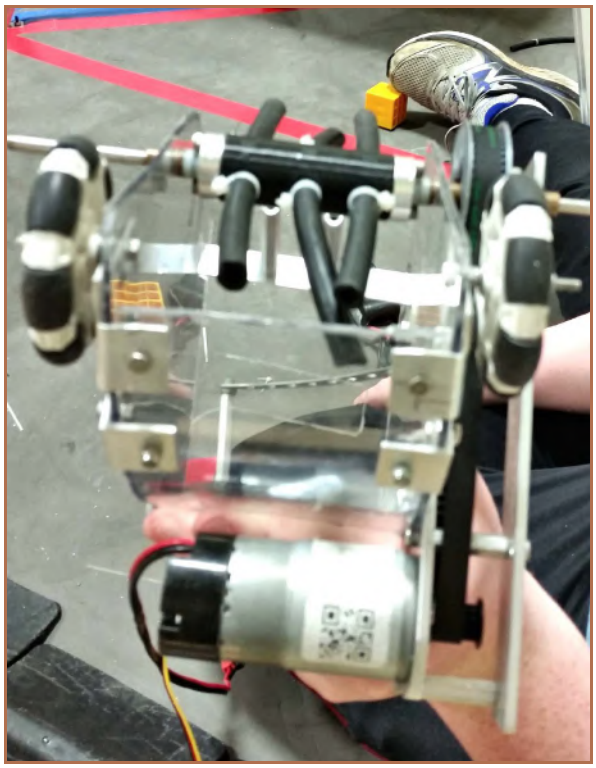
Date	Location	Start Time	End Time	Week #
March 20, 2019	AvaLAN Wireless	12:30 p.m.	6:00 p.m.	29

Meeting Goals: Continue working on intake/collector

Team Members in Attendance:

Megan, Ian

Tasks	Reflections
Robot Hardware - Intake/Collector	**Megan**: On Wednesday March 20th, Ian and I continued our work with the intake. The first thing we did was add longer tubing to the sweeper. This still didn't work the way we wanted it to. It picked up the balls with ease, however, there still wasn't enough traction for the fingers to pick up the cubes. We decided to try more rigid tubing at the same length. This time, it worked to pick up the cubes, but when there was a ball and another element inside the intake, the sturdier tubing wasn't able to form around the balls and the motor would stall. Before messing with the tubing even more, we cut off a little bit of the lip, so that the walls of the intake were longer than the bottom plate. This helped a lot, but we still needed to find the optimal type of tubing. Because the rigid tubing worked the best to pick up the elements, we used this material for the outside fingers, but we used the flimsier latex tubing for the middle. To our absolute delight, this seemed to be the best solution we had available to us! The only other thing we needed was to add the omni-wheels, so we drilled new holes and added higher screws which put the omni-wheels up higher, and put the intake lower to the ground. We were worried it would still be too high to pick up the elements, but thankfully it wasn't. Even with the wheels, the sweeper was still able to pick up the elements with ease! Now that we had the intake working the way we wanted it to, we needed to start thinking about mounting it to the robot. One of our main concerns was that we wouldn't have enough reach into the crater, so we decided to add a smaller, spring-loaded stage to the arms that the intake would mount to. We added one piece of REV extrusion on both arms, and then we connected the two with another piece of extrusion that ran between them. This was where we wanted to mount the intake, but we ran out of time and will continue working on it at our next meeting.



Collector with new tubing and omni wheels

Testing the collector

BROWNCOATS
Team 7842 Engineering Notebook - Rover Ruckus

Date	Location	Start Time	End Time	Week #
March 22, 2019	AvaLAN Wireless	12:30 p.m.	6:00 p.m.	29

Meeting Goals: Preparing to mount intake, Work on slideshows, Team discussion

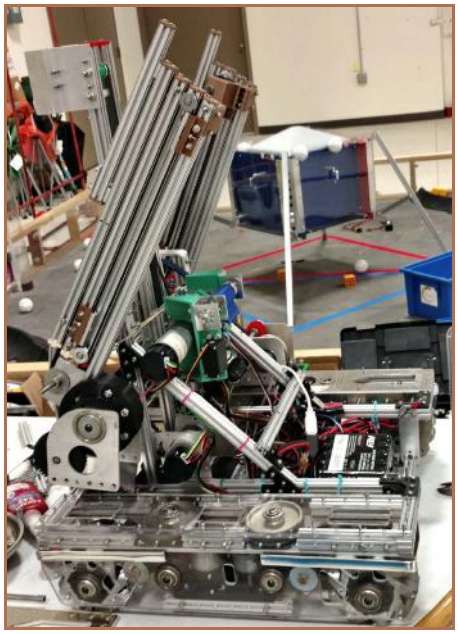
Team Members in Attendance:

Ian, Megan, Kye, Jalynn

Tasks	Reflections
Robot Hardware - Drive Train	**Megan**: On March 22nd, the first thing we needed to do is replace the aluminum top plate of the drive train after the failed attempt to replace the top plate with Lexan. We were hoping to replace this plate to save approximately .25-.5 lbs. Unfortunately, the plate did not fit properly.
Robot Hardware - Intake/Collector	**Megan**: Our work on the intake continued. We had printed another angled piece to mount the intake on the arms, however, we soon realized that we had added ten degrees in the wrong direction, meaning the angle wouldn't work. So, Ian spent a lot of time modeling a new one with the correct measurements and adding more support and stability to it. Afterwards, the team huddled together so we could discuss how we wanted to proceed. We'd set a deadline for ourselves as to when we decided whether or not to revert back to the old intake or continue with the new one. Even though there are still many things we need to accomplish, we all agreed that continuing on is the best way to go. We're hoping that once we have the angle piece printed for tomorrow's meeting, we should be able to finish mounting the intake by the end of the day, and then Ian can spend Sunday working on software. Once the decision had been made, Ian and I continued working with the spring loaded stage. We added pulleys and screws to the beam that would hold the rubber bands in place, which is what we're using as the spring loaded part. Once we had rubber bands on both sides, it worked rather well. Our only concern is that if the rubber bands break during a match, there's nothing to hold it in place, so we began discussing different options for some kind of latch that will hold it in position once it releases. Then, we talked about what would hold it in at the beginning of the match, and we decided that simple is the best way to go. We want to use a piece of metal or a thin beam on either side of the arm to hold it in place, and then we'll lift the arms up to release the tension. We also realized that in order for us to make this part,

Robot Hardware - Intake/Collector (continued)	**Megan**: we need the intake on first. So, our task for tomorrow is to get the intake mounted in its final position so we can continue with everything else!
Pit - Handouts - Slideshow	**Jalynn**: Kye and I started the meeting by gluing pin backs on our 3D-printed robot handouts. After that, I quickly updated any meeting entries before we started to actually put together the outreach slideshow. Using the new app that Ms. Cindy downloaded, we began to arrange the photos in a way that gave a good visual of the event. There were two or three photos for each event, so we put a label on the first photo of each set to say which event it/they came from. We did a lot of experimenting with fonts and colors until, with help from Megan, Ms. Cindy, and Ms. Jean, we had a basic font to use and four basic background colors for the text. After that, we played around with the effects to decide which effect(s) we wanted on our labels. After going through them all, we found two effects we liked. When we finished, we previewed what we had so far. It looked really good, but we wanted to explore the transition effects between the photos because neither of us really liked it on random transition. However, the meeting was drawing to a close, so we decided to do it tomorrow.

Team Huddle - how to proceed?



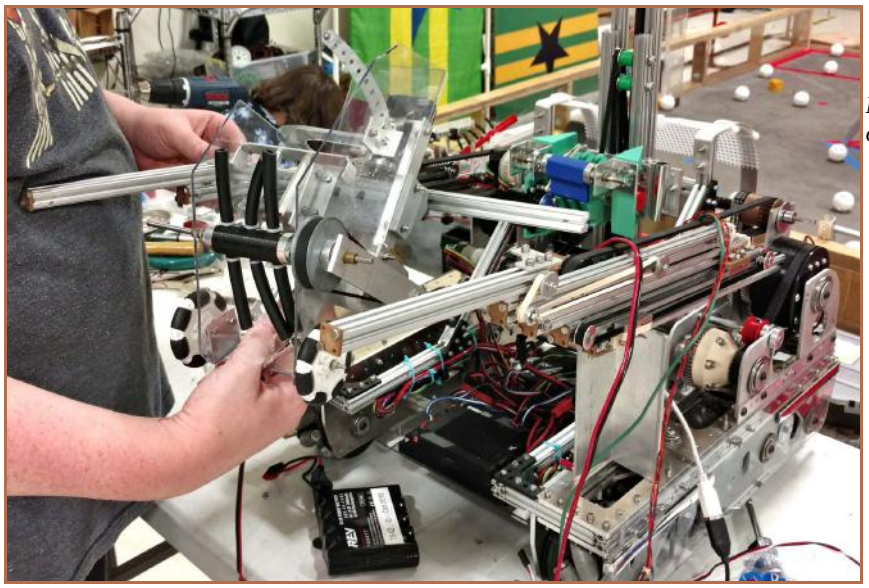
FAILED attempt to replace the aluminum top plate of the drive train with Lexan

BROWNCOATS
Team 7842 Engineering Notebook - Rover Ruckus

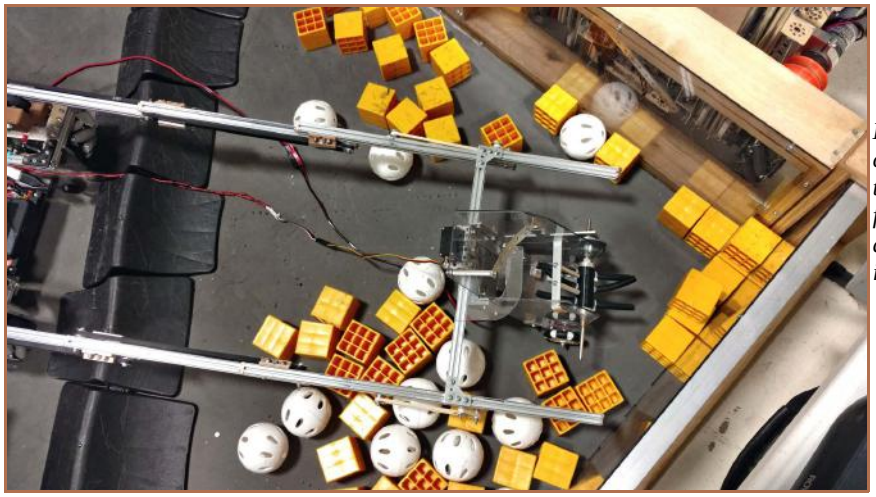
Date	Location	Start Time	End Time	Week #
March 23, 2019	AvaLAN Wireless	1:00 p.m.	6:00 p.m.	29
Meeting Goals: Installing intake, Continued work on slideshows				
Team Members in Attendance:				
Ian, Megan, Jalynn, Kye				

Tasks	Reflections
Robot Hardware - Intake Installation	**Megan**: On March 23rd, we continued our work on the intake. We'd reprinted another angled piece, however, this time we added the ten degrees in the correct direction, and we made it more sturdy with more mounting holes. When we went to mount the piece onto the intake, we soon realized it was too snug, so we filed the piece out until it fit comfortably, and then we added screws to keep it in place. From there, we added a beam of REV extrusion to the bottom of the 3D printed part. Once all of this was finished, it was time to mount it onto the spring loaded stage. We used two metal corner brackets on either side and mounted the beam of REV extrusion to them. Finally, the intake was on the robot. Our immediate concern was the fact that the intake seemed to be a little taller than the 18" cube. We used an 18" PVC pipe (the "Lori Stick") to try and measure the whole robot, but we're not sure how accurate it was. Sometimes the intake would fit fine, however, other times the pipe would hit the very top of the filter. We decided to build an 18" sizing box so we can accurately measure it at our next meeting.
Pit - Handouts	**Kye**: On March 23, we finished putting the backs on the 3D robots. **Jalynn**: During today's meeting, Kye and I worked on gluing more pins on more 3D- printed robots (they just keep coming!).
Pit - Slideshow	**Jalynn**: Today, we started looking at transition effects of our outreach slideshow. Like with the effects of the labels, we went through all the effects and selected a few we liked, then rotated

Pit - Slideshow (continued)	**Jalynn**: between them. We previewed the final result, then showed it to Ms. Cindy. It looked pretty great! Then, we decided to try working on the meeting slideshow next. However, there were 153 photos (not counting the ones from the most recent meetings) and it made for a 15 minute slideshow, which was WAY too long. This meant that we had to go through the photos and pull out unnecessary ones, but we're going to save that for next week.



Mounting the collector onto the telescoping arms



Demonstrating how the collector, when mounted to the rubber band actuated final slider stage, can reach all but just a few elements in the crater

BROWNCOATS
Team 7842 Engineering Notebook - Rover Ruckus

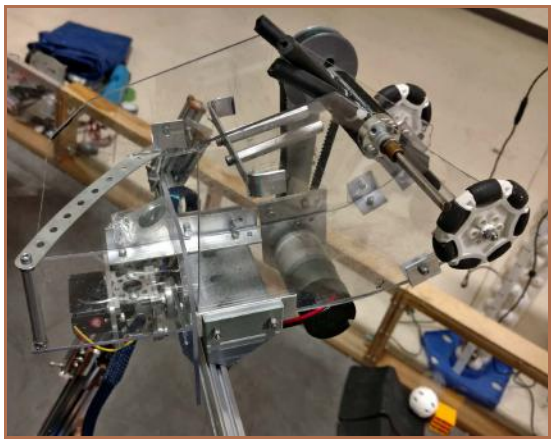
Date	Location	Start Time	End Time	Week #
March 29, 2019	AvaLAN Wireless	12:30 p.m.	6:00 p.m.	30
Meeting Goals: Continued work on intake, Continue working on Pit				
Team Members in Attendance:				
Ian, Megan, Kye, Jalynn				

Tasks	Reflections
Robot Hardware - Intake Installation and Testing	**Megan**: On March 29th, work on the intake continued. The first thing we did was add the two thin pieces of metal that would hold the spring loaded stage in place at the start of each match, so that we could properly test it. One of our main concerns about using rubber bands for the tension was that we didn't want them to snap during a match, because then that stage would have nothing to keep it still. So, to fix this, we added two small pieces of Lexan at the end of the beams on the spring loaded stage, so that when the intake deploys, they will fasten themselves into two of the screw heads, keeping it in place. We were worried that it wouldn't work as well as we wanted it to, however, once we tested it, we found that it worked much more consistently than we thought it would. After this, we quickly put the wires through a braid and temporarily rigged them onto the arms. Then, it was time to practice! We found a couple of issues with software that would need to be tweaked, but the intake was much faster than our previous version. One thing we noticed though, was that the spring loaded stage would bump into the field walls when the arm was at full extension, and this prevented us from reaching into the corner. So, we shortened the beams significantly and this helped a lot. While we're not able to reach into the farthest corner of the crater, we're pretty happy with how much reach we *do* have. Tomorrow, we're going to practice driving more. At the end of the meeting, we used our new 18" sizing cube to measure the robot, and to our delight, we were inside the constraints!
Engineering Notebook - Meeting Entries	**Jalynn**: I updated meeting entries and added photos to finished pages in the Engineering Notebook.

Pit - Handouts	**Jalynn**: I started the meeting by beginning to glue yet more pins on more handouts until Kye came. **Kye**: We glued more backs on 3D-printed robots, but we did not have enough backs to finish all the robots.
Pit - Display Shelf	**Jalynn**: I helped Kye and Ms. Cindy finish painting our PVC pipe display shelf for our pit.
Pit - Slideshow	**Jalynn**: I began sorting through the now 173 meeting photos in our meeting slideshow. I tried limiting the photos to 2 or 3 if necessary per meeting since there were 4 or even 5 photos for some meetings. However, it barely made a difference, so I turned to the team for advice. Megan suggested taking out the photos from the meetings where it was just her and Ian doing driving practice or software, or ones where we didn't look quite as productive. This sounded like a good idea, so I'm going to try it out at tomorrow's meeting and I instead worked on the Competition slideshow with Kye. This way, the competition videos can just be added on when ready.

Finally! Driving practice!

Current weight = 41.50 lbs.

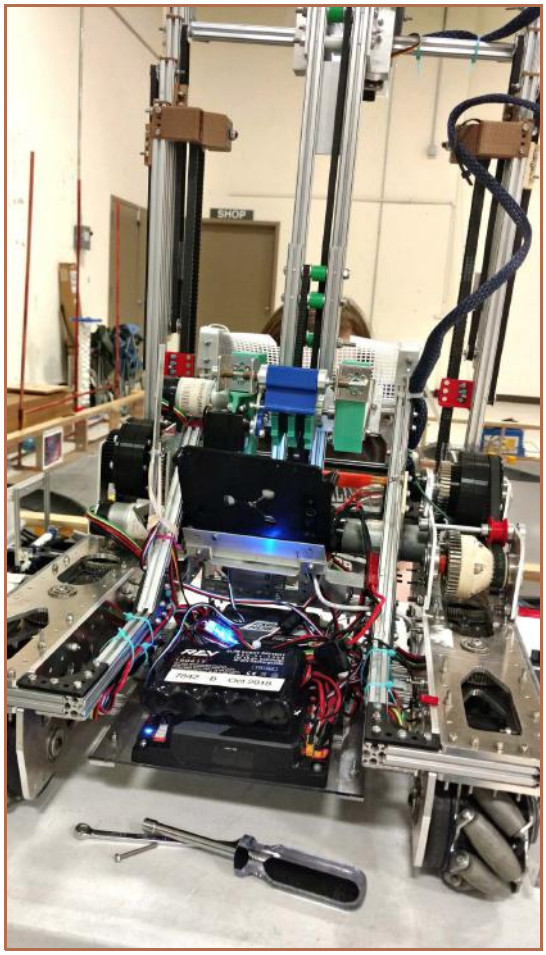


The new collector

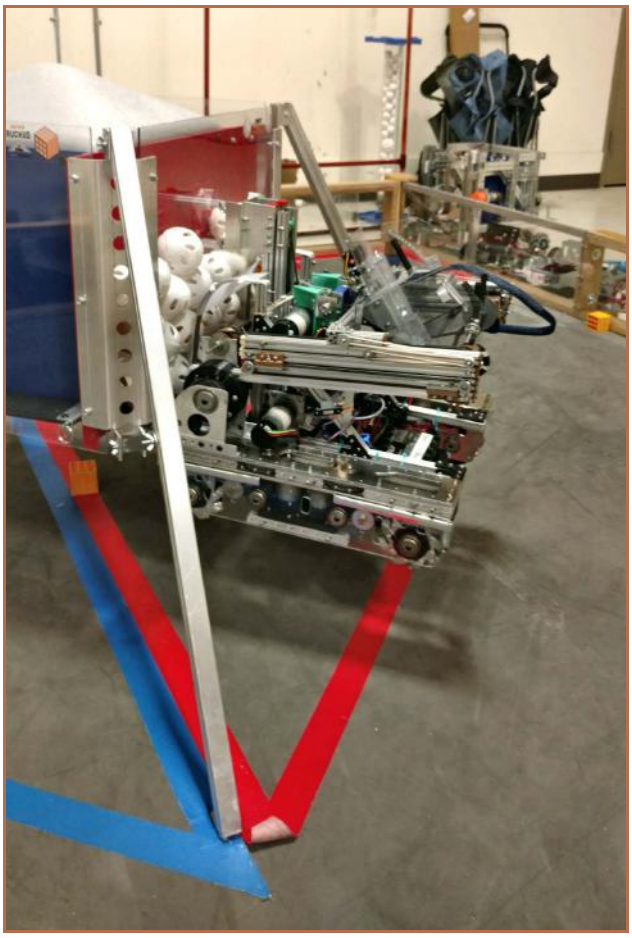
BROWNCOATS
Team 7842 Engineering Notebook - Rover Ruckus

Date	Location	Start Time	End Time	Week #
March 30, 2019	AvaLAN Wireless	12:30 p.m.	6:00 p.m.	30
Meeting Goals: Driving practice, Continued work on slideshows				
Team Members in Attendance:				
Ian, Megan, Kye, Jalynn				

Tasks	Reflections
Driving Practice	**Megan**: On March 30th, Ian and I continued to practice driving. We weren't as fast as we wanted to be, and part of this was due to the fact that depositing the elements was very slow. A lot of times, the cubes would get stuck on the standoff that held the filter rail in place. We weren't sure that taking the standoff out would help, or if it would make the whole system flimsy, but we decided to try it anyway. Once we took it off, we became much faster. The cubes wouldn't get stuck anymore, and we had a lot more consistency with the elements falling into their correct cargo hold. By the end of the day, we'd scored 10 cycles (20 elements) and 11 cycles at our best. In the next couple of meetings, we want to practice standing and scoring from different positions as well.
Pit - Costumes	**Kye**: I peeled off the excess parts of the vinyl iron-ons for our team numbers, so we can iron it on our shirts some other time.
Pit - Slideshow **Engineering Notebook** - Meeting Entries	**Jalynn**: Most of today's meeting I dedicated to finally conquering the Meetings slideshow. First though, I went through and updated meeting entries. I then, compiled this week's Nag List. When I decided to start on the slideshow, I first read briefly through our current Engineering Notebook and pinpointed necessary and unnecessary meetings to be featured in the slideshow (since we are trying to shorten it). I made a list of these meetings and began taking photos out. It took a while, but when I finished, I managed to shorten the slideshow from 17 minutes to 5 minutes! For the remainder of the meeting, I worked on moving photos around and composing the slideshow.



The final phone mount and completed wiring



Ready to begin a match. Everything fits within the 18-inch cube!