Date: Sat. 2/23/19	***Location***: San Jac	***Purpose***: SE Texas Regional Championship

Attendees: Entire team

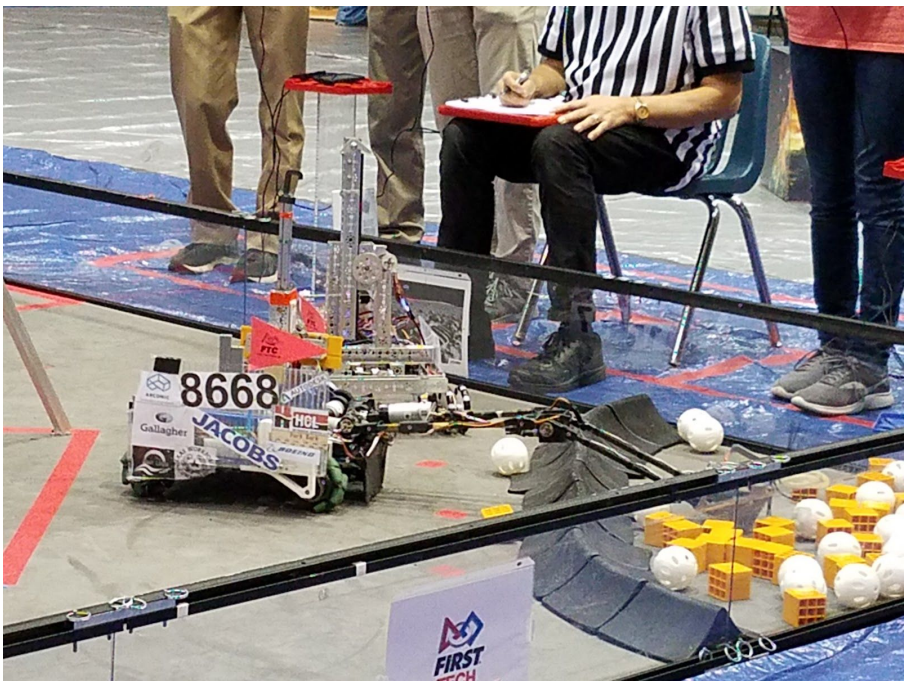
Agenda:

- Regional Championship

Reflections:

Knowing how to fix a broken u-joint in 5 minutes or less is a great skill to have!

We started the day off right by having a good judging session early on in the day. We then went on to qualifying rounds and did pretty good. We were able to win four of our five qualifying rounds and finish second overall. Because of our second place rank, we were able to be in the position of being an alliance captain. For our first pick we picked Team Name Wanted team number 11524 and Ironclad team number 8080 for our second pick. We won our first semi-final match. During our second match our hanger was positioned incorrectly for autonomous and got caught on the latch which kept the rest of the robot underneath the robot. Because the rest of the program tried to run the arm tried to extend up, but the arm was pinned under the lander which then broke the universal joint to the elbow. This problem completely broke our arm and we could not win that match. We were able to zip-tie the universal joint back together. Because of this, we went on to win the rest of our matches and the championship. Overall, we did really well and won the Think Award and second place Inspire.



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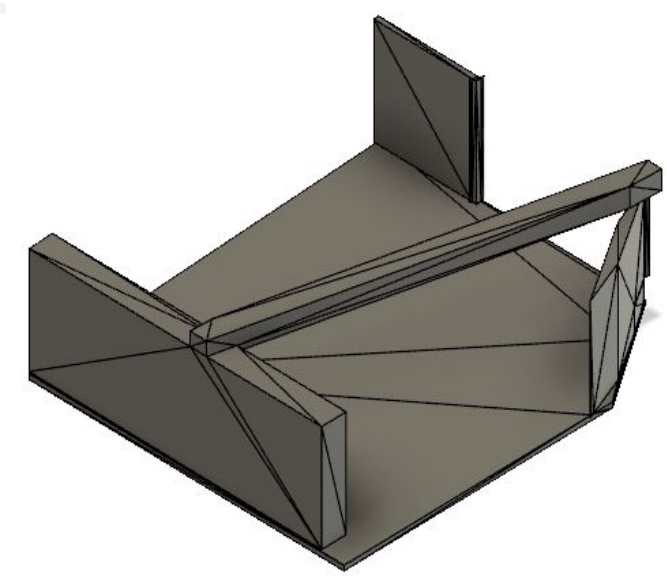
Date: Mon, 2/25/19	**Location**: Tate House	**Purpose**: Programming Subgroup

Attendees: Ben

Agenda:

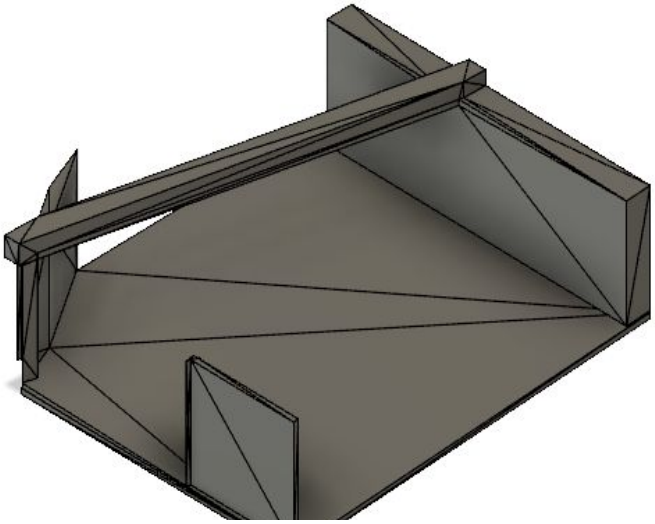
- Creating a prototype sorter in CAD

Reflections:

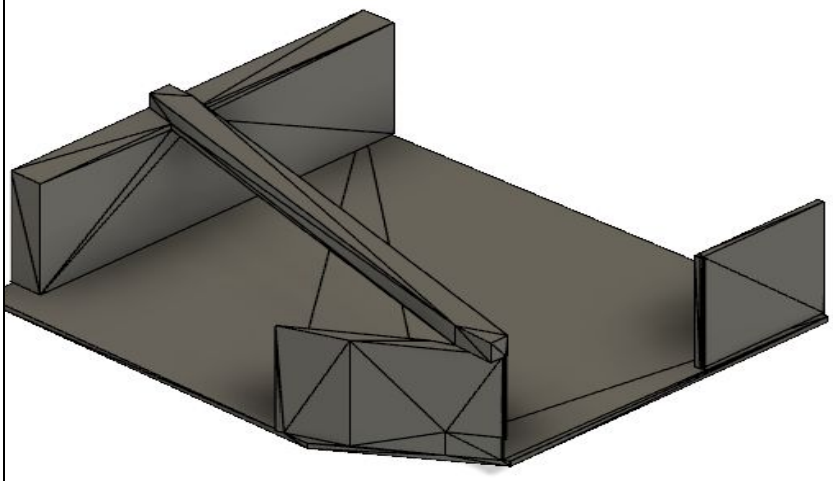


After reviewing other Championships, I saw that a lot of teams could sort the minerals into the correct sides of the lander. They also didn't have to worry about which mineral the collected from the crater. I designed a really quick prototype just to see if the sorter could work within the size limitations and with our current collector.

This prototype worked but was lacking support on the walls and a section that can attach to our collector. I went into fusion 360 and redesigned the part due to a mesh issue and so it could be added to the full robot assembly.



I also added the necessary supports to the walls and extended the sorter bar across the top.
This version lacks a section that can attach to the collector but I went ahead and printed it so it could be tested at our meeting later today.



Date: Mon, 2/25/19	***Location***: Belbas House	***Purpose***: Team Meeting # 41

Attendees: Entire team

Agenda:

- Evaluate our robot (SWOT analysis) from Championship

Reflections:

SWOT

Linear Slide

Strengths

1. Strong and repeatable.

Weakness

1. Encoder wire disconnect problem.
2. Robot does not hang level. (... not necessarily a weakness, but if the software guys want to use a pitch/roll measurement to detect when the robot is stuck on the latch in autonomous, it would probably be helpful if the robot is as level as possible when latched on the lander at the start)
3. Occasional snagging. Hook alterations are possible.

Opportunities

1. Make a new encoder wire.
2. Custom-design the cross-brace on the vertical tower to enable the robot to hang level and incorporate a ramp shape to replace the metal straps we installed a few days before the competition.
3. Possibly incorporate the tape measure??
4. Reprint base for spare.

Arm

Strengths

1. Can reach a large percentage of the crater.
2. Can reach the right spot at the lander to deploy silver and gold minerals at the same time.
3. Movement seems fast enough for mineral collection.
4. Withstood **significant** wear and tear at competition.
5. Can function with zip ties in the u-joints.

Weakness

1. “Slop” in the gearing creates “impact wheelies” when transitioning from the lander back to the crater positions. Those “impact wheelies” may eventually lead to part failure in the shoulder area. Not sure how to address this.
2. Need to replace all the brass gears.
3. Look at redesigning gear box to eliminate need for u-joints.
4. Need to replace elbow pivot parts with onyx.

Opportunities

1. Check into availability of carbon fiber tube
2. Raise shoulder to make space for wiring? But, if we raise elbow arm is longer - perhaps too long. If we shorten arm, then we can’t reach into crater as well.
3. Replace elbow with onyx.

Chassis

Strengths

1. Fast, smooth, and maneuverable
2.

Weakness

1. Can catch a silver mineral underneath when driving to the lander (happened at least once in qualification matches).
2. Mineral plow is taped on and can become unreliable if shoulder joint is removed too frequently. Print from ninjaflex?
3. Can trap a dropped mineral on top of chassis.

Opportunities

1. Replace gorilla tape plow connection with something that doesn't lose stickiness when removed a few times (the plow itself can still be gorilla tape if that helps).
2. Add walls and covers to sides and top. (Phantom used black/white Coroplast, and their bot looked very clean.)
3. Switch chassis to carbon fiber.
4. Wheel guards.
5. Return to low chassis so we can fit under lander. Possibly enable different autonomous path.
6. Generative design.

Collector

Strengths

1. Rubber tubing works well to collect minerals

Weaknesses

1. Can eject silver minerals too forcefully and overshoot to opposing alliance's cargo hold (equivalent to a minor penalty since it takes 5 away from us and gives 5 to them).
2. Can't sort minerals automatically (makes for slower collection at the crater and slower unloading at the lander)

Opportunities

1. Add passive mineral sorter. May solve weaknesses related to silver mineral overshoot and slowness of collection/unloading.
2. Remove divider in the middle of the collector. Keep two servos with individual control. Investigate if we can keep the collector the way it is but just use sorter.

Software

Strengths

1. Autonomous, when it worked, worked very well.
2. Arm presets seemed to help. Weren't used because they were too slow.

Weaknesses

1. Sampling is slow.
2. Autonomous, when it didn't work, failed spectacularly.
3. Can't tell when it is driving the arm into another object during autonomous.
4. Finding encoder values and angles for every possible autonomous scenario is time consuming.
5. Don't have a reliable way to claim the depot from crater side and not crash into other robot.
6. Don't have a simple way for the drivers to keep the collector at the same elevation, but increase its angle relative to the ground. (for the case the collector is too "flat" to collect a mineral that is right in front of the collector or at the front edge of the crater)

Opportunities

1. Speed up sampling by focusing on more than 1 mineral in the camera view; consider positioning the camera/robot so that it can see all 3 minerals when landed.
2. Add something which can sense when the robot is stuck on the latch so that corrective action can be taken before the robot breaks itself (Correlate current state with expected imu angles ... consider using more than just gyro angle when assessing whether the robot is stuck. Touch sensor integration into hanger support, etc...)
3. Experiment with correlating large motor current with lack of encoder movement to see if robot controller can detect a stalled or stuck arm. (since most of the underside of the lander is hollow, a limit switch on top of the elbow may not be too reliable)
4. Experiment with (x,y) calculations based on gyros and wheel encoders to keep track of robots' (x,y) location on field. If successful, may help with navigation during autonomous by enabling a waypoint-based approach for driving around the field.
5. Experiment with autonomous state machine concepts that can be updated easily for each match. If successful, could lead to real-time alliance-specific autonomous customization before each match.
6. Add a gamepad control that tweaks both the shoulder and elbow just enough to increase the angle of the collector without changing its elevation above the ground.
7. Add an autonomous that claims the depot when on crater side.
8. Increased normal drive to .6. All presets need to be increased as high as possible.

Threats

1. Need to upgrade rev hub firmware.

Judging

- Add up hours and number of people for each outreach category.
- Poster of raising up the next generation.
- Pit - videos, posters,

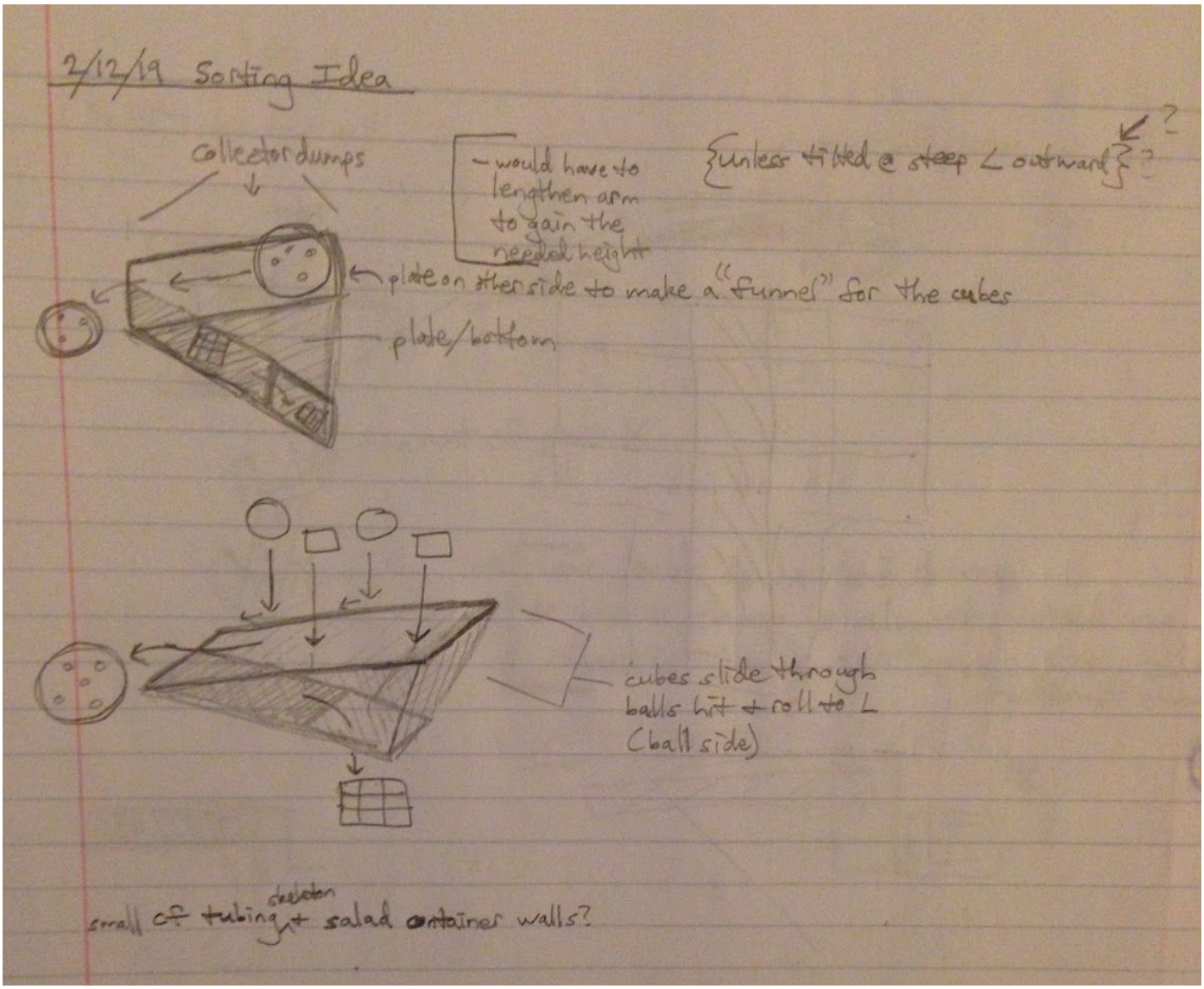
Notebook

- Assembly instructions
- Outreach and more in depth
- CAD the metal arm generation

Outreach

- Intuitive machines
- Jane Taylor - younger kids
- Highlight ASSiST
- Pursue project with Mayor. Get Little Blue fixed up. Perhaps ask Enaxis for funding to provide.
- Girls in the Boy Scouts. Take robotics to girl troop and help them get merit badge.
- Enaxis

Zach: Several of us had a similar idea of designing a sorter where the balls would roll to the silver side and the cubes would slide through to the gold slide. Below is a sketch I had made several weeks ago detailing this idea. I knew that if we advanced past Regionals, we would have more time and would definitely want to design a sorter to speed up collection cycles and make us more competitive.



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Date: Thurs. 2/28/19	***Location***: Tate House	***Purpose***: Programming Subgroup

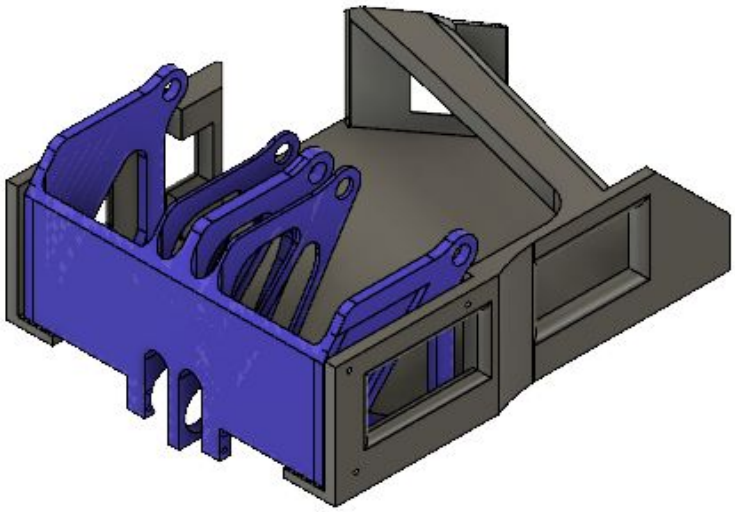
Attendees: Ben

Agenda:

- Prototyping a mineral sorter addition to the collector

Reflections:

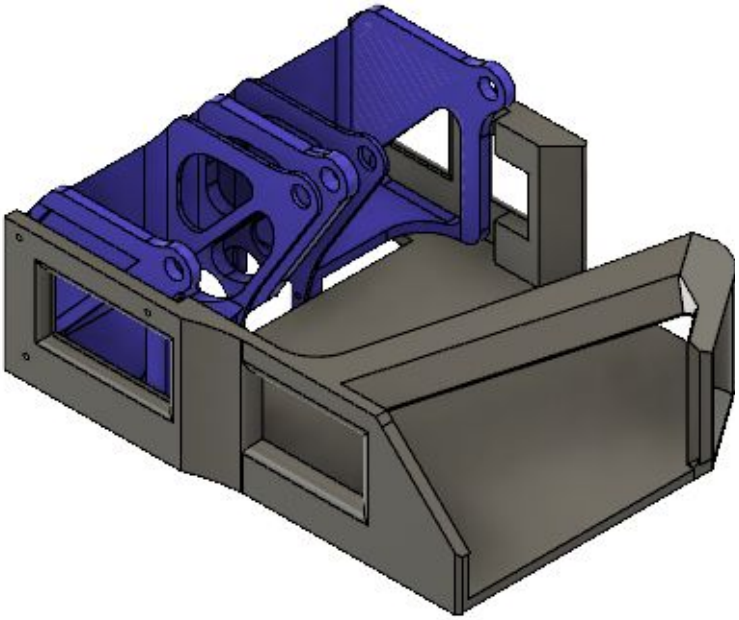
Ben: This was the first prototype of the mineral sorter extension. It was modeled off of some early designs made with Jacobs Engineering in the beginning of the year and more recent functioning models from other teams.

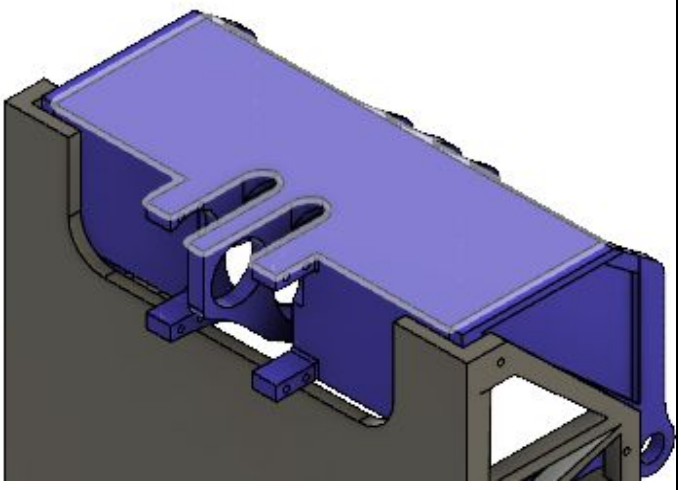


I started off by creating a very blocky shape that had a sorter bar just high enough for the gold minerals to slide under. Then I added extrusions to the mineral sorter walls that connected with the collector.

Next I added support walls in the front of the collector to prevent shifting and mounting screws to the side walls to secure it in place. The walls need to be high enough to put screw holes in but low enough to avoid the collector wheel bearings.

I also added fillets and chamfers to the right side wall and left corner of the silver mineral redirect bar. Unnecessary wall space was removed at the front wall and back right wall. This was to reduce the amount of infill and make the end product lighter.





Date: Fri, 3/1/19	***Location***: Belbas House	***Purpose***: Team Meeting # 42

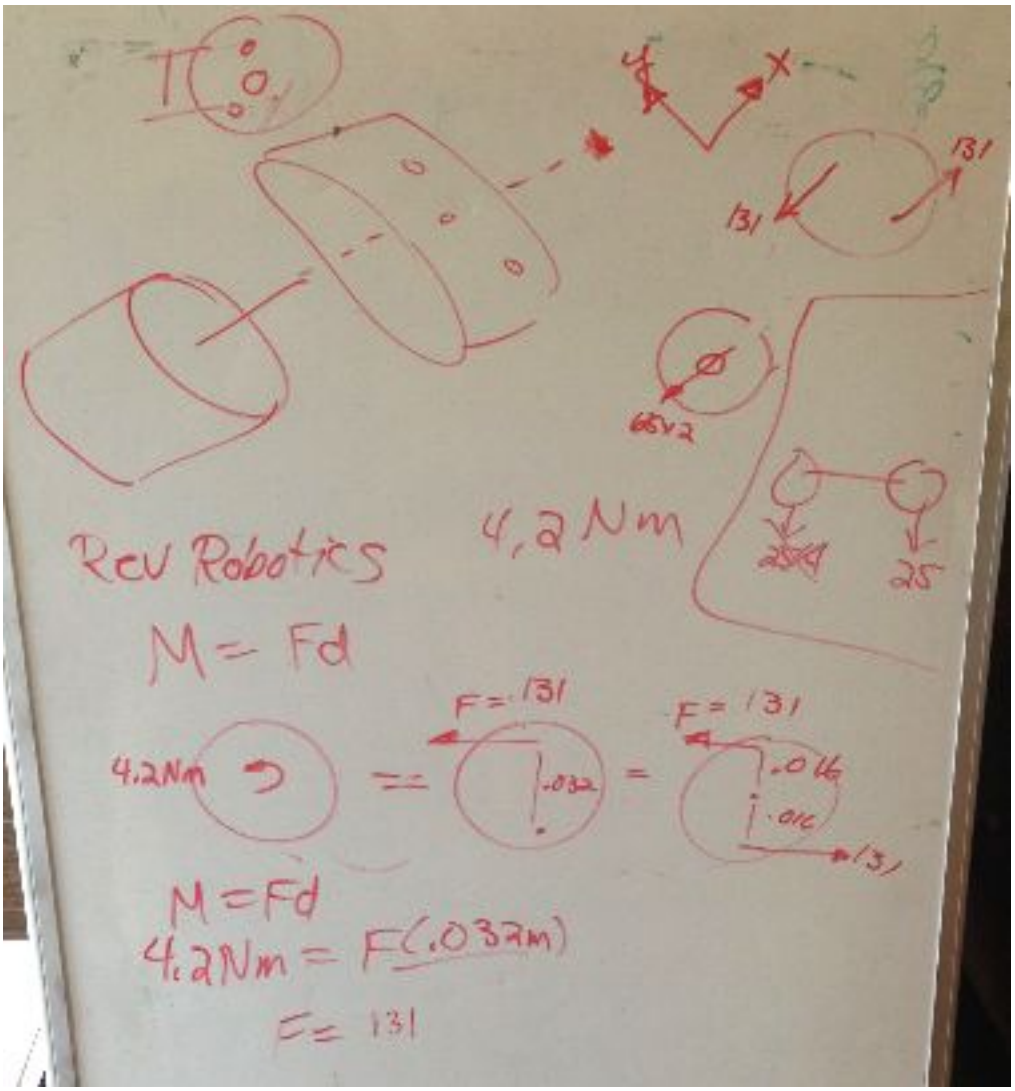
Attendees: Mark, Zach, Ben, Andrew, Luke, Coach Belbas

Agenda:

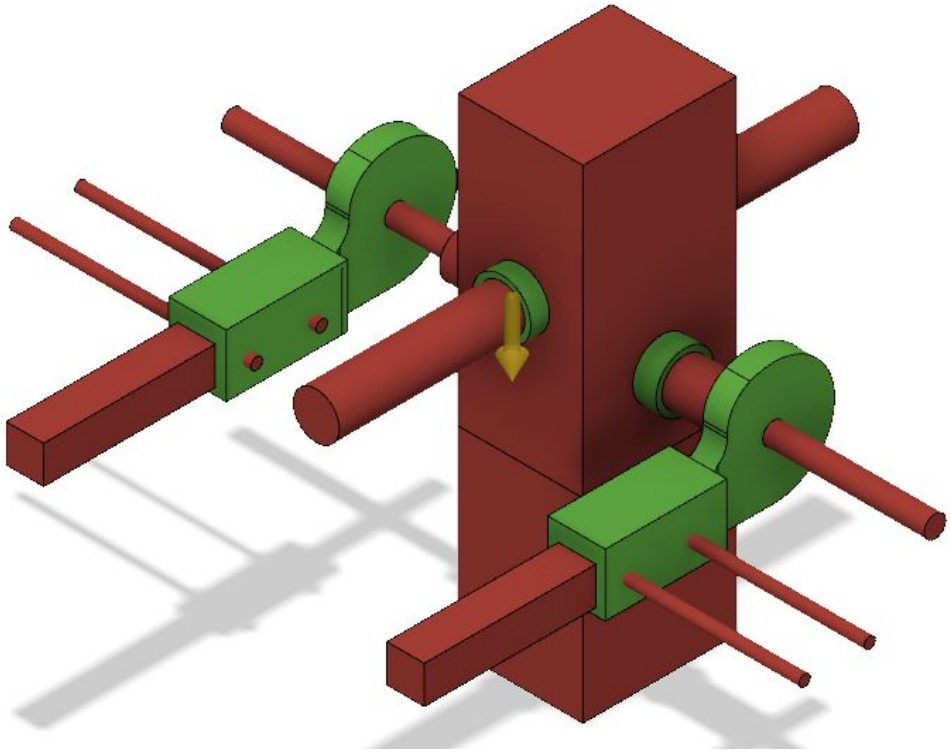
- Use generative design on wheel modules and elbow module
- Prepare Little Blue for proposal to Enaxis and the Mayor
- Make a parts list of Little Blue for the proposal

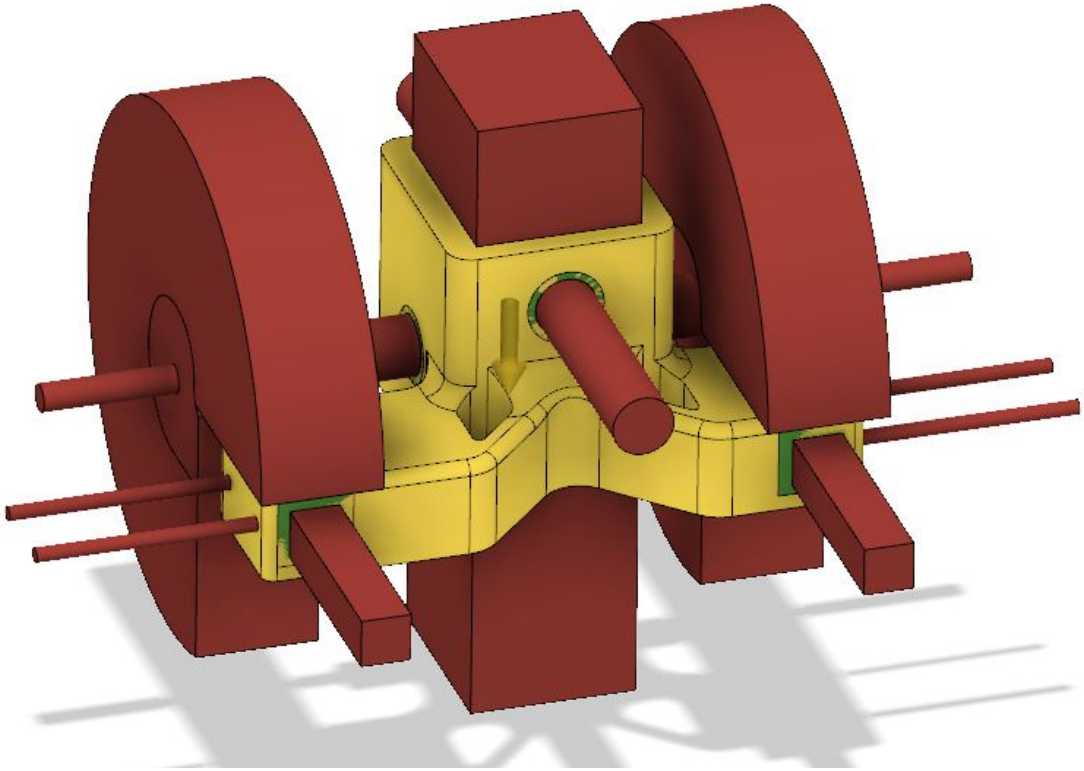
Reflections:

Today Mark, Zach, Ben, and Coach Belbas spent the entire meeting working with generative design. We learned how to use generative design at the Autodesk workshop in October and had used it a little, but we never had time to go deep with it until now. Mark and Ben worked on the wheel modules, and Zach worked on the elbow module. We set up the preserve geometry and obstacle geometry, and then we did the physics required to define the loads. Then we specified 3D printing as our manufacturing method, and finally we selected ABS, aluminum, and nylon as our materials before putting the parts in the generative study. The aluminum represents the strength of carbon fiber, which we could use if Jacobs can figure out how to fix their Markforged printer. Since there was no option for onyx material, we used nylon to get an idea of what might work with onyx since onyx is nylon with carbon fiber chunks. We were able to put the wheel module parts into the generative study, and we will finish the elbow module next meeting.



The following pictures show the elbow module in various phases of generative design. The preserve geometry is green and the obstacle geometry is red. The current elbow gearbox (yellow) is used as the starting shape for the new iterations that will be produced through the generative technology.





Date: Mon 3/4/19	***Location***:Belbas house	***Purpose***: Team meeting # 43

Attendees: Coach Belbas, Mark, Andrew, Mariah, Ben, Zach, Mrs. Gray, Mr. Bell

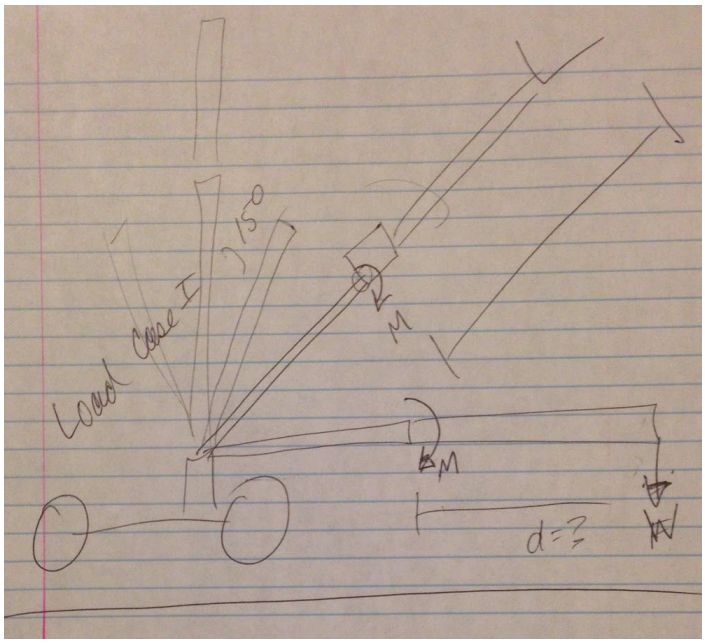
Agenda:

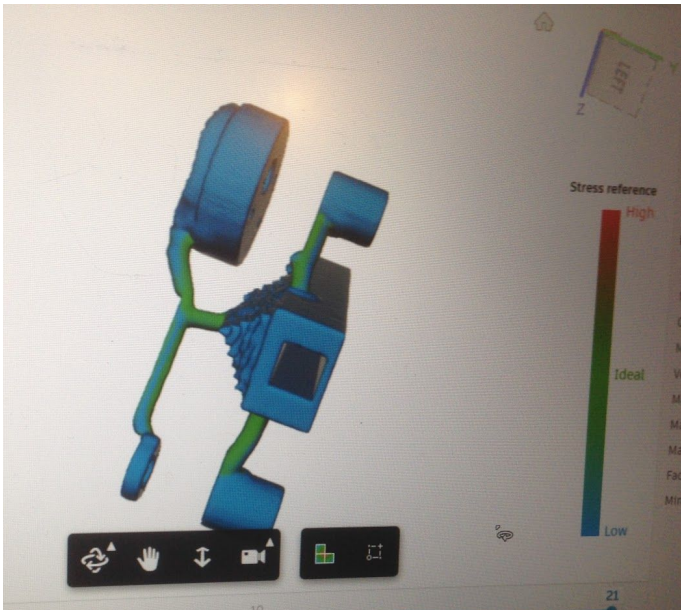
- Generative design
- Create the list of parts for little blue outreach

Reflections:

Mechanical (Mark, Zach): Today we worked on generative design for the onyx drive modules. We had 3D printed our previous model out of onyx to see how it would hold up, and we took the supports out and found that it did not fit on the chassis because the inside of the slots had bulged out because of the generative design calculations. We worked on using generative design to specifically design the drive modules for onyx, but there would always be a thin stick connecting each side of the module with a lot of filament piling up. We eventually realized that we need to change the load to only one of the bearings to force generative design to thicken the connection between the halves. We also remembered that we needed to first run generative design for maximum rigidity, and then take that mass and use it as a mass target for the next iteration of generative design, which is setting the objective to solve for minimal mass. This will probably reduce the filament that is piling up in unwanted places.

We also started working on the physics for the generative design for the elbow module, but we realized that we probably will not have time to work on the elbow with all the issues we are having to troubleshoot through on the drive modules.





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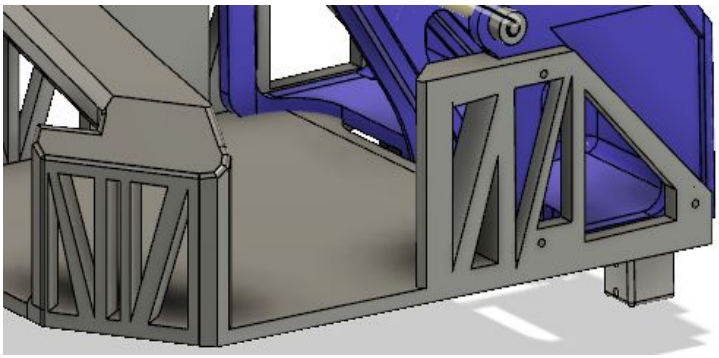
Date: Tues. 3/5/19	***Location***:Tate House	***Purpose***: Programming Subgroup

Attendees: Ben

Agenda:

- Add collector connection walls & supports onto the sorter

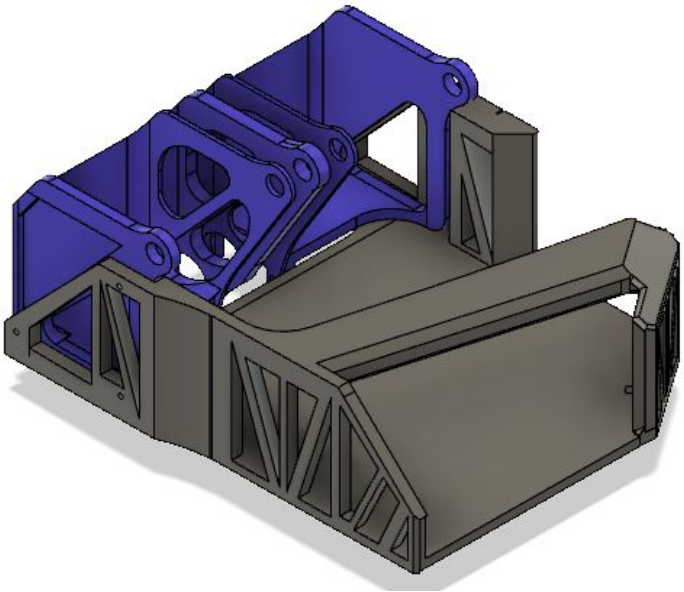
Reflections:

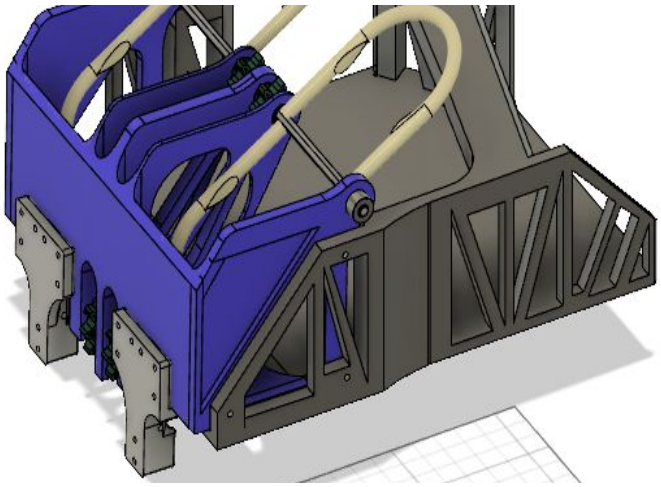


I brought the full collector assembly into the sorter file to see where the surgical tubing aligned with the mineral sorter bar.

I removed sections of the walls on all sides to make the mineral sorter lighter and to save on infill.

The sorter walls will need to be printed with a high infill for strength and durability.





Date: Mon, 3/11/19	***Location***: Belbas House	***Purpose***: Team Meeting #45

Attendees: Andrew, Ben, Mark, Joel, Coach Belbas, Mr. Lee

Agenda:

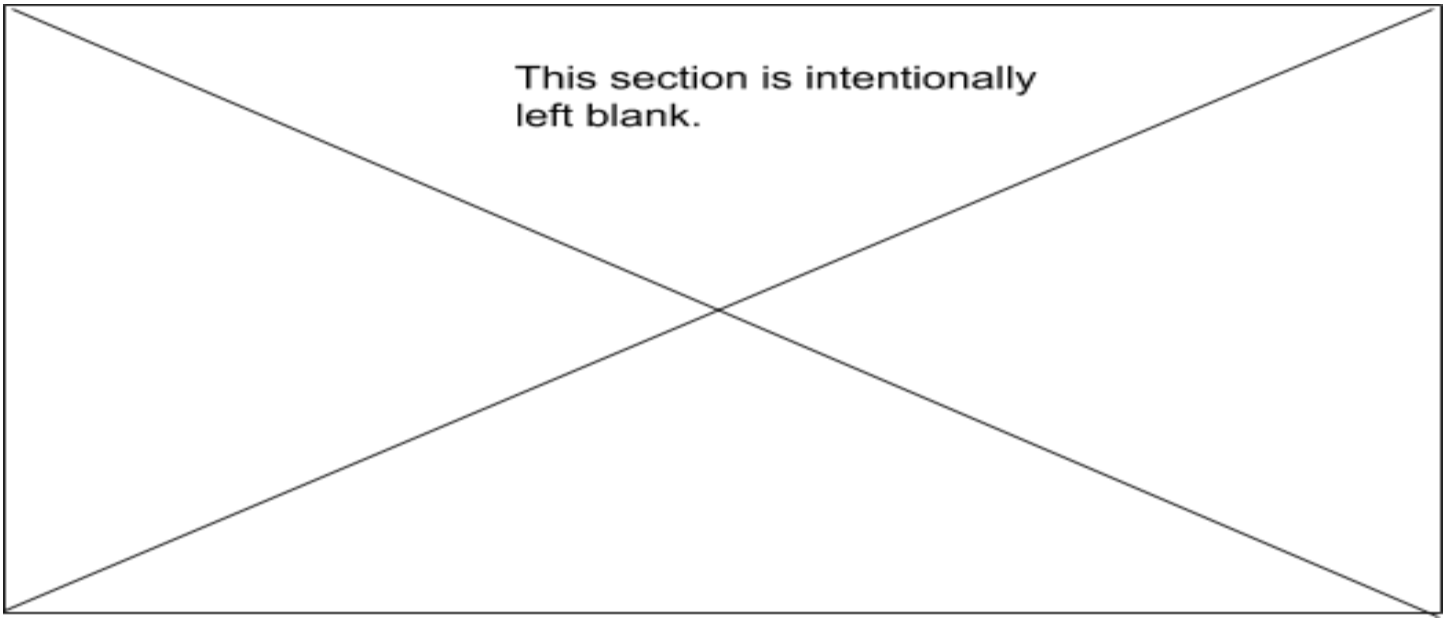
- Software Work
- Assembly Instructions and Gen 1 CAD
- Generative Design Work on Wheel Modules

Reflections:

Programming (Andrew, Ben, Mr. Lee): Today we focused on two main tasks: changing the TensorFlow logic to be more efficient and adding in the ability to detect if the robot is hung up on the lander.

- TensorFlow: Originally, the robot was programmed to turn to each mineral individually and check for gold. This could take up to nine seconds and was not a good use of time. We changed this to the robot would look at the left and center minerals at the same time. Then, if it saw gold in either position, we were fine. If it didn't see gold in either left or center than it knows gold is in the right position. This cut down the sampling time in autonomous to a maximum of four seconds and the average time comes out at less than half that.
- Stuck on Lander: Every now and then the robot would get stuck on the latch when landing during autonomous. The resulting fiasco of the robot attempting to do the entire autonomous while attached to the lander can severely damage the robot. To prevent this happening, after the robot lands, we added in a case where it checks its pitch. If the pitch is beyond +/-5 degrees, we know the robot is stuck on the lander. The next step is to program in recovery code so that it can get unstuck and continue with autonomous.

Mr. Lee also walked through with Ben the structure for the new method of doing autonomous (detailed last meeting).



Date: 3/14/19 - 3/22/19	***Location***: Tate House	***Purpose***: Working on a gen 2 sorter

Attendees:Ben

Agenda:

- Modifying on gen 1 of the sorter to fit within onyx limits

Reflections:

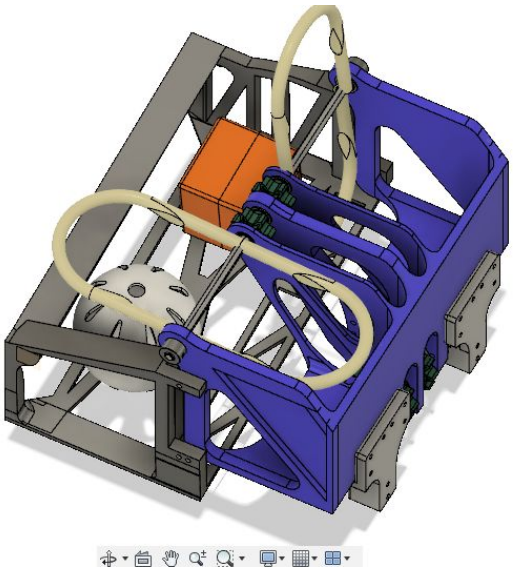
(Cad) Ben: I tested the generation 1 on the 8th to see if it functioned correctly. It sorted correctly but the silver minerals couldn't fall out due to an accidental extrusion and the gold minerals sometimes stalled because the sorter was way too long. I started to work on the next print with the fix for the issues mentioned above but Coach recommended that sorter needed to be printed out of onyx.

These were the advantages of printing with onyx that Coach discussed with me:

Because onyx is stronger we can cut holes into the floor and walls. This will reduce weight and allow for a smaller design.

I found a few issues later including:

A downside is that the onyx version had to be printed in 1 piece and since the onyx 3D printer has a really small print bed the sorter had to be shortened to accommodate for that restriction. The front section of the sorter had to be redesigned for this issue.



I spent the next week redesigning the part to look like this:

←

When I tested the part on the 21th I found that the minerals jammed because they were too close to the intake tubing. This model did not sort properly and we had mineral getting stuck in the left and middle sections of the sorter.

This is the maximum the sorter can be if we want to print it out of onyx.

(I later had an idea to splice the sorter in half and then use some type of adhesive to combine the models later allowing for a larger model to be printed.)

The next design will probably look very similar to gen 1 as it worked most of the time and only needed a few edits to fix. I figured out that the sorter only works off of 2 principals:
#1 - The ball has enough free space to roll.
#2 - The redirect bar has to be high enough to avoid hitting the gold minerals but low enough to redirect the silver minerals.

Date: Fri, 3/15/19	***Location***: Intuitive Machines	***Purpose***: Outreach/ team meeting #46

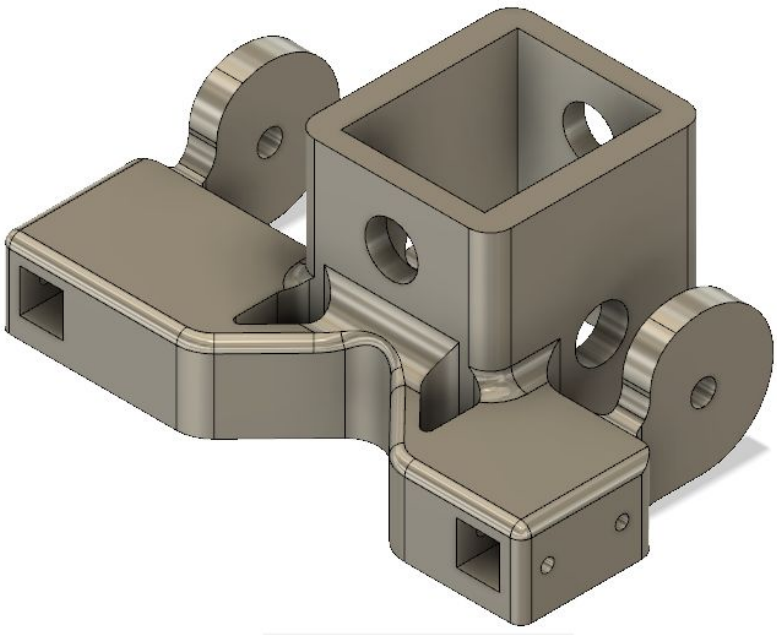
Attendees: Mark, Zach, Luke, Andrew, Ben, Joel, Coach Belbas, Mrs. Tate, Nick

Agenda:

- Visit Intuitive Machines
- Work on generative design

Reflections:

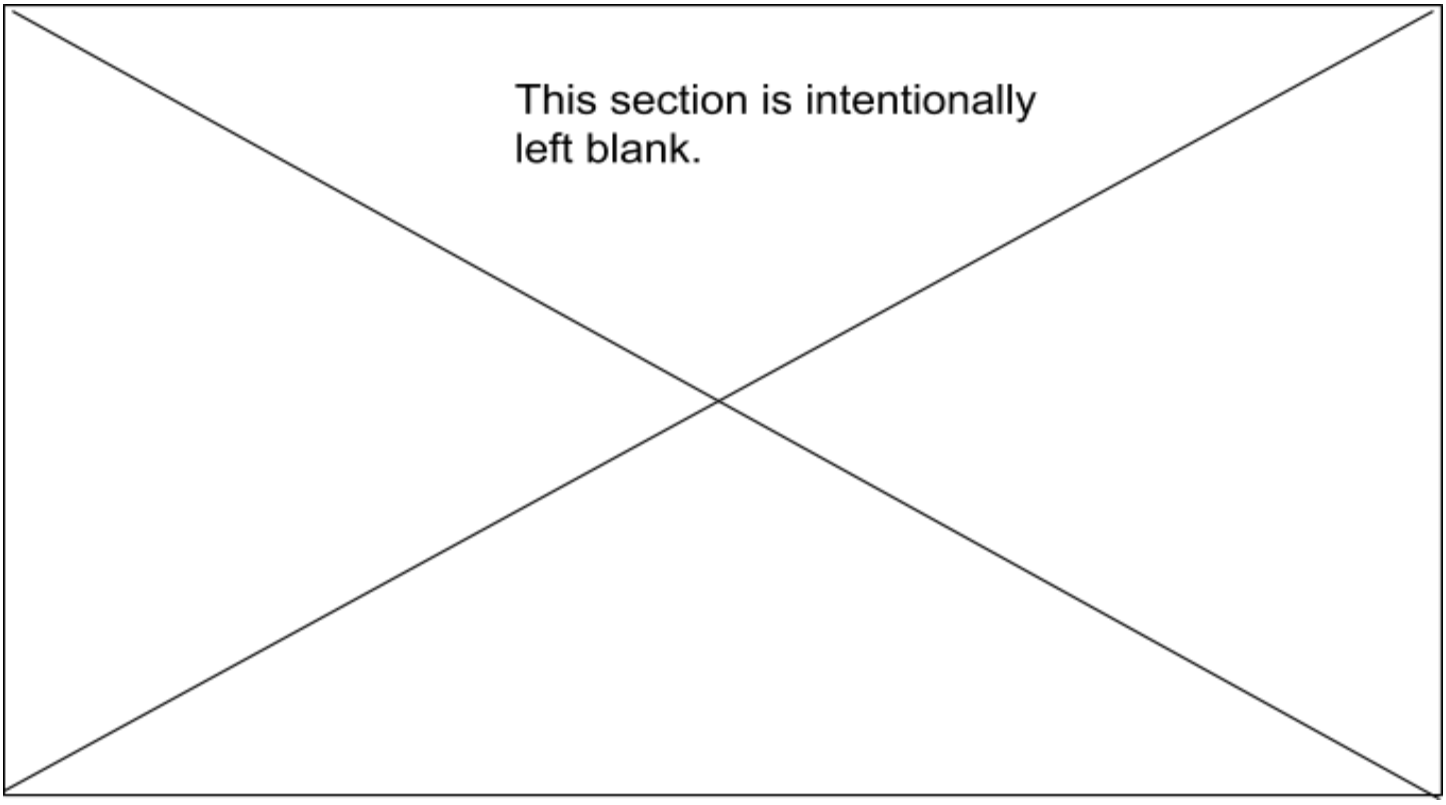
Today we visited Intuitive Machines as part of our engineering outreach. Our coach had made a connection with them through a class she teaches, and they said they would be happy to host our robotics team. After listening to our presentation, they gave us a tour of their facility. They showed us their autonomous drones that they built by custom-molding carbon fiber as well as their lander that will go to the moon in 2021. They also showed us their Additive Lab, which included their work with metal 3D printers. They showed us prints out of titanium and inconel that used similar generative technology to what we are working with. Also, they generously offered to print



parts for us out of inconel! This is very generous as they would usually charge at least $20,000 for a medium-sized part. We will run another generative study on our wheel modules with inconel as the specified material, and Intuitive Machines will include them in the excess print-bed space in some of their prints.

Mechanical (Mark, Zach): After the visit to Intuitive Machines, Mark, Zach, and Coach Belbas strategized about what parts to send to Intuitive Machines to have 3D printed out of inconel. We discussed printing the elbow gearbox out of inconel, but we found that inconel is about eight times as dense as ABS, which would make the elbow too heavy. (The picture below shows testing the density of the elbow gearbox in inconel). So, we decided to run the inconel on our wheel modules after running them through another generative study with inconel as the specified material. After talking again with Intuitive Machines, we discovered they are probably willing to print all four wheel modules.

Programming (Andrew, Ben): For the back half of the meeting we worked on the lander fail-safe. If the robot detects that it is stuck on the lander, it needs a way to detach itself and continue with autonomous. After the robot drives back, it checks the pitch. If the pitch is past a certain threshold, we know that the robot is stuck. If that happens, we have the robot drive forward, raise the hook, and reattempt a reverse drive. This cycle keeps happening until the robot is free from the lander latch. Today was nailing down the right threshold values for pitch as well as modifying the drive backwards to help with pitch consistency. The robot successfully un-stuck itself once, but the algorithm needs some tightening up.



Date: 3/18/19	***Location***: Belbas House	***Purpose***: Team Meeting #47

Attendees: Andrew, Ben, Mark, Zach, Mariah, Coach Belbas, Mr. Lee

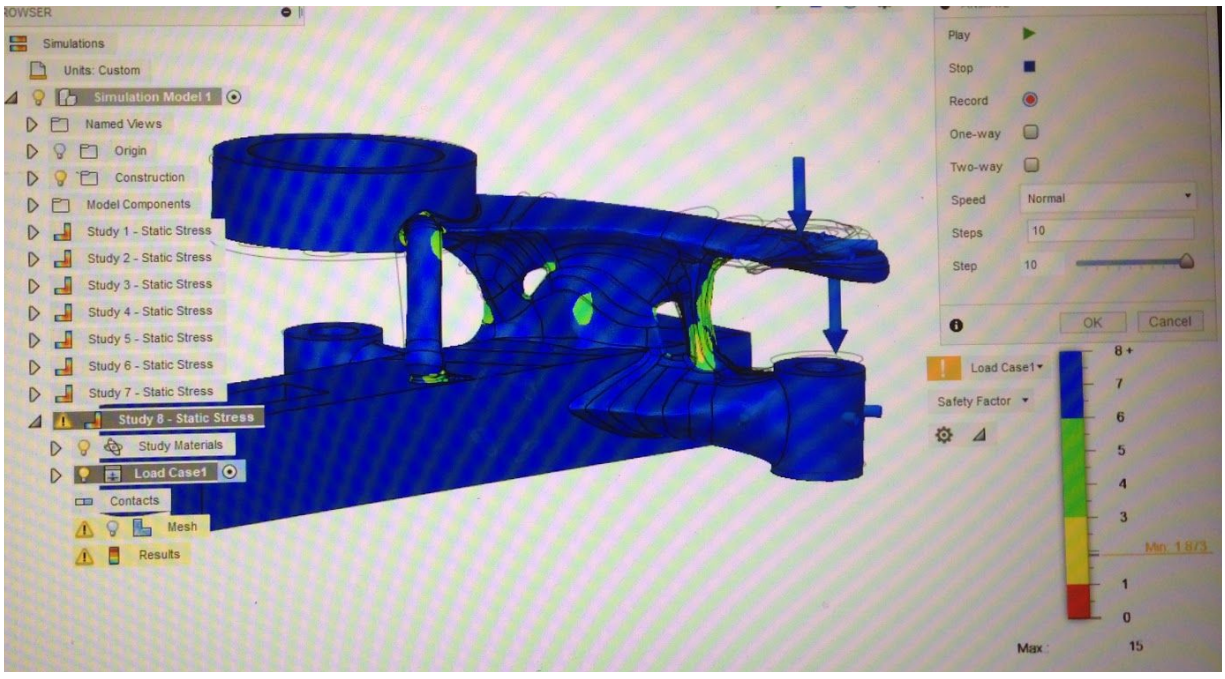
Agenda:

- Continue making new autonomous structure
- Work on Generative Design
- Learn how to run an FEA

Reflections:

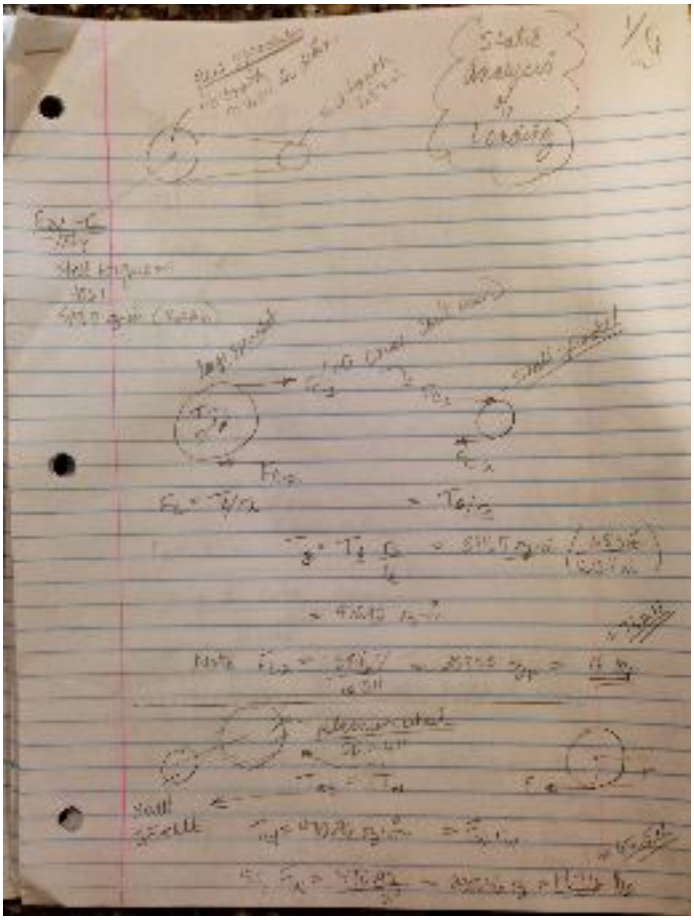
Programming (Andrew, Mr. Lee): We worked on building the new autonomous structure. The program will have a collection of “actions” that it cycles through. We made a “wait action” and a “drive action.” Most of our time was spent with the “wait action” trying to make the action logic to work. The wait part itself was fine, but getting the code to properly load and discard actions from the run list was troublesome. Now the program correctly loads, executes, and discards an action and then loads the next action for executing and subsequent discarding. Next we need to make a library of actions that the robot can do and link those actions to the library of methods we already have.

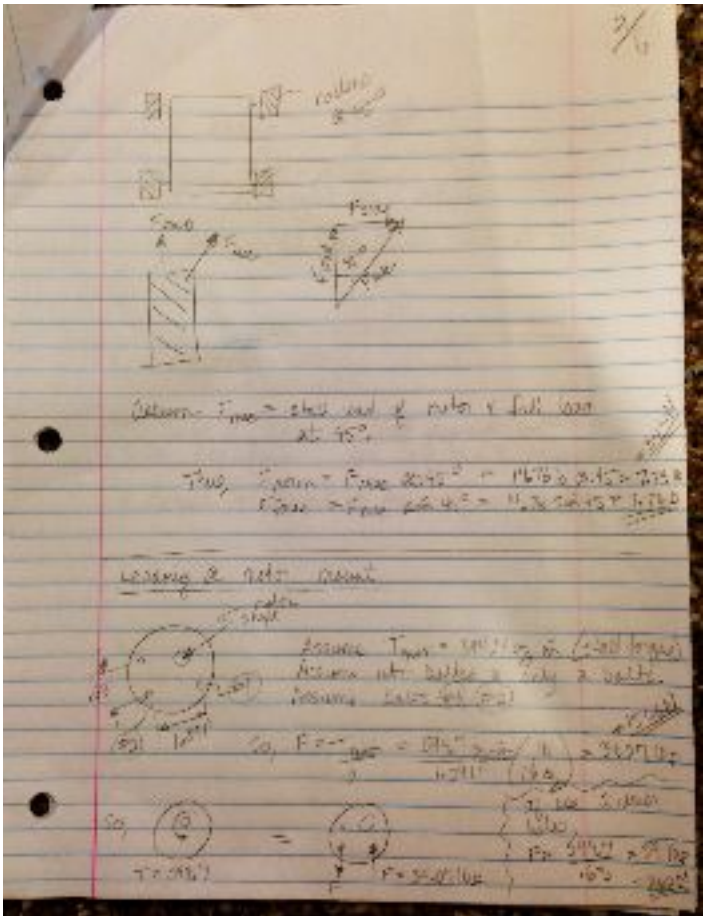
Mechanical (Mark, Zach, Coach Belbas): Today Coach Belbas taught Mark and Zach how to run an FEA (Finite Element Analysis). To run an FEA, you plug in your materials, constraints, and loads, and the technology will calculate the stress of the part. Generative Design uses this same technology, so an FEA is technically not necessary after using generative design to calculate a part. However, sometimes there is an inconsistency in the results from within generative design and the results of an FEA of the imported part due to changes in the mesh when the part is imported. Also, running an FEA is useful after post-processing and making modifications to the imported part from generative design. It will tell you if your part can still withstand your specified loads.



Mark continued work on the generative design for an onyx drive module. Coach Belbas and Zach also reviewed the physics we did to calculate the loads on the drive modules. This was a great refresher and helped Zach prepare to

explain the physics to others who ask about generative design. The calculations are pictured below.





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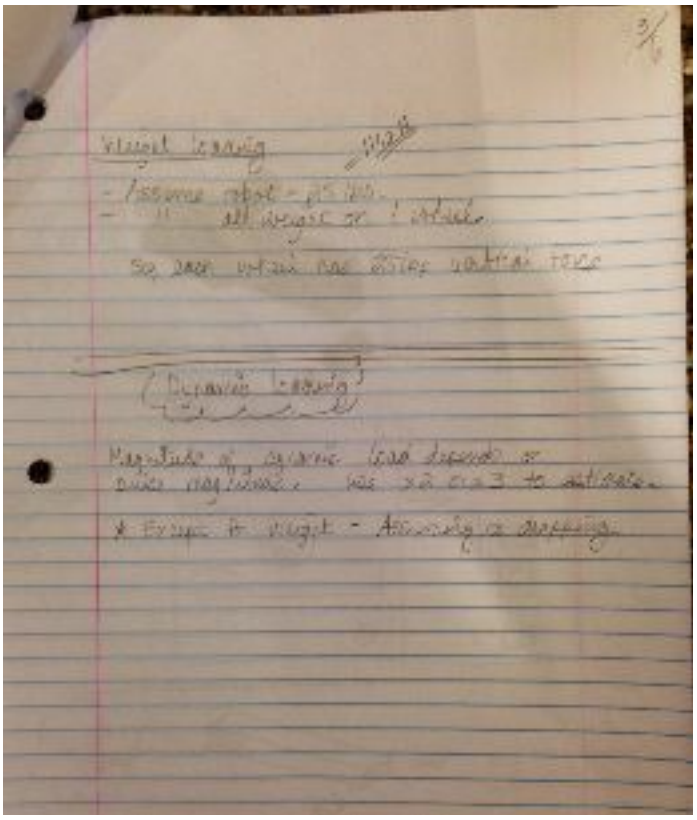
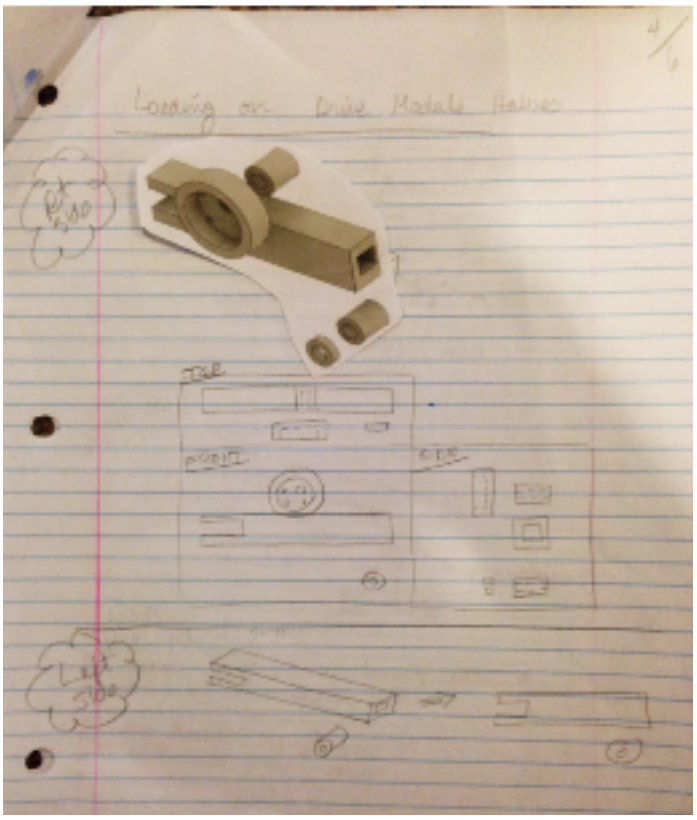
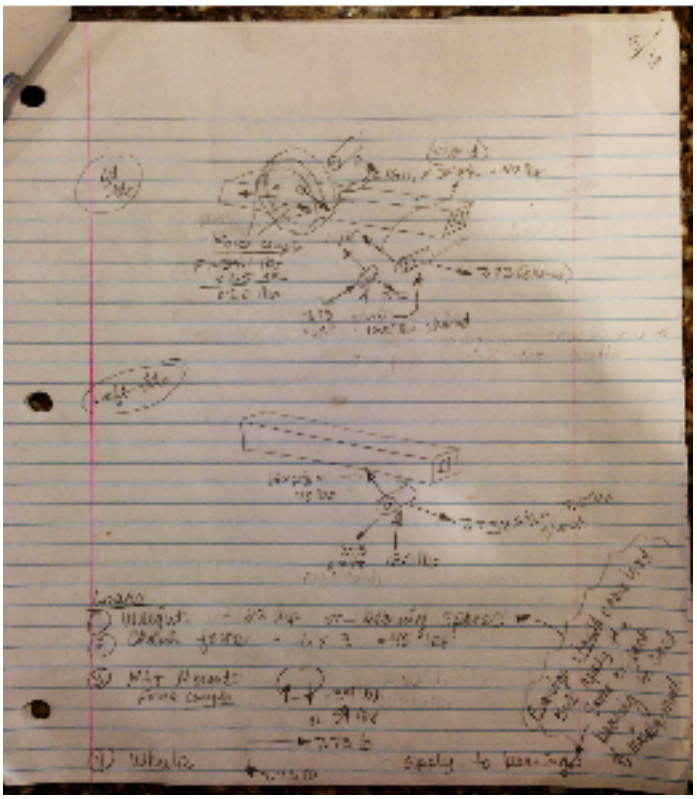
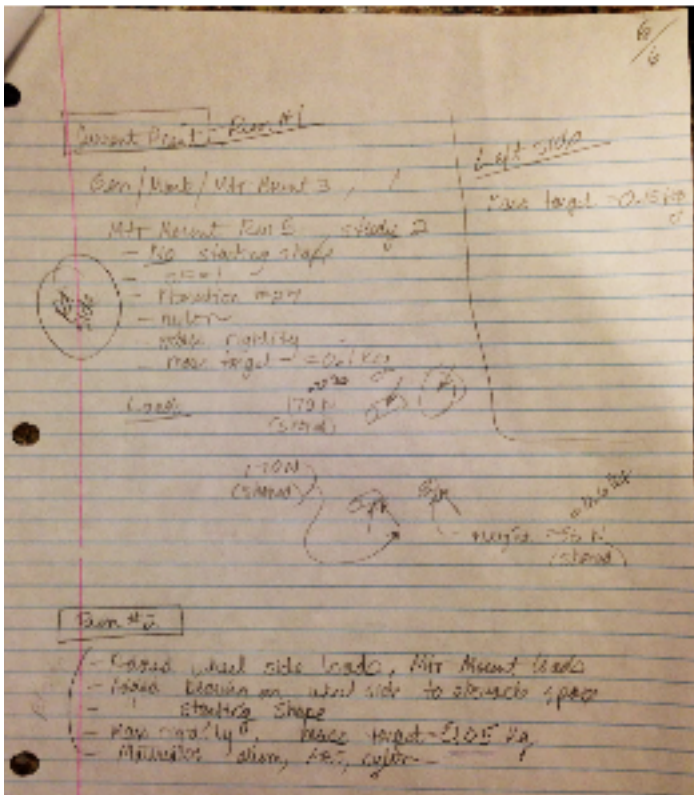
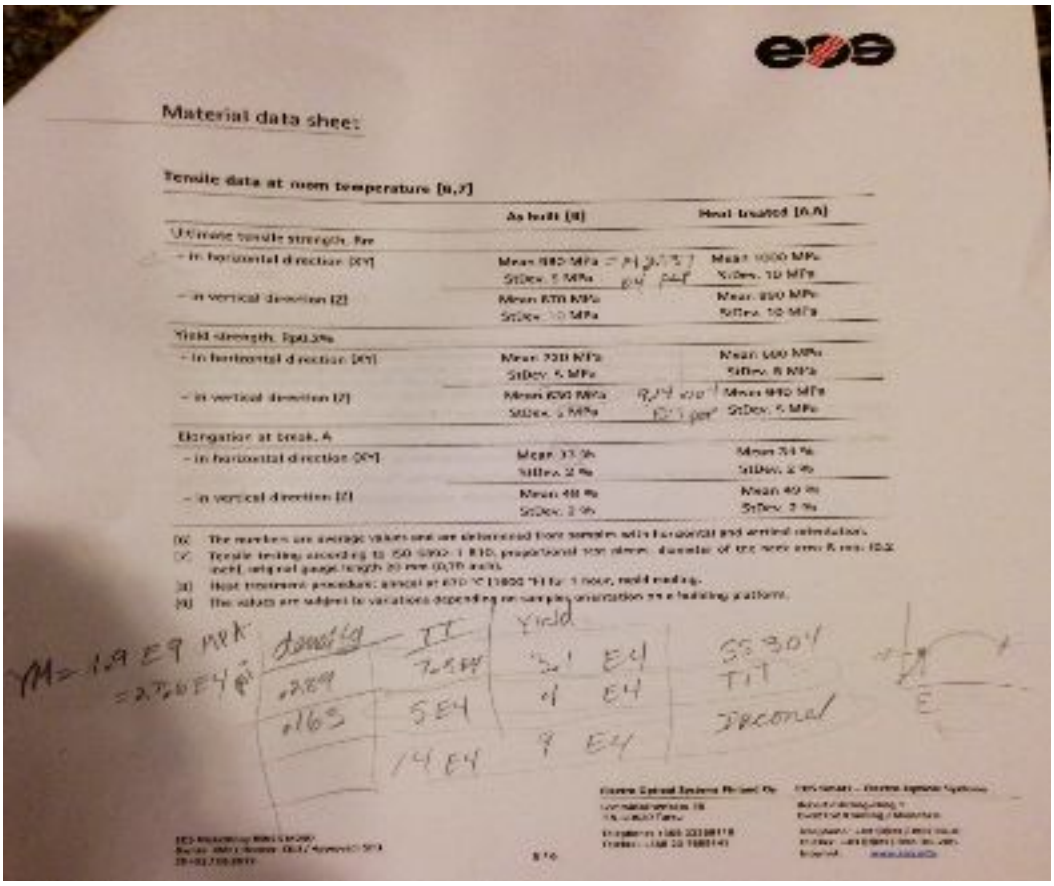








We also discovered that inconel was not one of the material options in Fusion 360. So, we analyzed the material science by looking up the material properties of inconel from the EOS website and comparing them to the different materials that are listed in Fusion 360. We compared Young's Modulus, tensile strength, strain, stress, and density. We found that the properties of inconel are very close to those of the nickel-chromium alloy.



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Date: Fri, 3/22/19	***Location***: Belbas House	***Purpose***: Team Meeting #48

Attendees: Andrew, Mark, Zach, Mariah, Ben, Coach Belbas, Mr. Tate

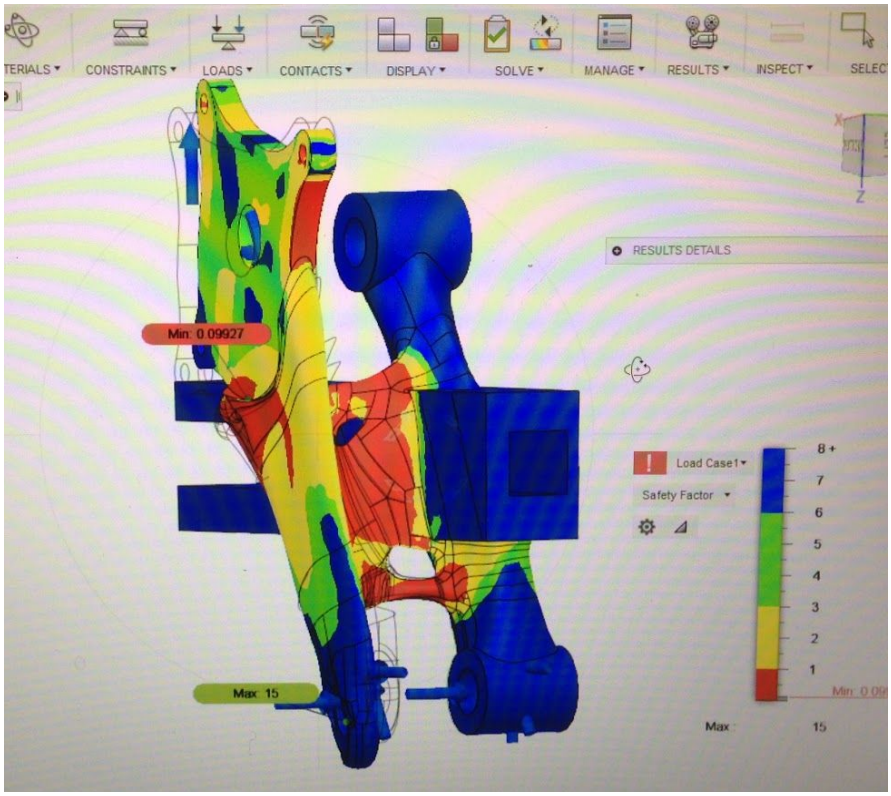
Agenda:
- Work on Autonomous Actions
- Generative Design Troubleshooting
- Run lots of FEAs

Reflections:

Programming (Andrew): I added four new action classes to the new code structure:
- HangAction: operates the hanger on the robot
- ArmAction: operates the mineral arm on the robot
- MarkDeployAction: operates the mark deploy servo on the robot
- TurnAction: turns the robot
- DriveAction: moves the robot

Pretty much an action is needed for every mechanism and major function on the robot.

Mechanical (Mark, Zach, Coach Belbas):
Previously, Mark and Zach discovered that they would have to drill through a socket to fully assemble the generative drive modules. So to start off, they modified the modules to have a motor mount conversion piece that would attach to the motor and allow the motor to easily attach to the drive module. However, in doing this, it widened the bolt holes that would experience the loads and greatly increased the stress on the module.

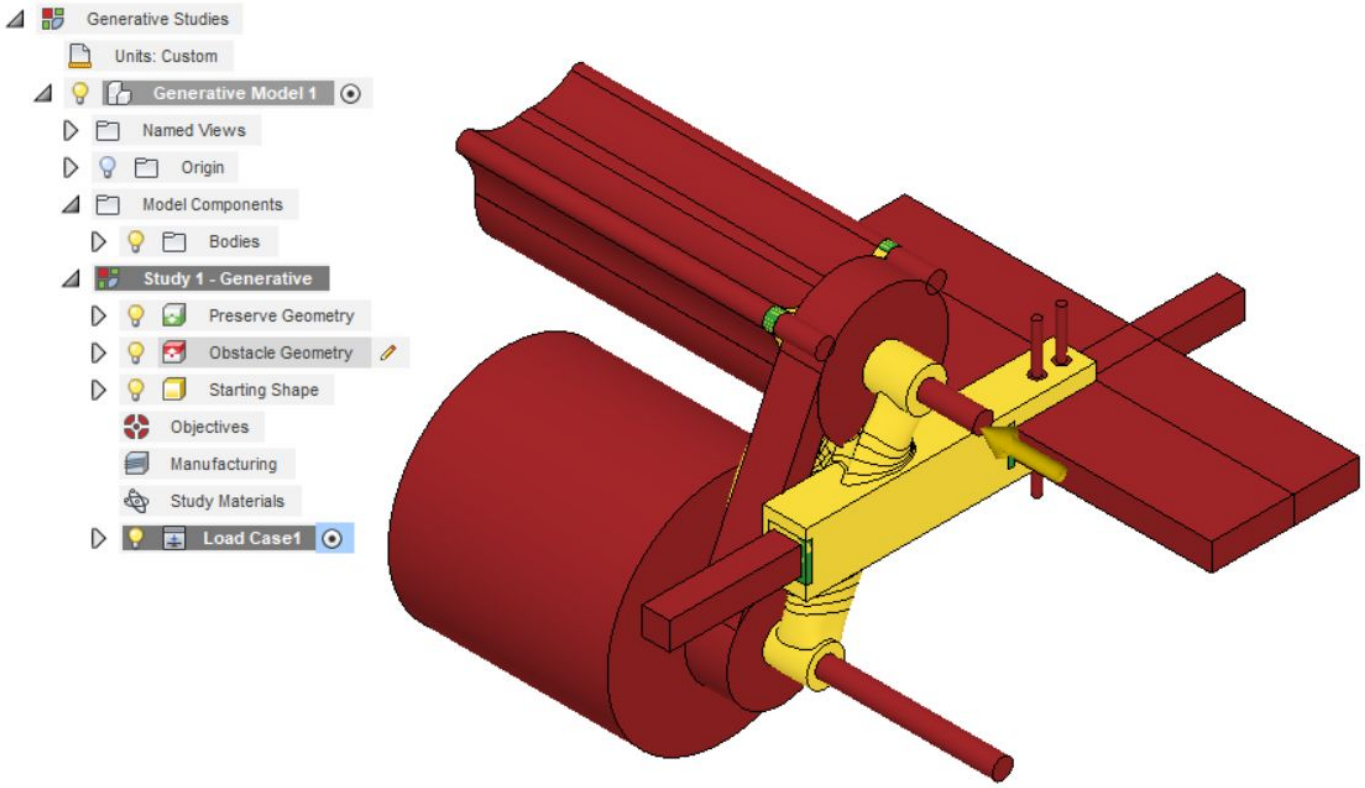


Zach tried to manually find a workable solution for inconel by running FEAs and making modifications to the part. He plugged in the loads to perform an FEA (Finite Element Analysis), and there were many more areas of high stress that resulted from the bolt holes being widened. He continued to spend most of the meeting making modifications to the piece, running an FEA, seeing if the stress was reduced, making more modifications, and then running another FEA.

Mark spent most of his time troubleshooting generative design to create a part out of inconel. We

tried so many things such as raising the safety factor and increasing the loads, but no matter what we tried, generative design would not calculate a part out of inconel that met our design parameters and safety factor. We came to the conclusion that the AI that runs the algorithms of generative design must be failing because of how overdesigned our part is. With such low loads and such a strong material (inconel), the algorithms must fail since it thinks our scenario is too impractical.

Below is a picture of the preserve geometry, obstacle geometry, and starting shape for our attempt at using the generative technology to calculate a part out of inconel.



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Date: 3/22/19 - 3/25/19	***Location***: Tate House	***Purpose***: Sorter Modifications

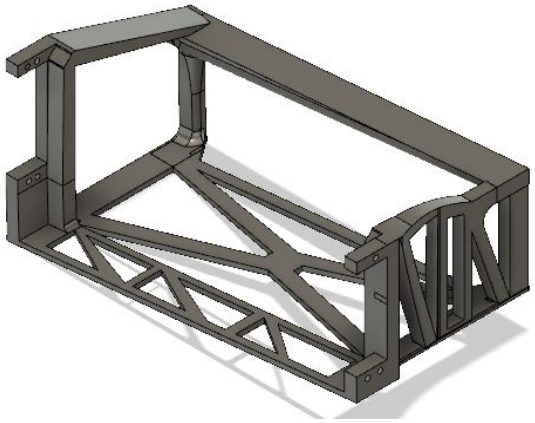
Attendees: Ben

Agenda:

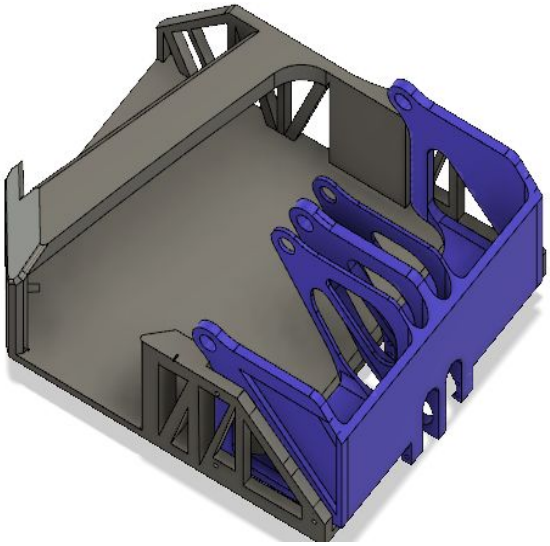
- Create a gen 3 of the sporter that resembles gen 1

Reflections: Ben: After testing Gen 2 sorter, I found that it could not sort. The minerals didn't have enough room and would get jammed with the tubing. I redesigned this new version to look like a mix between Gen 1 and Gen 2. This version will include a curved redirect bar farther away from the collector tubing from gen 1 (Right) combined with the sloped floor from gen 2 (Left).

Gen 2



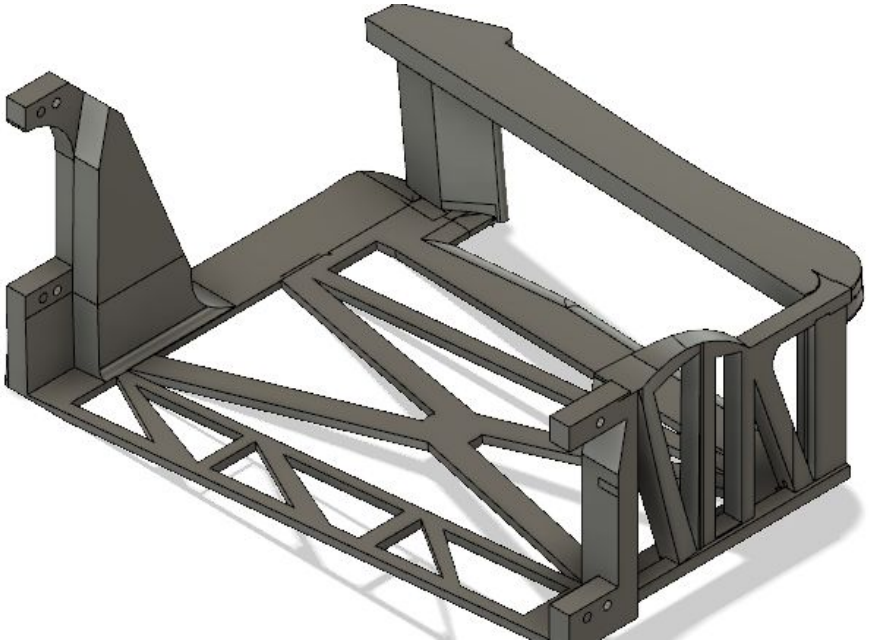
Gen 1

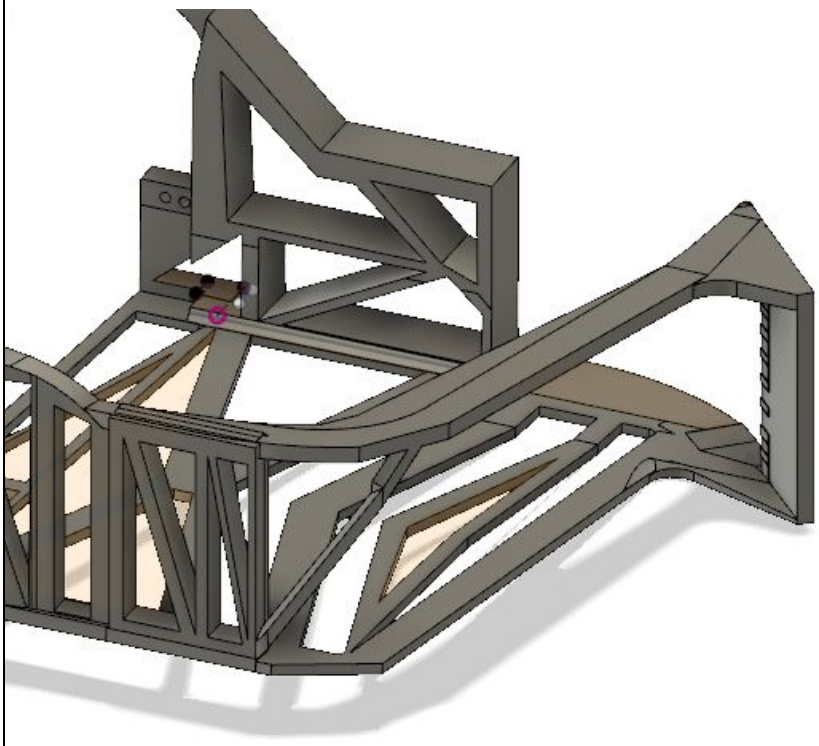


Gen 3

I designed it to have a shorter connection point to the collector by adding screw holes in key places and added a gold mineral redirect wall on the left side of the sorting bar.

I also realized that if the sorter is printed out of onyx, the redirect bar can be smaller allowing for less weight.





It was really hard to edit the redirect wall and the surrounding floor due to mesh issues. These mesh issues are caused by the sloped floor merging with the flat left side. This causes a ton of awkward angles and that is why you see many random lines in the sorter floor or walls. However this has no bearing on the overall function this design and is acceptable at this stage of development. This version will be tested on the 25th to see if it sorter properly.

Final version of Gen 3 before testing on the 25th

Date: Mon, 3/25/19	***Location***: Belbas House	***Purpose***: Team Meeting #49

Attendees: Andrew, Mr. Lee, Ben, Mark, Zach, Mr. Tate, Coach Belbas, Mr. Bell

Agenda:

- Programming work
- Sorter work
- Assemble new worm gears
- Start building spare elbow module

Reflections:

Andrew: First I built the last action class, called CameraAction and used for finding the gold mineral. I then worked with my dad and programming mentor, Mr. Lee, to begin designing code to read from a text file. We have all the actions and the action master complete, now we need a way to source actions from a text file. The code for reading a file will be stored in a new class called FileRead. We got the code to successfully write a file, but we haven't got it to read a file yet. Also I set up our new Galaxy S5 phone to be a robot controller.

Zach: Today I assembled the new worm gears and the steel REV pieces. The arm experienced a lot of wear and tear from Regionals, and the worm gears had been worn down and needed to be replaced to eliminate as much slop in the motion of the arm as possible. We also started building the spare elbow with the onyx gearbox.

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Date: 3/28 - 30/19	***Location***: Tate House	***Purpose***: Sorter Testing & Prep for onyx

Attendees: Ben, Mr.Tate

Agenda:

- Test sorter and them modify for issues and prep it for onyx

Reflections: Ben: We tested the sorter on the 28th to see what worked/didn't. When we tested the sorter we originally had a little tab extending down from the left side instead of a full wall.

Then we realized that if we positioned the sorter farther forward and to the right more, the cubes no longer needed to be redirected so we took it off.

Originally we thought that the sorter needed to be positioned at a certain point **on** the lander. Later I looked at the arm and saw that it was not fully extended. When I extended the arm completely the collector was about 2 inches higher than the lander. This allowed the collector to angle forward allowing the minerals to sort freely. Since we need the collector to be at a specific angle each time, I will program in a preset for the arm to extend right to that position.

The only problems we encountered at this point were:

1. The sorting bar was really small and round causing the minerals to flip over.
2. The side of the collector broke so the minerals fell out at an angle causing them to fall onto the floor

On the 30th I edited the model and made changes to account for these problems.

More holes were added for a lighter sorter module and less filament used in the printing process.

Final version is going to be tested on April 1rst and then sent to be printed out of onyx. The onyx bed is really small so I had to splice the model in order to print it.

Spliced model **------>**

Date: Mon,4/1/19	***Location***: Belbas House	***Purpose***: Team Meeting #50

Attendees: Andrew, Mr. Lee, Ben, Mark, Zach, Mr. Tate, Coach Belbas, Mariah, Mr. Bell

Agenda:

- Sorter work
- Discuss pit design
- Refurbish arm joints

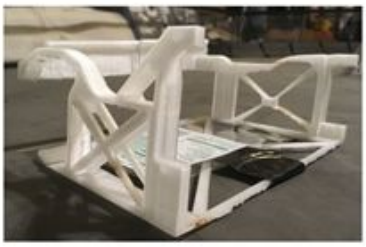
Reflections:

Most of the meeting was taken up discussing the pit design. We focused primarily on the top row of banners and we discussed and voted on the themes we wanted on the banners and also the style. We did decide on the side banners, but we wanted some changes done to the main banner before we made the final decision. The two options are below (we're going to vote tomorrow via Slack):

Andrew: After the pit design meeting, I tested my sorter design for the first time and it worked decently well. The ball guide needed to be tweaked and the minerals tended to jump over the guide wall so that needs to be made taller. The design is very minimalistic and light and it holds promise.

Ben: I tested the latest iteration of the sorter design, this sorter was made in 2 sections. The onyx print bed is too small for the entire model so I had to split into smaller sections.
Changes to this model from last meetings design:

1) Added an extra slant to the top of the sorter bar to prevent minerals from being pushed out.
2) Added a wall to the right side to prevent the gold minerals from falling onto the floor.

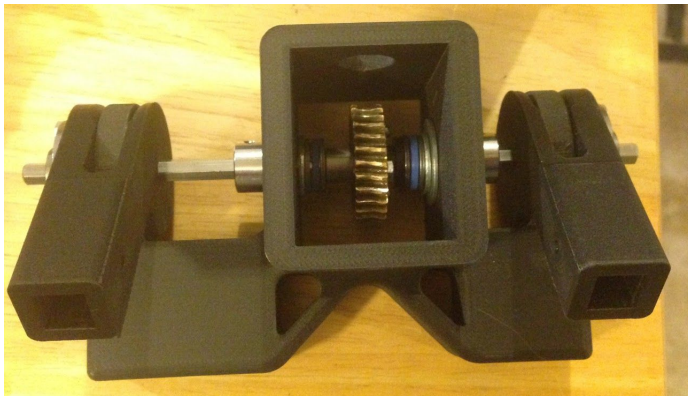


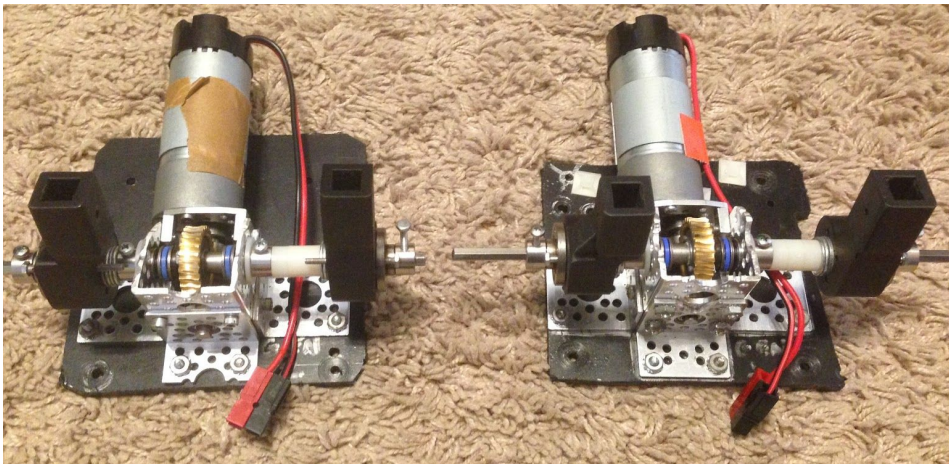
With the assistance of Mentor Mr.Bell I tested the sorter on the lander.

Mr.Bell helped hold the collector as it was disconnected from the arm. This design sorted correctly from both sides of the lander.

However, I cannot say for sure how well it will work in competition because it was in an estimated position. Between now and next meeting I will see if i can reduce more weight and clean up the CAD model as much as I can. If the arm is fully assembled on Friday I will do another test to see how it works.

Zach: Today I attached the onyx joints to the spare elbow module. I also finished replacing the worm gears on the shoulder modules. I noticed that there was quite a bit of slop in the shoulders, so I might need to change out the onyx sleeves that provide a tight fit in the bearings.





Date: Tue, 4/2/19	***Location***: Lee House	***Purpose***: Programming Work

Attendees: Andrew, Mr. Lee

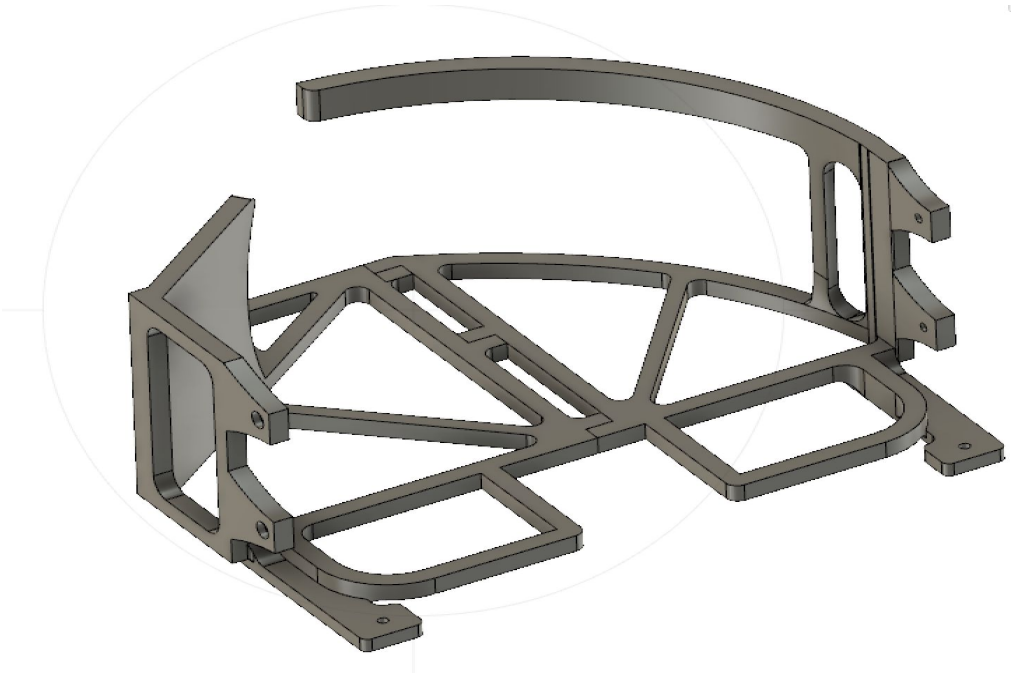
Agenda:

- Work on reading files
- Create action spreadsheet
- Edited my sorter design
- Create mineral plow model

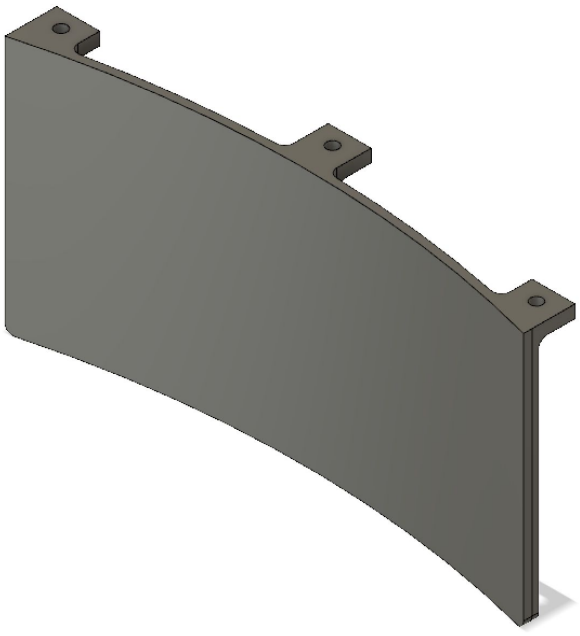
Reflections:

Andrew:

I modified my sorter to have a longer ball guide and I also made the guide wall taller. I'm thinking about inserting slots for rollers to help the minerals move along, but we'll see.



I also made a model for a mineral plow. The shape is concave because we discovered with the tape plow that a concave shape significantly improves the chances of preventing the mineral from getting caught up in the wheels.



Programming-wise, I worked on the action spreadsheet a lot. I took the DepoFaceLeftEnter autonomous drive path and typed it into the action spreadsheet. I then exported the table to a csv file and uploaded it to the phone. The FileRead program successfully read the entire csv file and displayed it to the screen. Now I just need to tell the code which columns mean what and we will be well on our way to running autonomous with the new system. We're trying to get the new system done quickly because, with worlds in two weeks, we need to move over to programming the new drive paths sooner rather than later, and those are more important than bells and whistles like this new system. The image below is the action spreadsheet for the DepoFaceLeftEnter drive path. I also spent a of time working on the website, bringing over our notebook to the website.

DepoFaceLeftEnter

	Type	ID	Next Action	Duration	Power	Direction-Heading	Distance
	WaitAction	One	Land	3			
	HangAction	Land	ResetHeading	4.5	0.9	OUT	
	TurnAction	ResetHeading	LeaveLatch	2	0.2	reset	
	DriveAction	LeaveLatch	IsStuck	6	0.3	180	4
	GyroAction	IsStuck	SlideAway	6			
	DriveAction	FailS1	FailS2	4	0.2	0	4
	HangAction	FailS2	IsStuck	2	0.9	OUT	1.25
	DriveAction	SlideAway	DriveForward	6	0.3	270	6
	DriveAction	DriveForward	GoldTurn	6	0.3	0	4
	TurnAction	GoldTurn	Look	6	0.2	-75	
	CameraAction	Look	CenterDrive	30			
Turn to Gold Mineral	**TurnAction**	LeftTurn	LeftDrive	4	0.2	-55	
	TurnAction	CenterTurn	CenterDrive	4	0.2	-87	
	TurnAction	RightTurn	RightDrive	4	0.2	-120	
Push off Gold Mineral	**DriveAction**	LeftDrive	LeftBackward	4	0.4	0	45
	DriveAction	CenterDrive	CenterBackward	4	0.4	0	52
	DriveAction	RightDrive	RightBackward	4	0.4	0	37
Drive Backward	**DriveAction**	LeftBackward	FaceDepoL	4	0.4	180	3
	DriveAction	CenterBackward	FaceDepoC	4	0.4	180	3
	DriveAction	RightBackward	FaceDepoR	4	0.4	180	3
Turn to Face Depo	**TurnAction**	FaceDepoL	DepoSlideL	3	0.3	40	
	TurnAction	FaceDepoC	DepoSlideC	3	0.3	135	
	TurnAction	FaceDepoR	DepoSlideR	3	0.3	120	
Slide Towards Depo	**DriveAction**	DepoSlideL	DepoDriveL	3	0.4	270	0
	DriveAction	DepoSlideC	DepoDriveC	3	0.4	90	25
	DriveAction	DepoSlideR	DepoDriveR	3	0.4	90	0
Drive into Depo	**DriveAction**	DepoDriveL	DepoTurn	3	0.5	180	30