# HR 2 BREAKDOWN

## TEAM: 20FB14 Mountain Bike Suspension Team

Due Date:
Friday, March 19, 2021 at 11:59pm

Provide several pics of the current state of your completed system thus far here:

| Fork and Shock Setup Guide | | | | | |
|---|---|---|---|---|---|
| Rider Weight | 90 | kg | | | |
| Fork Setup | | | Shock Setup | | |
| Fork Pressure | 79 | psi | Shock Pressure | 245 | psi |
| Rebound | 5 | clicks from closed (all the way clockwise) | Rebound | 5 | clicks from closed (all the way clockwise) |
| Compression | Open | | Compression | Middle Setting | |
| | | | | | |
| | | | | | |
| Adjustments for terrain | | | | | |
| Are you going up or down? | | Descending | | | |
| What terrain are you riding? | | Green Circle | | | |
| Fork Adjustments | | | Shock Adjustments | | |
| Damper Value | 650 | kg/s | Damper Value | 1000 | kg/s |
| Rebound Adjustment | +1 | Clicks | Rebound Adjustment | +1 | Clicks |
| Compression | Open | | Compression | Mid | |

Figure 1: This is what a consumer using our model will see when they use our model to adjust their suspension. The inputs will be rider weight, descending or ascending, and the terrain type. The model will output a basic setup, then adjustments based on our model.

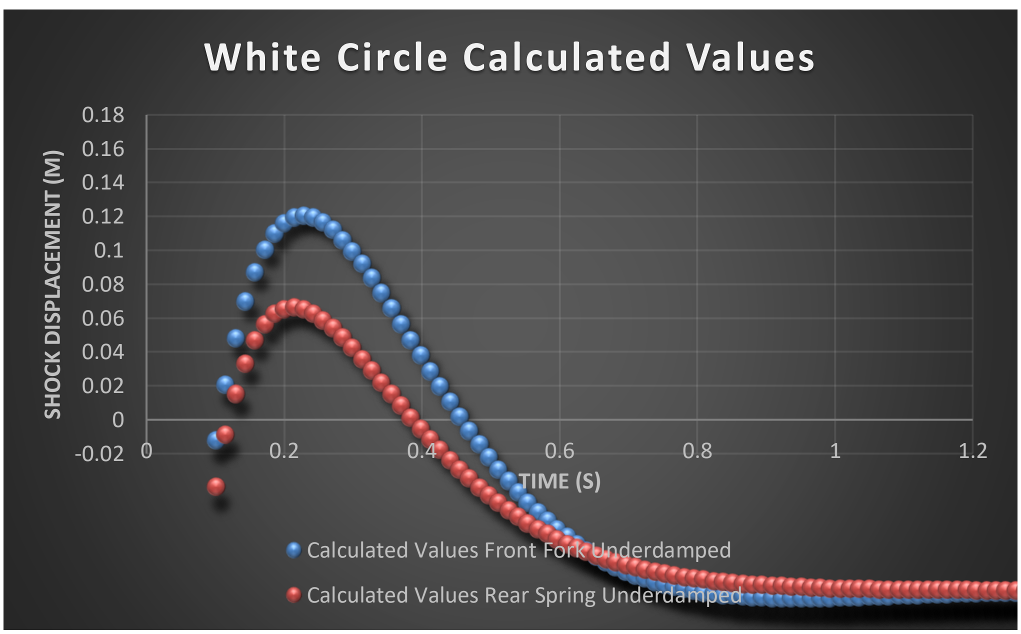



Figure 2: This shows the shock displacement versus time following the spring mass dashpot equation. These graphs are adjusted for terrain types and are how we adjust the model. For the white circle terrain, we want a slightly underdamped fork and shock to provide support on less bumpy trails.

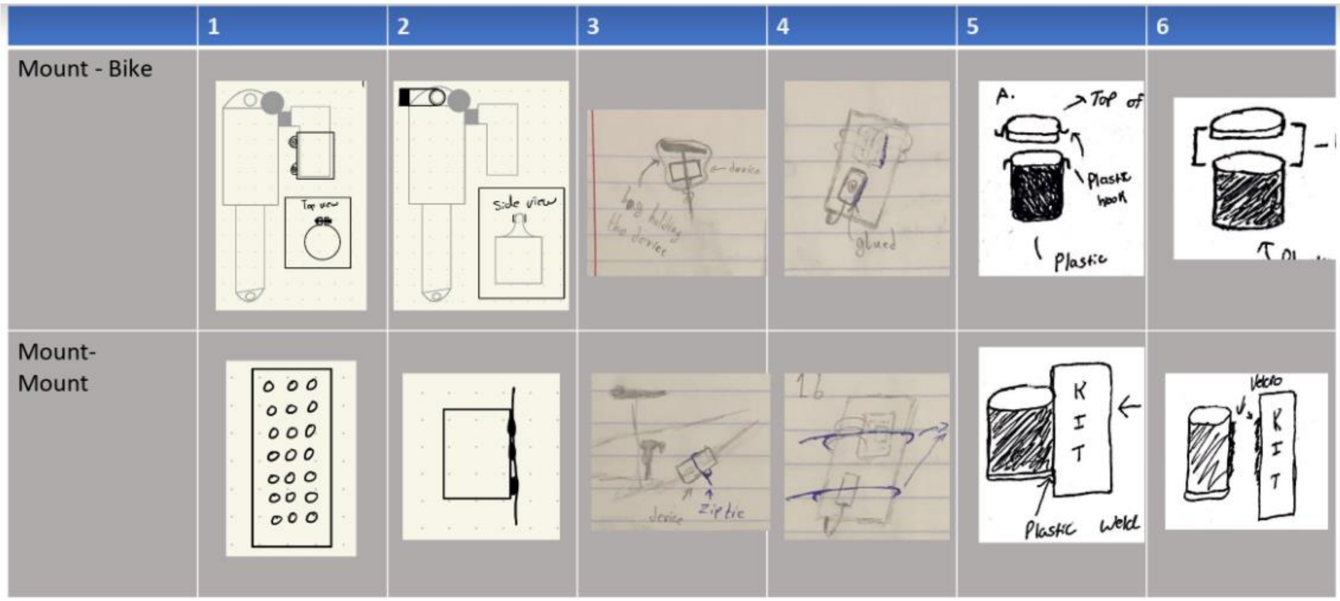
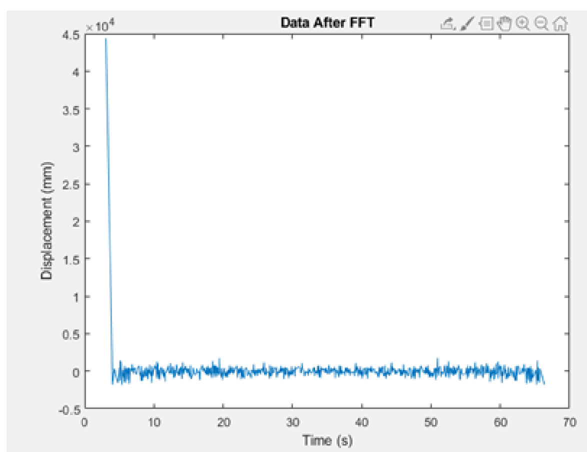



Figure 3: This figure shows 6 design concepts for 2 of the device sections. Each member of the devise design team provided two for 5 different sections in total (2 sections are shown in the figure). From these sketches the 2 top concepts of each section were then 3D modeled in SolidWorks.

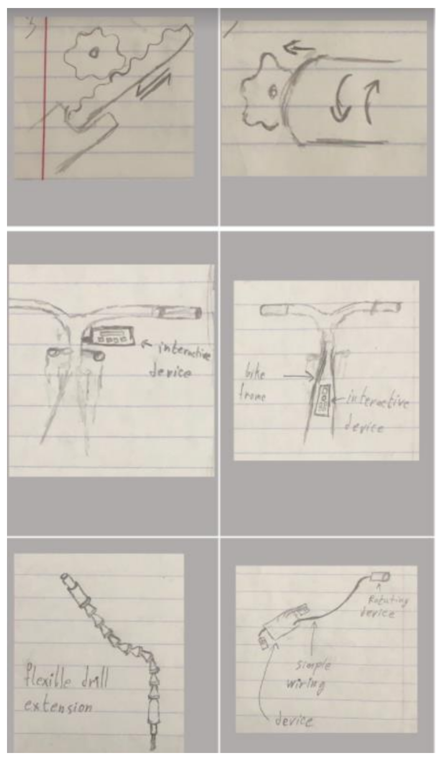
The following are the Action Items each person completed between Hardware Review 1 and Hardware Review 2:

## Team Member: Erik Abraham

| Action Item | Date Completed | Result/Proof of Completion |
|---|---|---|
| Create skeleton code for vibration analysis in MATLAB | 3/12 |   Output graph from FFT code in MATLAB. Data is from the testing software the team is using to test the bike (MotionIQ). |
| Create adjustments for rebound and compression based on model | 3/15 | As seen above in figure 1 under "shock adjustments", there are various adjustments that the user makes. These are based on the damper value ( a mass flow rate) of the shock. Each terrain type corresponds to different damper values that yield the qualities we want in a shock. These qualities align with the graphs made for figure 2. We can control how the shock feels with how the graph behaves, whether that is how quickly it returns to 0 or how many oscillations happen. |

| | | |
|---|---|---|
| Finish math model page the consumer will use | 3/5 | Our final product is going to be an easy to use document where a rider input the highlighted boxes in figure 1, then the model will correctly tell them how to setup their shocks for each terrain type. |

## Team Member: Suliman Alsinan

| Action Item | Date Completed | Result/Proof of Completion |
|---|---|---|
| Sketched design ideas for each individual part of the device | 2/1/2021 |  |

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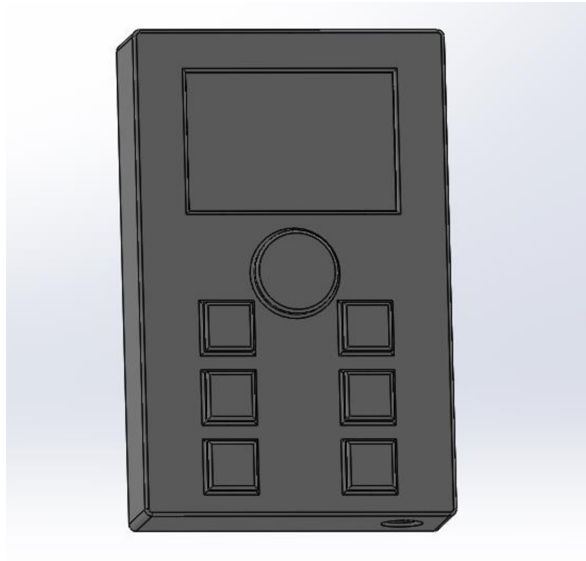
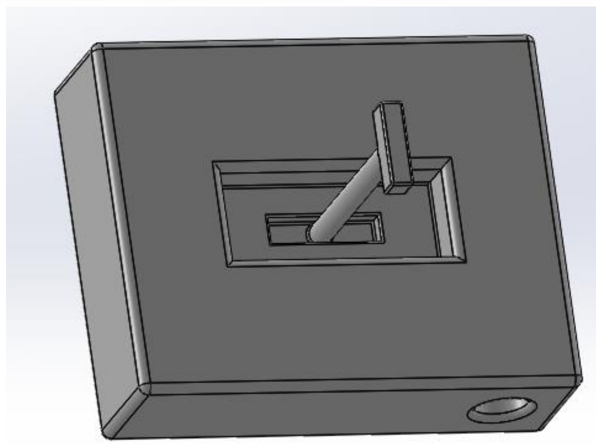
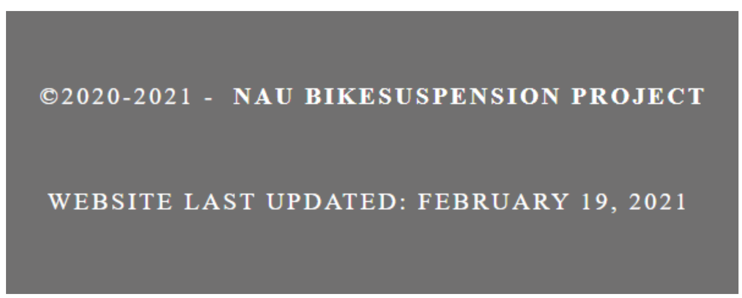
|---|---|---|
| Designed the two most popular designed user interfaces in solidworks | 2/26/2021 |   |
| Updated the team website's content | 2/19/2021 |   |

## Team Member: Austin Coyne

| Action Item | Date Completed | Result/Proof of Completion |
|---|---|---|
| Finish working with the mathematical model team with Leverage Ratio in Linkage x3 | 2/26 | In the last hardware review, I was able to collect leverage ratios from the linkage x3 program and get an average implemented into the mathematical model. |

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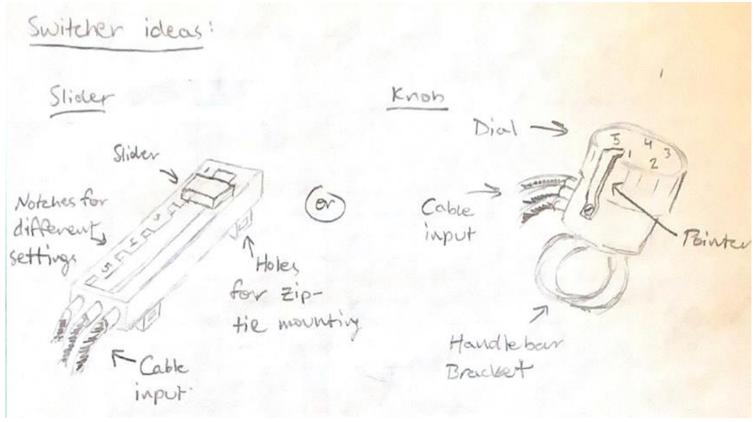
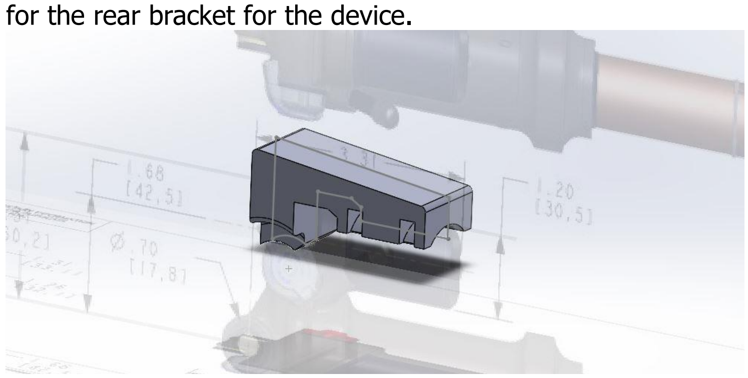
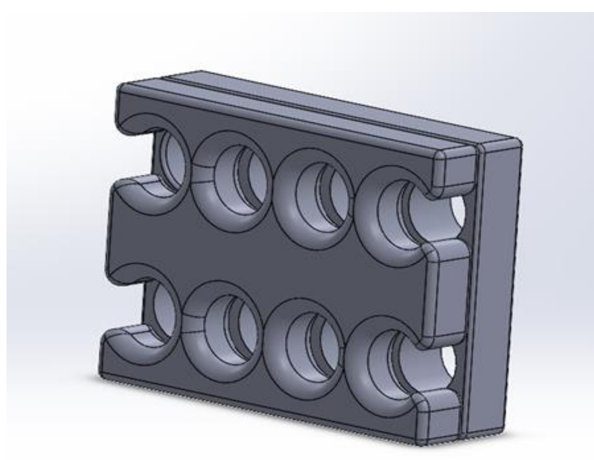
|---|---|---|
| Brainstorm and sketch out ideas for physical design. | 3/10 | I was able to sketch out my ideas for the physical design after I switched to the design team. The sketches include ideas for the input switcher, rear bracket, and front bracket.   |
| Design the "Rear Bracket" in Solidworks | 3/12 | After sketching out ideas, I was able to come up with a design for the rear bracket for the device.   |

## Team Member: Jacob Cryder

| Action Item | Date Completed | Result/Proof of Completion |
|---|---|---|
| Created and designed mounting plates and shims for the design process in SolidWorks. | 2/20/2021 |  |

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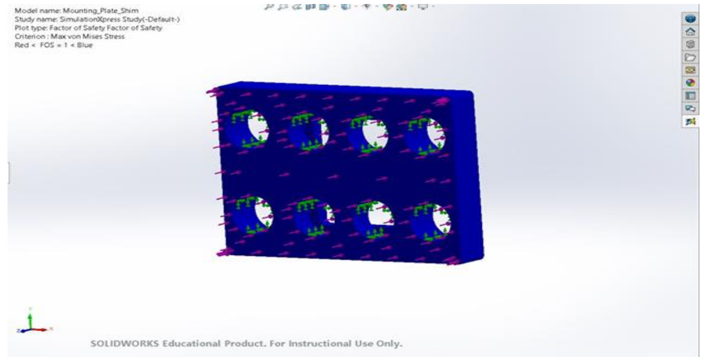
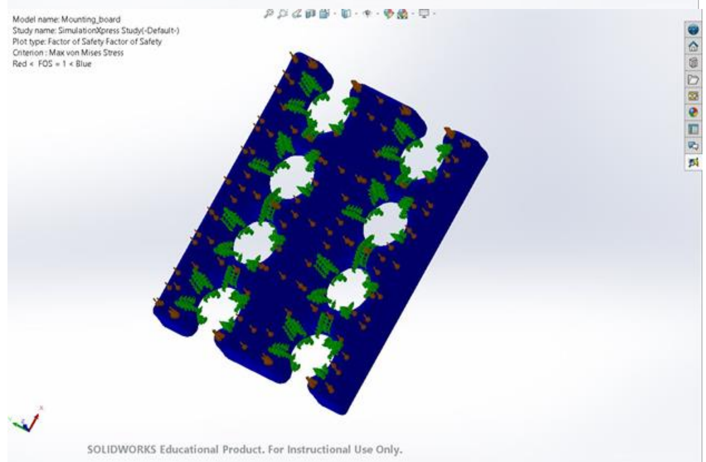
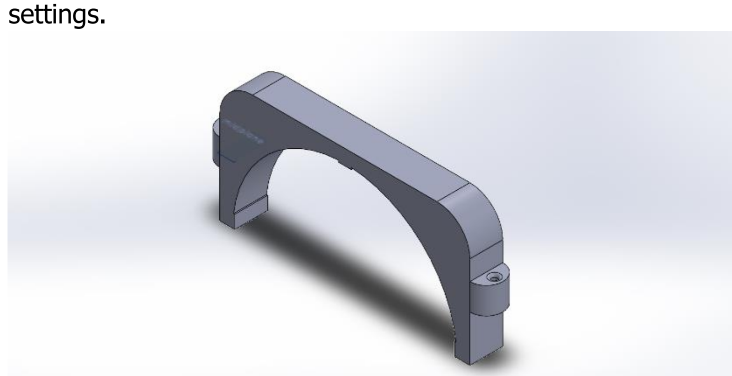
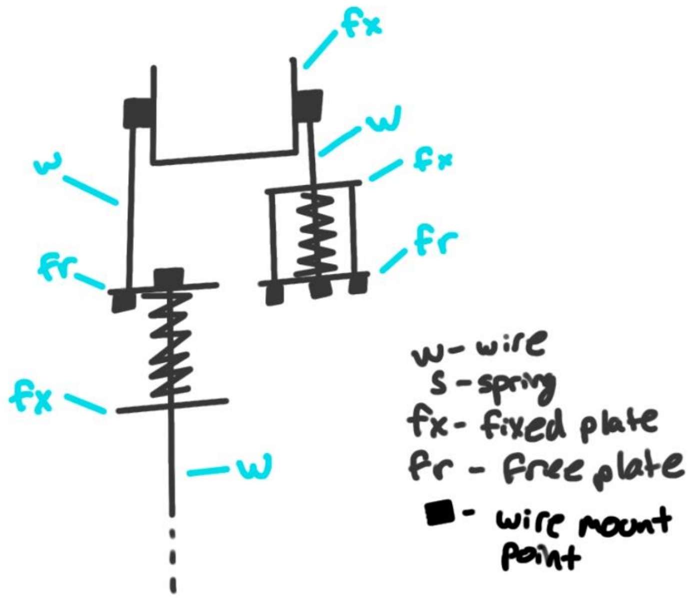
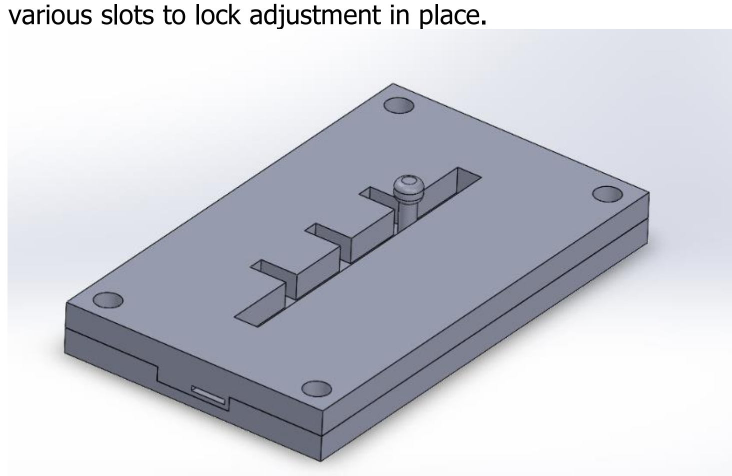
|---|---|---|
| Created various sketches and ideas for the morph and decision matrix | 2/4/2021 | Each team member in the design team generated a total of five sketches for the engineering requirements. This allowed the team to compare between the various designs to see which concept would be considered the best to use. |
| Created a stress analysis on the mounting plates to ensure that they could support the applied load. | 3/1/2021 |  |

## Team Member: Dylan Klemp

| Action Item | Date Completed | Result/Proof of Completion |
|---|---|---|
| Designed Clamp to control suspension knob movements | 2/26/21 | Utilized Solid works and bike suspension dimensions to design a suspension knob clamp. Designed to use with a mechanical wire system to control needed movement of suspension dial settings.  |

| | | |
|---|---|---|
| Dial Control Study and Application | 3/11/21 | I researched, benchmarked, and utilized similar applications of this spring and wire technique from existing mountain bike shifter components. I also created new solutions to accompany research to allow for a working overall design concept.   |
| Physical User Interface Design | 3/16/21 | Created a user interface that accompanies the above spring tension design for controlling knob adjustment. The wire will attach to the moving knob and a user can slide it into the various slots to lock adjustment in place.  |

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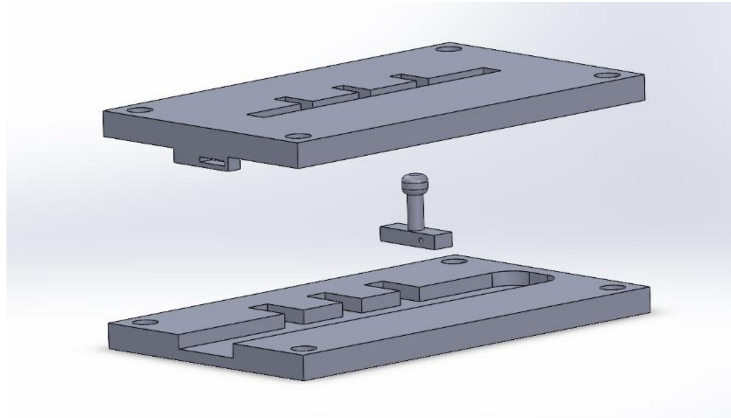
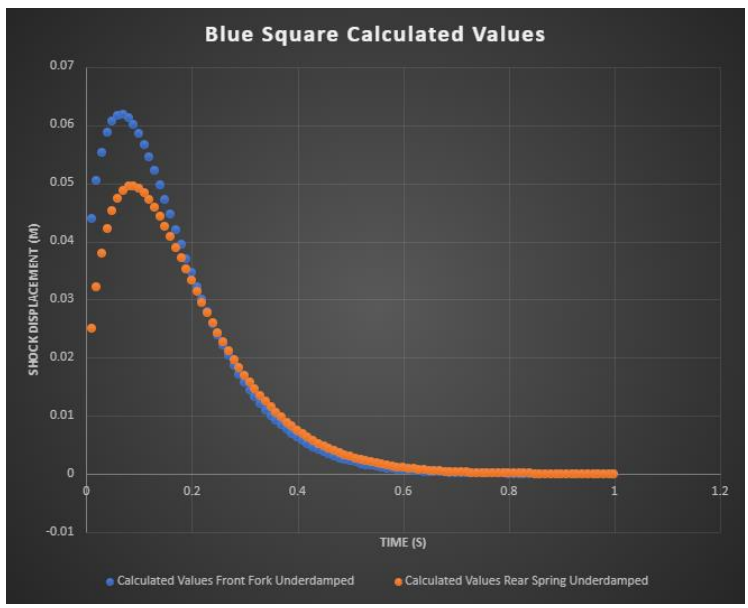
| | |  |

## Team Member: Tyson Spencer

| Action Item | Date Completed | Result/Proof of Completion |
|---|---|---|
| Develop displacement vs. time graphs for each trail type in the math model. | 3/11 | <br>This graph represents ascending a Blue Square trail (medium difficulty). The grade is 10%. |
| Design and 3D print brackets for rear linear potentiometer. | 3/10<br>3/14 | I designed two prototypes. The first allowed the potentiometer to bottom out before the shock, which would break the brackets. The second is completely optimized.<br>1. |

| | | |
|---|---|---|
| | |   2.   |
| Install linear potentiometers semi permanently on bike for testing. | 3/14 | Everything is connected using existing connection points, zip ties, and double-sided adhesive tape so that the frame and components are not permanently damaged. This is a very expensive donated bike.   |

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|---|---|---|
| | |   |

The following are the Action Items for each team member between HR 2 and the Final Product presentation:

| Team Member | Action Items | Date Due |
|---|---|---|
| Erik Abraham | 1. Test bike and adjust math model<br>2. Finish math model validation<br>3. Complete vibration analysis for Honors Capstone<br>4. Help create team poster.<br>5. Help complete final report. | 1. March 31st<br>2. April 10th<br>3. April 10th<br>4. April 23rd<br>5. April 23rd |
| Suliman Alsinan | 1. Update the team website<br>2. Discuss with the math model team to decide what interface would work | 1. March 26<br>2. March 30 |
| Austin Coyne | 1. Design Front Bracket<br>2. Design Clamps for all shock knobs | 1. March 22<br>2. March 26 |
| Jacob Cryder | 1. Produce final 3d printed design of plates shim<br>2. Work with the team on assembling the final desing | 3. March 29<br>4. April 3 |
| Dylan Klemp | 3. Complete spring tension design for suspension dial adjustment.<br>4. Determine what components can be 3D printed and which can be considered for machining, CAM applicable parts<br>5. Work with design team to determine and create final design | 5. March 25<br>6. March 27<br>7. March 29 |

| | | |
|---|---|---|
| Tyson Spencer | 1. Test bike and calibrate math model.<br>2. Validate math model with test results.<br>3. Help create team poster.<br>4. Help complete final report.<br>5. Finalize BOM. | 1. March 31st<br>2. April 10th<br>3. April 23<br>4. April 23<br>5. April 26 |