


# HR 2 BREAKDOWN


## TEAM: Red Feather

Friday, October 16, 2020

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

### Team Member: Nathan Fisher

Action Item	Date Completed	Result/Proof of Completion
Created preliminary construction plan for device, to be updated later.	8/29/20-9/1/20	PowerPoint presentation with listed steps of how I expected construction to be completed. It was anticipated that many items would be changed or reordered (which they were).
Cut 2x4's to size, as well as cut 45° angle into ends.	9/12/20	

<p>Reduced size of 2x4's down to new scaled down dimensions (from 4ft and 8ft, to 3ft and 6ft).</p>	<p>9/23/20</p>	
<p>Cut plywood down to size (3ftx6ft).</p>	<p>10/2/20</p>	<p>Plywood was purchased at a size of 4ftx8ft, which was the original dimensions of the device. After scaling down, it was necessary to reduce the size to 3ftx6ft using a circular saw.</p>
<p>Painted 2x4's, plywood, and aluminum sheets with heat resistant black paint.</p>	<p>10/2/20-10/6/20</p>	<p>In order to increase the life span of the wood, as well as increase the heat absorbing capability of the aluminum, they were spray painted black. Since the device heats up to a high temperature, heat resistant paint was used. Each material received 2+ coats of paint.</p>
<p>Completed individual analysis on heat loss out of system</p>	<p>10/5/20-10/11/20</p>	<p>In order to understand the heat loss out of the system, a MATLAB program was written to determine, in watts, the heat loss out of each boundary. These values were then summed. The result has prompted a reevaluation of certain design aspects to reduce heat loss.</p>

Attached wood frame to plywood and aluminum sheet.

10/10/20



Updated construction plan to reflect work completed thus far.

10/12/20-10/15/20

**Step 1: Gather all necessary materials.**

**Step 2: Gather necessary hand and power tools.**

**Step 3: Cut the first two 2x4 planks to length [6ft] using circular saw.**

**Step 4: Cut the third 2x4 into two separate sections (3ft each) using circular saw.**

**Step 5: Cut a triangular piece off both ends of all four 2x4 planks using the table saw with blade set at 45° angle (cut along dotted line).**

**Step 6: Paint all 4 cut planks using high-heat black paint.**

**Step 7: Paint the 4ftx8ft plywood sheet using high-heat black paint.**

**Step 8: Paint all 4 of the 3ftx3ft aluminum sheets using high-heat black paint.**

**Step 9: Lay two of the aluminum sheets out across the top side of the plywood sheet fully covering the wood surface with aluminum.**

**Step 10: Lay each 2x4 frame member sheet on top of the plywood and aluminum sheets and pre-drill 12 holes through all three surfaces.**

**Step 11: Fasten the plywood sheet to the four 2x4 planks by screwing 12 wood screws into the pre-drilled holes.**

**Step 12: pre-drill 8 holes into the four cut 2x4 planks at their angled ends (4 each side).**

**Step 13: Fasten the four cut 2x4 planks together by screwing 8 wood screws into the pre-drilled holes, fully mating the ends.**

**Step 14: Use heat resistant caulk to fill in any gaps at the mated edges, completely sealing the device.**


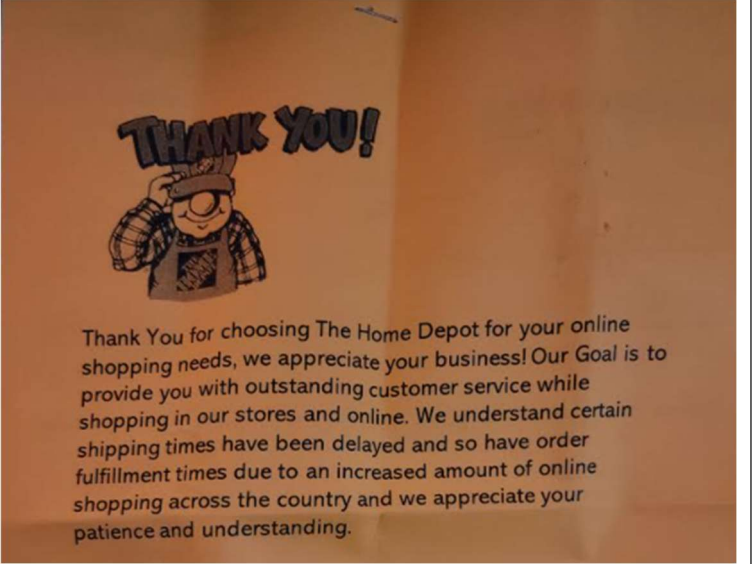

**Step 15: Paint the caulk with the high-heat paint.**

## Team Member: Leann Hernandez

Action Item	Date Completed	Result/Proof of Completion																
Improve Calibration on Arduino and update Arduino Instructions	10/9/20	$temperature[C^{\circ}] = 5.89 * voltage[v] + 11.85$ <p>Table 1: New Calibration Calculations using Probability and Statistics</p> <table border="1"> <tr> <td>voltage average[v]</td> <td>0.678</td> </tr> <tr> <td>variance</td> <td>0.03</td> </tr> <tr> <td>temperature average[C]</td> <td>14.96</td> </tr> <tr> <td>covariance</td> <td>2.74</td> </tr> <tr> <td>b1</td> <td>5.88</td> </tr> <tr> <td>b0</td> <td>15.66</td> </tr> </table>	voltage average[v]	0.678	variance	0.03	temperature average[C]	14.96	covariance	2.74	b1	5.88	b0	15.66				
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Conduct Uncertainty Analysis for Testing	10/9/20	<p>Table 2: Uncertainty Analysis</p> <table border="1"> <tr> <td>v</td> <td>10</td> </tr> <tr> <td>Syx</td> <td>0.0541</td> </tr> <tr> <td>t(10,95)</td> <td>1.812</td> </tr> <tr> <td>sp</td> <td>0.0981</td> </tr> <tr> <td>bp</td> <td>0.01</td> </tr> <tr> <td>up</td> <td>0.098</td> </tr> </table> <p>The error due to the accuracy for the temperature sensor is 0.01 volts.</p>	v	10	Syx	0.0541	t(10,95)	1.812	sp	0.0981	bp	0.01	up	0.098				
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Conduct Cost Analysis for prototype size and full size model	10/12/20	<p>The total amount the team has spent for the scaled down prototype not including testing materials is \$388. If we made 100 units of the prototype size, we could get the price down to \$331. For a full size prototype, the current cost analysis is at \$447 each for 100 units.</p>																
Search for vendors for bulk pricing	10/10/20	<table border="1"> <thead> <tr> <th>Source</th> <th></th> </tr> </thead> <tbody> <tr> <td>Home Depot</td> <td><a href="https://www.homedepot.com/p/2-in-x-6-in-x-10-ft-2-and-Better">https://www.homedepot.com/p/2-in-x-6-in-x-10-ft-2-and-Better</a></td> </tr> <tr> <td>acme plastics</td> <td><a href="https://www.acmeplastics.com/acrylic-sheets/clear-cast-acrylic">https://www.acmeplastics.com/acrylic-sheets/clear-cast-acrylic</a></td> </tr> <tr> <td>Home Depot</td> <td><a href="https://www.homedepot.com/p/7-16-in-x-48-in-x-8ft-Oriented">https://www.homedepot.com/p/7-16-in-x-48-in-x-8ft-Oriented</a></td> </tr> <tr> <td>menards</td> <td><a href="https://www.menards.com/main/paint/spray-paint/all-purpose">https://www.menards.com/main/paint/spray-paint/all-purpose</a></td> </tr> <tr> <td>Home Depot</td> <td><a href="https://www.homedepot.com/p/Master-Flow-4-in-x-12-ft-Insul">https://www.homedepot.com/p/Master-Flow-4-in-x-12-ft-Insul</a></td> </tr> <tr> <td>Hotmelt</td> <td><a href="https://www.hotmelt.com/products/high-temperature-silicone">https://www.hotmelt.com/products/high-temperature-silicone</a></td> </tr> <tr> <td>industrialmetalsales</td> <td><a href="https://www.industrialmetalsales.com/5052-H32-Aluminum-Sh">https://www.industrialmetalsales.com/5052-H32-Aluminum-Sh</a></td> </tr> </tbody> </table>	Source		Home Depot	<a href="https://www.homedepot.com/p/2-in-x-6-in-x-10-ft-2-and-Better">https://www.homedepot.com/p/2-in-x-6-in-x-10-ft-2-and-Better</a>	acme plastics	<a href="https://www.acmeplastics.com/acrylic-sheets/clear-cast-acrylic">https://www.acmeplastics.com/acrylic-sheets/clear-cast-acrylic</a>	Home Depot	<a href="https://www.homedepot.com/p/7-16-in-x-48-in-x-8ft-Oriented">https://www.homedepot.com/p/7-16-in-x-48-in-x-8ft-Oriented</a>	menards	<a href="https://www.menards.com/main/paint/spray-paint/all-purpose">https://www.menards.com/main/paint/spray-paint/all-purpose</a>	Home Depot	<a href="https://www.homedepot.com/p/Master-Flow-4-in-x-12-ft-Insul">https://www.homedepot.com/p/Master-Flow-4-in-x-12-ft-Insul</a>	Hotmelt	<a href="https://www.hotmelt.com/products/high-temperature-silicone">https://www.hotmelt.com/products/high-temperature-silicone</a>	industrialmetalsales	<a href="https://www.industrialmetalsales.com/5052-H32-Aluminum-Sh">https://www.industrialmetalsales.com/5052-H32-Aluminum-Sh</a>
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Update Gantt Chart	10/15/20	<ul style="list-style-type: none"> <li>Start Building Final Project 9/7/20 9/15/20</li> <li>Build Frame of Solar F... 9/7/20 9/15/20</li> <li>Build Frame of Solar F... 9/7/20 9/15/20</li> <li>Build Arduino and Pr... 9/7/20 9/15/20</li> <li>Individual Anlysis 2 9/14/20 10/5/20</li> <li>Research Individual T... 9/14/20 10/5/20</li> <li>Research Individual T... 9/14/20 10/5/20</li> <li>Research Individual T... 9/14/20 10/5/20</li> </ul>
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**Team Member: Trevor Scott**

Action Item	Date Completed	Result/Proof of Completion
All parts ordered for prototype. Found vendors and competitive pricing on parts.	10/15/20	<p>Final purchase request confirmation:</p> 
Picked up materials from orders. Trips were made to and from Home Depot to deliver materials to Nathans house.	10/15/20 (Ongoing)	
Prototype construction (Frame + prep for fins) See Nathan's action items relating to build. All construction was done by Trevor and Nathan together.	9/12/20-10/10/20	
Fin analysis and justification.	10/9/20	<p>Proved that corrugated metal fins were 3.7 times more effective than flat fins while only being 2.3 times the price.</p>

Meeting scheduling and communication.	10/15/20 (Ongoing)	Coordinated meetings through zoom with client. Communicated updates and feedback with advisor. Next meeting is Oct. 21 @ 2:00 PM.
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The following are the Action Items for each team member between HR 2 and the Final Product presentation:

<b>Team Member</b>	<b>Action Items</b>	<b>Date Due</b>
Nathan Fisher	<ol style="list-style-type: none"> <li>1. Poster draft started</li> <li>2. Update website</li> <li>3. Complete construction of main device</li> <li>4. Implement fan and solar panel into device</li> <li>5. Complete construction manual</li> </ol>	<ol style="list-style-type: none"> <li>1. 10/20/20</li> <li>2. 10/20/20</li> <li>3. 10/25/20</li> <li>4. 10/30/20</li> <li>5. 11/04/20</li> </ol>
Leann Hernandez	<ol style="list-style-type: none"> <li>1. See if we can get cost analysis down even lower</li> <li>2. Poster draft started</li> <li>3. Put all testing equations in one spreadsheet</li> <li>4. Transport the Arduino to Flagstaff for testing</li> <li>5. Complete testing write-up/summary</li> <li>6. Update any changes in Gantt Chart</li> </ol>	<ol style="list-style-type: none"> <li>1. 10/20/20</li> <li>2. 10/20/20</li> <li>3. 10/26/20</li> <li>4. 10/26/20</li> <li>5. 11/04/20</li> <li>6. 11/01/20</li> </ol>
Trevor Scott	<ol style="list-style-type: none"> <li>1. Set up final meetings with red Feather/Chuck</li> <li>2. Poster draft started</li> <li>3. Help Nathan update website</li> <li>4. Order any last-minute materials</li> <li>5. Complete prototype construction</li> <li>6. Complete construction manual</li> </ol>	<ol style="list-style-type: none"> <li>1. 10/25/20</li> <li>2. 10/20/20</li> <li>3. 10/20/20</li> <li>4. 10/21/20</li> <li>5. 10/30/20</li> <li>6. 11/04/20</li> </ol>