Overview

Challenge: Reliable and inexpensive transportation is a necessity for developing countries where automobiles are a luxury. Having access to transportation would greatly improve the lives of people who must travel miles for their daily needs. To encourage research in this area, ASME hosts an annual challenge that tests vehicles maneuverability, speed, and ability to carry a payload.

Solution: Develop a human powered vehicle that meets and exceeds all the standards outlined in the ASME 2018 HPVC rulebook. By doing this, we intend to compete at a high level while honing our engineering skills.

Customer Requirements

• HPV must be able to withstand a 2.5 hour endurance race on a paved course.
• Must be able to navigate obstacles (Slalom turns, 180-degree hairpin turn with a radius that does not exceed 8 meters, speed bump, rumble strip, and a quick turn into a 3m-wide lane.)
• Be able to complete a 450m drag race on a level course in under 30 seconds, from a stand still start.
• Must be able to come to a full stop from a speed of 25 km/hr in a distance of 6.0 meters.
• Must demonstrate stability by traveling for 30 m in a straight line at a speed of 5 to 8 km/hr.
• The rollover protection system (RPS) must withstand a force of 2670 N applied to the topmost bar.
• HPV will contain a safety harness that meets the requirements outlined in the ASME HPVC 2018 Rules for North American West.
• Maintenance costs less than $500 from finishing of prototype through competing in the HPVC.

Subsystems

• Main Frame
• Steering
  • Trail = $R_p \cos(A_h) - O_f$

Design

The vehicle will follow a typical recumbent bicycle design with a roll-bar for added safety. The frame utilizes a sliding seat to accommodate different riders. The frame is built around the ideal seat angle for delivering maximum torque from the rider to the cranks as well as the trail number.

Steering: Trail Calculation

<table>
<thead>
<tr>
<th>Rim Radius</th>
<th>Tire thickness</th>
<th>Wheel Radius</th>
<th>Head Angle (Deg)</th>
<th>Head Angle (Rad)</th>
<th>Rate</th>
<th>Trail MECH</th>
</tr>
</thead>
<tbody>
<tr>
<td>451</td>
<td>25</td>
<td>250.5</td>
<td>65</td>
<td>1.13</td>
<td>28</td>
<td>77.9</td>
</tr>
<tr>
<td>451</td>
<td>25</td>
<td>250.5</td>
<td>66</td>
<td>1.15</td>
<td>28</td>
<td>79.9</td>
</tr>
<tr>
<td>451</td>
<td>25</td>
<td>250.5</td>
<td>67</td>
<td>1.17</td>
<td>28</td>
<td>68.9</td>
</tr>
<tr>
<td>451</td>
<td>25</td>
<td>250.5</td>
<td>68</td>
<td>1.19</td>
<td>28</td>
<td>65.8</td>
</tr>
<tr>
<td>451</td>
<td>25</td>
<td>250.5</td>
<td>69</td>
<td>1.20</td>
<td>28</td>
<td>61.8</td>
</tr>
<tr>
<td>451</td>
<td>25</td>
<td>250.5</td>
<td>70</td>
<td>1.22</td>
<td>28</td>
<td>57.7</td>
</tr>
<tr>
<td>451</td>
<td>25</td>
<td>250.5</td>
<td>71</td>
<td>1.24</td>
<td>28</td>
<td>53.6</td>
</tr>
<tr>
<td>451</td>
<td>25</td>
<td>250.5</td>
<td>72</td>
<td>1.26</td>
<td>28</td>
<td>49.4</td>
</tr>
<tr>
<td>451</td>
<td>25</td>
<td>250.5</td>
<td>73</td>
<td>1.27</td>
<td>28</td>
<td>45.2</td>
</tr>
<tr>
<td>451</td>
<td>25</td>
<td>250.5</td>
<td>74</td>
<td>1.29</td>
<td>28</td>
<td>41.0</td>
</tr>
<tr>
<td>451</td>
<td>25</td>
<td>250.5</td>
<td>75</td>
<td>1.31</td>
<td>28</td>
<td>36.8</td>
</tr>
</tbody>
</table>

Recap and Lessons Learned

• We placed 13th overall out of 17. 9th in the Women’s drag race, 10th in the men’s drag race, and 9th in the endurance race. For both drag races, our qualifying times placed us as the 6th seed.
• Placed 14th overall in design and innovation
• Bicycle performed better than most schools in the racers, but riders struggled to get a good start.
• Steel frame allowed for easy assembly and welding
• Two wheels require more skill for balance and steering, but generally achieve higher speeds than tricycles

Project Roles

Connor Maliesky – Team Leader, CAD
Caleb Kramer – Fabrication Lead, CAD
Marco Pantoja – FEA Analyst, Fairing Mold
Jackson “Send It” Feld – Chief Welder
Jeffrey LaRocco – Chief Editor and Conditioning Specialist - “The legs feed the wolf, gentlemen.”
Cassidy “The Anchor” Kuhn – Apprentice and Speed Demon