Team Human Power

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Overall Goal

To Design and Build one of These:
Overall Goals

“Team HPV will design and build an aerodynamically and mechanically efficient vehicle that uses pure human power to achieve a top speed of at least 61.5 mph.”

The HPV team’s goals include:

• Team HPV will assemble and build a vehicle to compete in land speed challenge

• Team HPV will perform all necessary calculations by hand

• Computer tools will be used to verify previously completed hand-calculations

• Accuracy of final prototype ensured through careful analysis of simplified calculations
Goals for Spring 2009

• Acquire foam, carbon fiber, and resin.
• CNC foam plug.
• Layup carbon fiber shell and frame
• Place components.
• Test Vehicle
**Power Feasibility**

**Why 80 MPH? Design and build to a higher degree of precision incase:**
- Rider Change (≈80% the rider’s Power Output)
- Unforeseeable Mechanical Losses
- Unforeseeable Drag Losses

**The rider can produce roughly 1200 Watts**

- Rolling Resistance requires 95 Watts at 80 mph
- Wheel Rotation Power requires 124 Watts
- 5% loss due to (Known) Mechanical Losses yields 60 Watts

**921 Watts remaining to overcome aerodynamic drag**

- The Problem? 921 Watts can be maintained for roughly 10 seconds
- Keep in mind our goal is merely 61.5 mph
Losses will be measured by:

Determining input watts to the SRM Powertap

Acceleration will be computed through experimental procedures.

The differences in wattages will be our mechanical losses.
Frame Considerations

- Stability
- Rider Ergonomics
- Strength
- Torsion Rigidity
- Weight

Max Tension 1.88 kip
Max Compression .56 kip
Max Shear 1.88 kip
Max Moment 28.4 ft*kip
Team Human Powered Vehicle’s Prototype Mule Frame

- All components have been mounted (ie: gears, chains, steering, etc.)
- Frame is rideable once wheels arrive
- Parts transferrable to carbon model
- Brakes work, shifts thru 9 gears on cassette

![Prototype Aluminum Frame Diagram]
Prototype Aluminum Frame

More Pictures...

DriveTrain: Crank to Mid Drive

Digital Speedometer mounted on handlebar

CNC Adapter Plate

Rear Disc Brakes
Preliminary Shell Design

- Shell features clear front windshield for visibility
- Will be assembled as an upper and lower half that will be permanently connected.
- Clear windshield will be hinged for maintenance and entry/exit.

Note: Keep in mind these features were from literature analysis before any experiments were conducted.
Wind Tunnel Testing

Team Human Powered Vehicle

Two shapes were fabricated, and then mated to a common rear structure.

- Rear structure
- Shape 1
- Shape 2

Graph: Coefficient of Drag Per Iteration
- Shape 1 Cd = 0.114355
- Shape 2 Cd = 0.016097
### Vehicle CdA

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<tr>
<th>Vehicle</th>
<th>CdA</th>
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<tr>
<td>Virtual Edge</td>
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<tr>
<td>Our Vehicle</td>
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<td>0.3</td>
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</tbody>
</table>

CFD results confirm wind tunnel results within experimental error.
Representation of what shell will look like based on CFD and wind tunnel testing.
References

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Questions?