Vehicle Design Summit

The Assisted Human Powered Vehicle
Vehicle Design Summit Summary

- Developed 4 alternatively-powered practical vehicle designs with 200 mpg or more equivalence
  - AHPV - Assisted Human Powered Vehicle
  - Pulse - 1 person all electric commuter vehicle
  - Fuel Cell - 90% recyclable body and shell
  - Biofuels - ran on straight vegetable oil
- Worked on emerging technologies, in concert with collaborators in industry and academia
AHPV Overview

• One person commuter vehicle capable of full electric drive, full human drive, & everything between

• Capable of sustaining 50 mph for >50 miles on one charge

• Can both plug in to the grid and charge off of solar power

• Substantial autonomous range

• 500 mpg equivalency @ 35 mph

• Safe to drive: visible, good field of view, and crash worthy

• Enough storage space for the typical commuter

• Must be usable by the 95th percentile human
What were the goals of the AHPV

• Breaks new ground in assisted human power:
  • High sustained speed and a useful range
  • Capable of making the typical commute autonomously

• Generates excitement about alternatives

• Demonstrates what college students can do to address major global challenges
AHPV Performance

Vehicle Range at Speed

- Full Charge
- Full Charge + Human Input
- Autonomous Range (Sunny Day)
AHPV Performance

Vehicle Range at Speed

- Autonomous Range (Sunny Day)
- Range: Solar only (sunny)
- Human Input only

Sustained Speed (mph)

Range (miles)
AHPV Performance
The potential uses of the AHPV

• Commuting / energy conscious personal transportation

• Exercise / recreation

• Helps to create awareness and stimulate interest energy efficient alternatives

• Use in Developing countries
4 Design Opportunities

• Solar panel integration

• Electric Hub Motor Design

• Electric Motor Mechanical Integration

• Door and Windshield
Electric Hub Motor
Electric Hub Motor Overview

• Used frequently in electric bicycles, solar racers, etc

• No Gearing, integrated directly into the wheel hub

• Extremely High efficiencies (up to 98%)

• Limited production volumes in high power ranges (> 2kW)

• Expensive (e.g. the NGM motor on the AHPV costs > $8000)
**Electric Hub Motor Goals**

- Design and build a 10kW, 90% efficient Electric Hub Motor that can integrate with AHPV

- Cost and manufacturing simplicity are key

- Interface with standard NGM EV-C200 Motor Controller

- Could be the first generation of a motor used in VDS 2.0 (full size production-ready concept vehicle)
Electric Hub Motor Teams

• Team 1 - Electrical components
  • Rotor, stator, windings, etc
  • Responsible for the electrical components

• Team 2 - Mechanical integration
  • Building a housing for the electrical components
  • Integration with AHPV drivetrain
Solar Panel Integration Overview

• Solar power is a nice concept for vehicle energy, but cannot dynamically meet vehicles power needs.

• However, most cars spend 90+% of each day sitting still.

• The AHPV solution: solar panels to recharge the battery while the vehicle is sitting outside all day in a parking lot, driveway, etc. This allows the solar panels to “catch up” with the AHPV’s energy needs.
Solar Panel Integration Goals

• Design a system that allows the solar panels to be deployed to face the sun when the AHPV is stationary

• Must be hand deployable by one person in 30 seconds or less

• Solar panels cannot be bend. The rear of the AHPV has a flat surface for storing the panels during motion
Egress, Ingress, and visibility Overview & Goals

• The AHPV drives...but there are two main issues

  • Getting in and out of the vehicle is extremely difficult - there is no door

  • Visibility is limited for the driver due to small windshield
Egress, Ingress, and Visibility Goals

• Design a system of entry and exit for the passenger that allows the passenger to be seated in 10 seconds or less
  
  • Note here that there are very few hard mounting points suitable for doors in the front end of the AHPV.
  
  • Is likely to require unusual door configurations

• Re-design windshield for better visibility
The Future of AHPV

• February - SolidWorks World (New Orleans)

• April - Compete in Shell Eco-Marathon (France)

• Summer - Museum of Science (Boston)