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

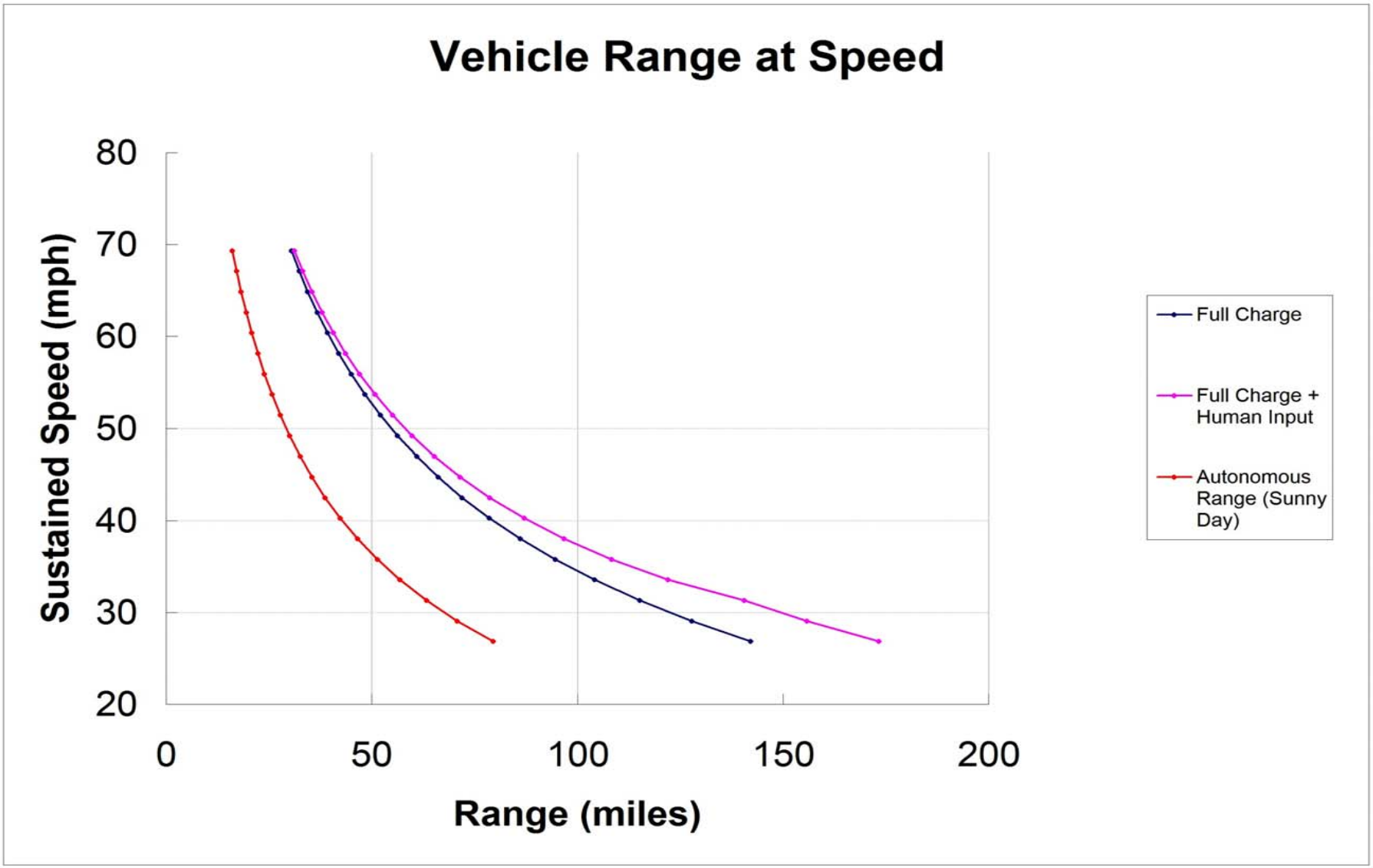
AHPV Overview

- 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

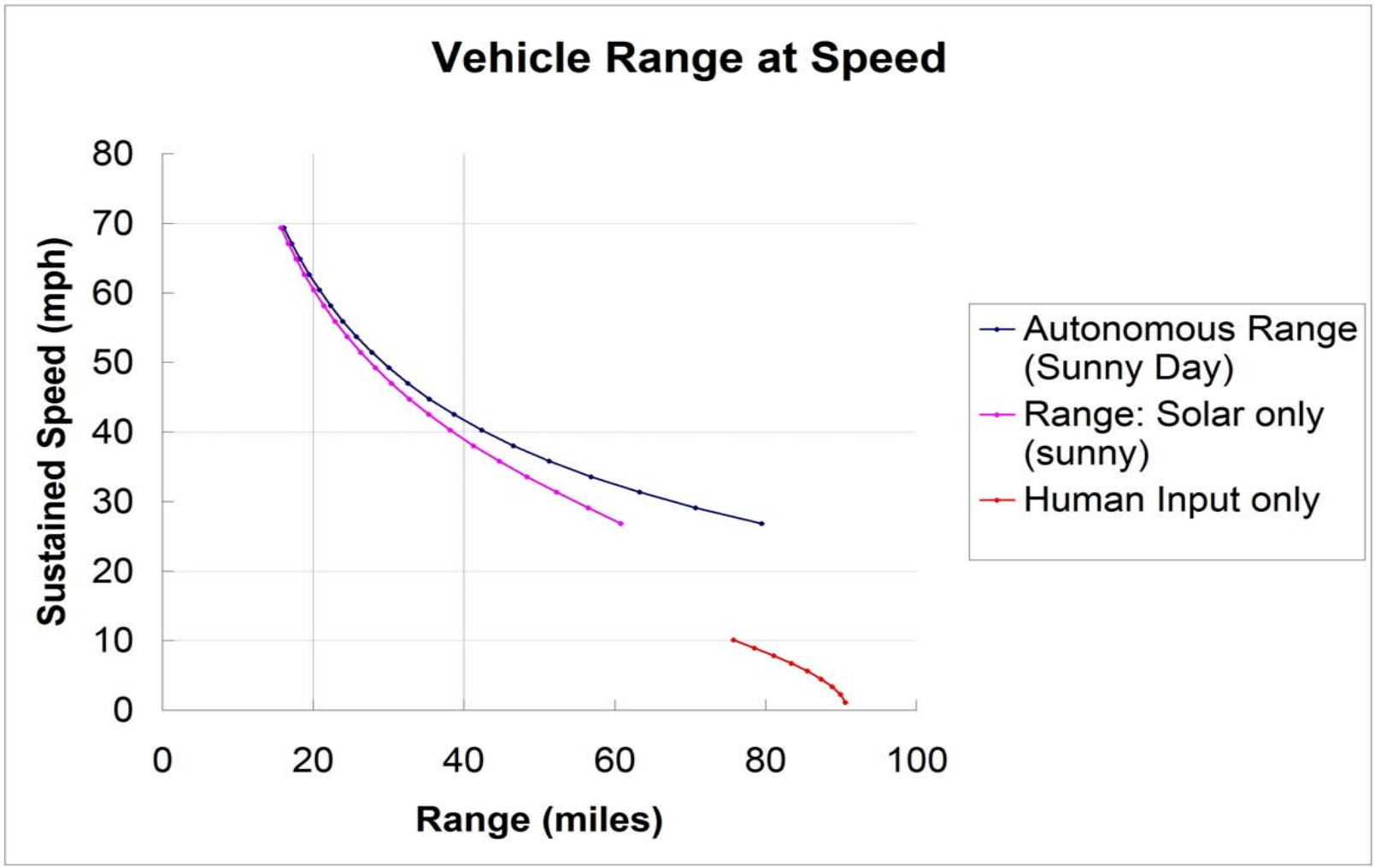
What were the goals of the AHPV

- 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

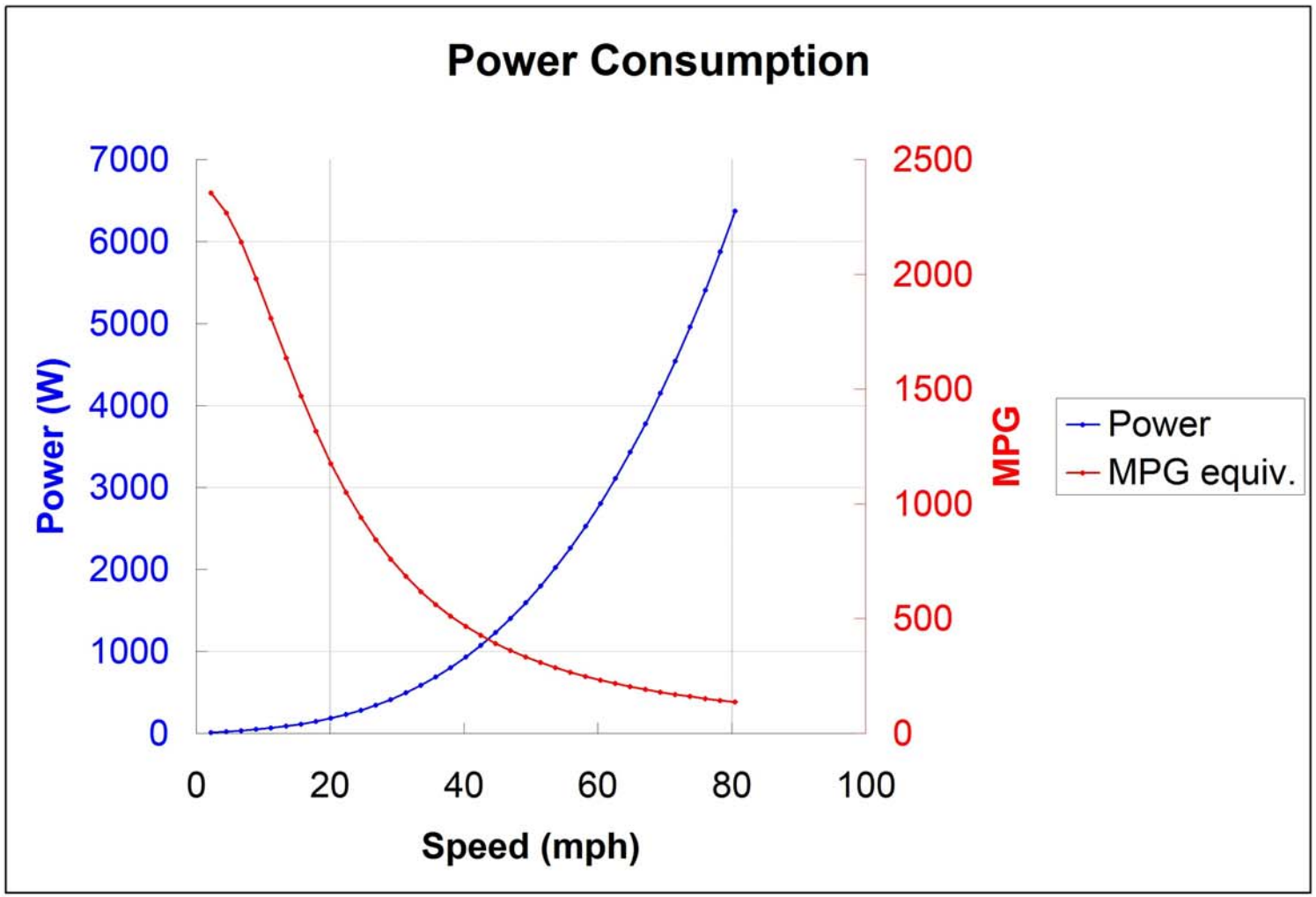
AHPV Performance



AHPV Performance



AHPV Performance

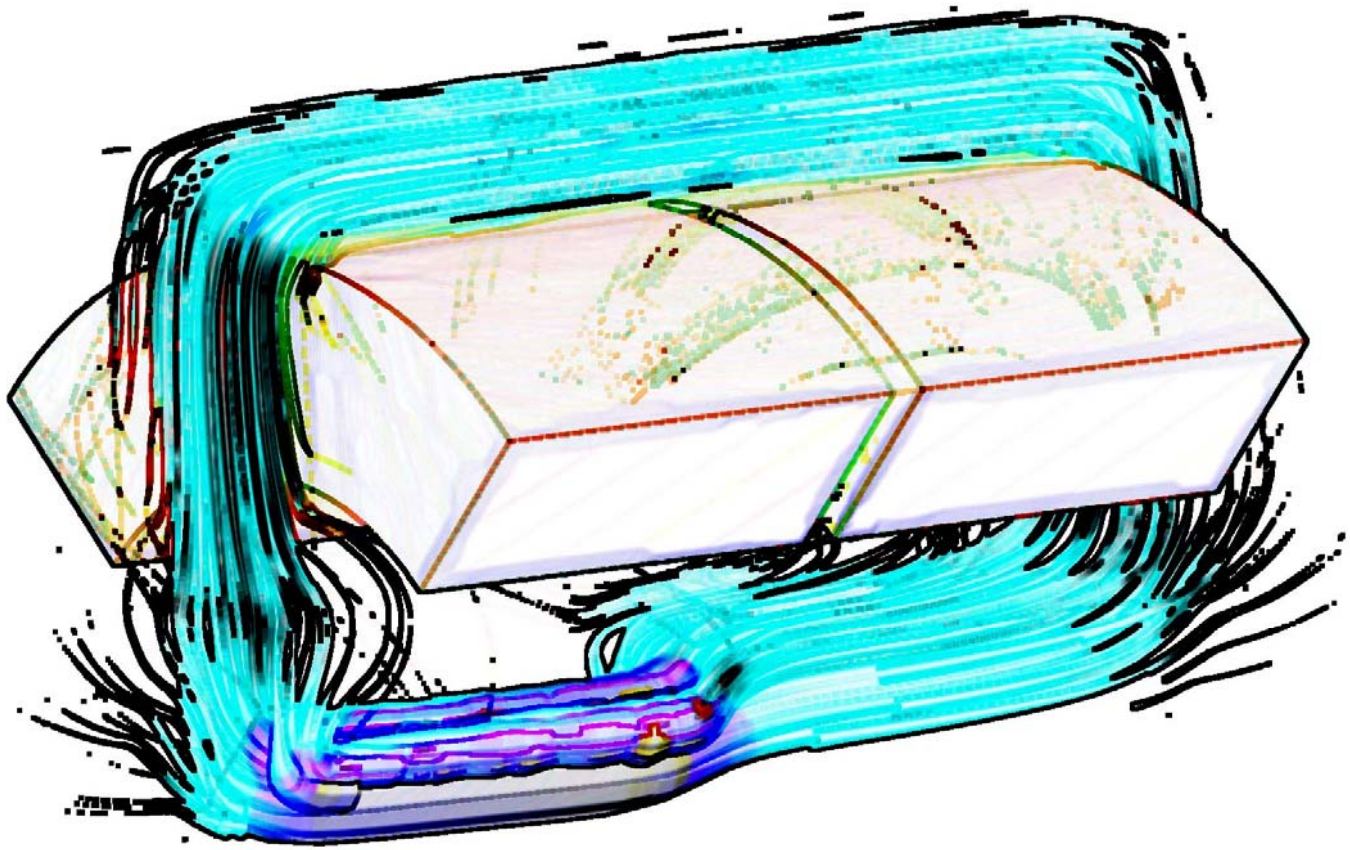


The potential uses of the AHPV

- 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

Design + Build

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)