Customer Requirements – Perry G. Wood, P.E.

1. Design, Prototype, Test and Manufacture an ASME Human Powered Vehicle
    - Vehicle can reach high speeds - Sprint and Endurance Competitions
    - Light weight - Maximize strength to weight ratio of the frame, power train, hardware, fairing and keep cost down
    - Highly maneuverable - Able to maneuver safely and repeatedly during the sprint and endurance race
    - Contains cargo space - Meet the requirements of the ASME Efest HPVC competition rules
    - Large field of view - Have a field of view to safely operate the vehicle
    - Support cargo weight – Support rider and cargo weight
    - Protects rider in the event of a roll over - Complete a thorough structural analysis of the HPVC frame, be able to explain how you setup the problem, have a thorough understanding of FEA, be able to explain failure criteria why Von Misses stresses are used, understand the difference of determinate vs indeterminate structure. Back up analysis with testing, and include all analysis in your final design report
    - Aerodynamic – Design a frame, drive-train, and fairing with the lowest possible coef. Of drag. Analyze COD by properly setting up a CFD analysis and verifying the output first with classical equations for COD. Example run cfd on a circular plate or sphere and check your answers for COD with classical equations for COD. Check your final analysis with scaled down version of your HPVC that fits in our wind tunnel using Reynolds number. Measure the force on the scaled version of the HPVC in the wind tunnel at varying speeds and convert to COD. Check these values against your hand calculations and Fluent CFD model. Report all results in your design report
    - Production run manufacturability - Number one goal to is to design your hpvc for manufacturability in our shop. Also think about manufacturing for mass production. Think about what would be required to scale up to produce your HPVD for developing countries.
    - Fits diverse range of operators - Your vehicle will be designed to fit a range of rider torso and leg lengths. The goal is to transfer the most energy to the crank shaft as possible in the fastest possible way for acceleration (sprint event), and for duration (endurance event). You want to minimize the amount of energy that is used to deflect the frame, minimize energy loses to heat generation (mechanical in-efficiencies in the hpvc). Must come up with ideal seat position, crank position, gearing, and drive train to optimize energy in you to crank rotation (cadence) and sustained speed in the HPVC.