1. Context

1.1. Need Statement

In today's market, there isn't a vehicle that exists quite like the moonbuggy that will be built. The closest resemblance would be a one person recumbent bicycle or a tandem bicycle. Only some of the recumbent and tandem bicycles on the market include the ability to go off-road, as they are mostly for leisurely riding. The moonbuggy that is being designed has the potential to fulfill this need for an off-road human powered vehicle (HPV) that is capable of carrying two passengers.

The Great MoonBuggy Race sponsored by NASA in Huntsville, Alabama is the perfect opportunity to build a two person off-road HPV to fulfill this need. The competition aims at facing engineering students with the challenges faced by the original moonbuggy team. The competition comes complete with a set of rules that will guide the design of the moonbuggy, but will also meet customer needs. In the process of designing and building a vehicle to compete in the Great MoonBuggy race, Team MoonBuggy will also be working towards creating a product that will fill the current gap in the market.

1.2. Problem Statement

Building a moonbuggy to fill the current market gap and to compete in the Great MoonBuggy Race requires extensive design in three key areas. These areas are suspension, frame, and drive train design.

1.2.1. Suspension Design

The suspension of the moonbuggy must be able to absorb the forces encountered on the rough terrain so that the impulses are not transmitted to the rider. This will lead to not only a smoother ride, but also a safer ride. In addition, suspension parameters such as camber, caster, roll center, and travel need to be optimizes for the moonbuggy. This will allow the suspension to be set up optimally for different terrain types to enable a smooth, responsive, safe ride.

1.2.2. Frame Design

It is critical that the frame be lightweight enough for portability should the moonbuggy need to be lifted or transported. It is equally important that the frame be robust in terms of both stiffness and strength. It must not only withstand a static load of about 300 lbs from the riders, but also withstand the impulses and dynamic loading encountered when riding through rough terrain. Also, it must remain rigid under stress so that deflections don't cause the drive train or suspension to lock up. In addition the frame design must be able to accommodate two passengers, a drive train, suspension, and fold into a four foot cube.

1.2.3. Drive Train Design

The drive train involves bringing the human generated power to the wheels of the vehicle. This is difficult due to the fully adjustable suspension that will be in place. It must have enough degrees of freedom that it does not lock up or break under suspension travel. The drive train also needs a full range of gears in order to navigate all terrains.

1.3. Design Team

1.3.1. Student Design Team Members

Figure 1: From left to right: Elizabeth Nies, Quentin Benson, Emina Maric, Mark Kocik, Jonathan Hilton, and Dave Meier

Quentin Benson · Team Lead and Suspension Team · qbenson@gmail.com · Quentin brings knowledge to the team in the areas of automobiles and bicycle systems.

Jonathan Hilton · Suspension Team ·jonathan.jonathanhilton@gmail.com Jon brings previous automotive experience as well as strong math and assembly skills to the team.

Mark Kocik · Frame Team · lmark84l@gmail.com Mark brings finite elements and Matlab experience to the team as well as knowledge of bicycle systems.

Dave Meier · Frame Team · evadreiem@aol.com Dave brings valuable solid modeling skills developed in industry to the team.

Emina Maric · Drive Train Team · me.mina@gmail.com Emina brings strength of materials knowledge to the team.

Elizabeth Nies · Drive Train Team · e.nies@utah.edu Elizabeth brings knowledge of composites to the team as well as strength of materials.

2.1.1. Teaching Team

William Provancher · Asst. Professor · wil@mech.utah.edu

Teaching Assistant · Nick Sylvester · nick.powderhound@gmail.com