NASA Human Exploration Rover Challenge

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Structure

The frame will consist of an aluminum 6061 rectangular truss that will be a total of 6 feet in length. The frame will fold in the middle utilizing a hinge and lock system to allow for the buggy to fit within the design package constraints. The aluminum properties were tested using CATIA material analysis and finite element analysis.

Suspension

The suspension will consist of a fully independent spring suspension. We went with fully independent suspension to provide the most stability over all terrain allowing us to maintain a higher velocity. The rover will utilize a freewheel design to allow each wheel to rotate independently. This allows the rover to turn easier and to coast thus reducing stress on the axels.

Wheels/Tires & Brakes Systems

For the rover, we chose to use energy return wheels due to the newest regulation made by NASA. This new rule made the use of pneumatic tires illegal and also prohibited any rubber use in wheels. This energy return wheel by Britek will deliver the most efficient performance while following these new guidelines. With adjustable hubs, we will still be able to incorporate the disk brakes that we planned on using in our original bike tire design.

Abstract

NASA's Human Rover Exploration Challenge, held annually in at the Marshall Space Flight Center in Huntsville, Alabama, is an engineering design challenge that asks teams of student engineers to design a human-powered vehicle capable of traversing a simulated lunar surface. However, there is an interesting stipulation in the design of the rover: it must be able to be transported in a 5x5x5 foot cube, echoing the design constraint faced by the engineers who built the Lunar Roving Vehicles used by the astronauts of the later Apollo missions. The vehicle in this proposal, *Ocelot,* designed by the Society of Women Engineers at Embry-Riddle Aeronautical University's Prescott campus, is intended to a contender in the 2015 Human Rover Exploration Challenge, and builds off of the ideas shared by veteran participants of the Race as well as shoring up innovative ideas from the design team.

Competition Information

The Human Rover Exploration Challenge covers a 0.7 mile track around the United States Space and Rocket Center, weaving in between historic rockets and through a simulated patch of the lunar surface. The course consists of a series of difficult obstacles including gravel mounds, deep sand patches, and steep inclines, all designed to push the rovers and their riders to their limits.

Vehicle Overview

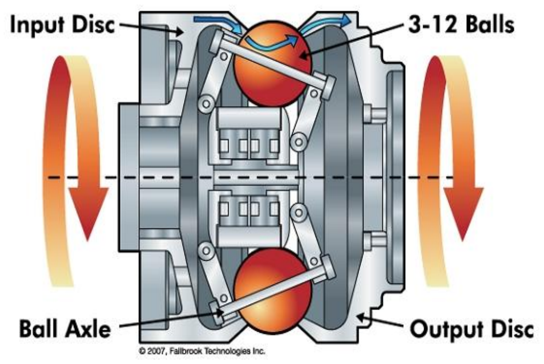
- Collapsible, must fit within 5ft cube
- Human Powered
- Two people must be able to carry vehicle
- 15" above ground
- Turning radius of 15 feet or less
- Pneumatic tires are not allowed
- Simulated electronic equipment

Driver Safety

As the riders will be traversing difficult obstacles at high speeds and steep inclinations, safety is of the utmost concern. This will be addressed through two main categories: safety restraints, and rider wear. To help provide sufficient lumbar support to the drivers, we are designing our own seats. As required by NASA rules, our riders will wear gloves, goggles, and long pants and shirts to protect from debris and accidents.

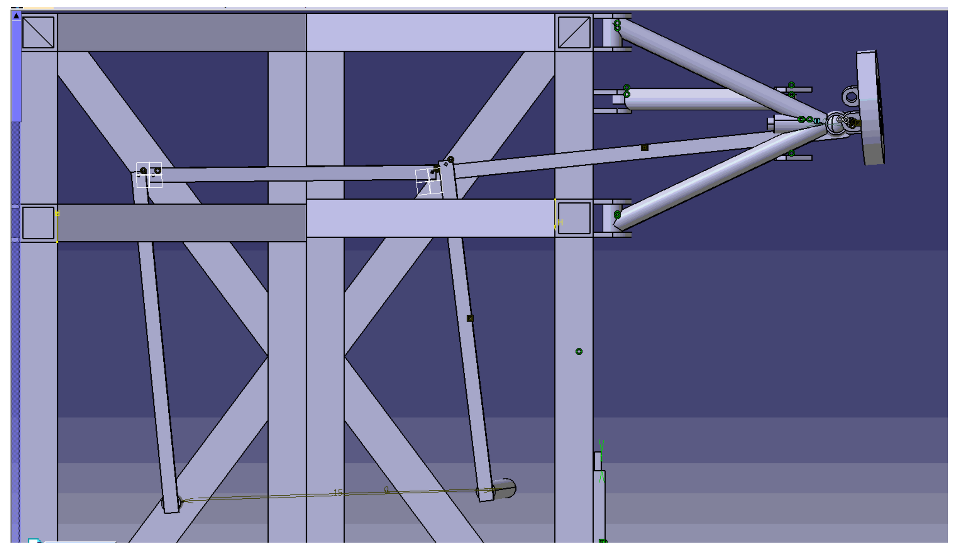
Drivetrain

The drivetrain subsystem includes a NuVinci CVT bike transmission that will send power to a free wheel differential that will ensure smooth wheel rotation while turning. Both drivers are providing power to an axel providing power to all four wheels. The advantage of the CVT in this situation is that both drivers are able to pedal at a setting that is most comfortable to them.



Steering

The under-seat steering assembly functions by using handlebars on the side of the driver to direct the vehicle by using a track and tie rod system to shift the inner wheel in the direction the vehicle is turning. This system, while cost effective, will require maintenance and assembly in order for it to function properly.



Electrical

Per NASA Human Exploration Rover Challenge requirements, every vehicle must be equipped with a simulated high gain antenna, TV camera, two batteries, and an electrical control panel containing a radio, display, and rover controls. Together these systems must be greater than one cubic foot in volume. The planned electrical system for the rover includes an accelerometer, gyroscope, GPS, video camera and viewing screen, warning lights, sensor lights, strain gauges, radio, high gain antenna, batteries, and control panel. The electrical control and viewing panel will be located in front of the rear driver and will allow control of the rover's visibility system and viewing of the sensor data. For the AIAA Telemetry and Electronics Award, the video and/or sensor data must be transmitted in real time to a central station for viewing. Team Ocelot plans to use APRS over an amateur radio frequency to transmit sensor data to a central station and a radio frequency to transmit the real-time video. Sensor data will also be stored for post-competition processing.