Design and Fabrication of an Alternative Wheel for Lunar and Martian Environments – P. Visscher, J. Smith, Ontario Drive and Gear

The successful powertrain system on a planetary rover ultimately depends on the rover's tractive performance. This presentation will describe the development of ODG/Argo's industrial knowledge as culminated in the latest metallic wheel project. The design focuses on traction, durability, and the wheel's contribution to the rover's suspension characteristics. Additional focus is placed on weight management and wear resistance. The common terrestrial equivalent of rubber, pneumatic tires will be compared to this design for performance in lunar analogue conditions. Testing is performed on either a four-wheeled or eight-wheeled, skid-steer lunar rover prototype.

A planetary rover must perform a variety of tasks in difficult terrain; from exploration to excavation in deep soft regolith and on steep, rocky hills. Payloads and tasks vary from transporting large heavy power stations, transporting humans further for exploration, as well as mining and earth-moving assignments. This creates a greater demand for efficiency and accommodation from the traction design.

The ODG/Argo wheel uses flat springs and formed metallic lugs connected by flexible cabling. The flat spring maximizes the contact patch along uneven terrain, increasing the tractive performance of the wheel. The formed metallic lugs grip the terrain to also increase traction. The cabling distributes the load across several flat springs. Iterative designs are created to optimize these geometry constraints and balance traction, suspension capabilities and weight.

While load characteristics will also vary by rover, payload, and job task, putting a variety of constraints and requirements on the tractive performance, the lunar environment will also demand extreme wear capabilities from the traction system. Material selection and coating options are being explored to meet these conditions.

Prototypes will be tested extensively to characterize and improve the ODG/Argo traction technologies. Drawbar pull, steering resistance, deflection versus load, performance over obstacles, impact resistance, and durability will be used as parameters for testing. All testing will be performed on the Canadian Space Agency's latest lunar exploration rovers, with Argo-specific rubber pneumatic tires used as a baseline.