**Design and Fabricating Third Generation Lunar Tracks.** P. Visscher, Ontario Drive and Gear (pvisscher@odg.com)

The purpose of this presentation is to describe and characterize alternate traction concepts that could be used on planetary exploration and/or ISRU rovers. Consideration was given to finding an appropriate compromise between mass, reliability, and traction. Additionally, the traction concepts were evaluated to determine performance and reliability characteristics in a wide variety of terrain, from soft sand to sharp rocks. Ongoing work is aimed at improving traction and reliability as well as reducing mass.

Surface mobility will be a critical aspect of any robotic or manned planetary surface mission. The lunar and Martian surfaces have a wide variety of terrain types. Prospecting rovers must have the ability to climb steep slopes and traverse soft, deep sand, while ISRU-specific rovers require high levels of traction to accomplish land-forming tasks. Whereas their terrestrial counterparts generally rely on rubber pneumatic tires, rubber tracks, or segmented steel tracks to provide high levels of traction in extreme terrain, environmental conditions and mass constraints on the moon preclude the use of these traction devices for space exploration applications. At Argo/ODG, alternative technologies are undergoing development in an effort to provide planetary rovers with high levels of traction that are capable of surviving the extreme environmental conditions. One of these concepts, a metallic track, has been developed and is compared to a baseline rubber pneumatic tire. Further tests intended to quantify various characteristics of extreme terrain mobility are planned using the JUNO rover platform which was designed and built in response to the Canadian Space Agency's interest in pursuing lunar and Martian mobility platform development.

The JUNO Rover is a four wheeled rover with a differentially linked walking beam suspension and skid-steering directional control that was designed to be a robust vehicle that, adaptable to a multitude of ISRU and exploratory activities and payloads. More importantly, the rover was designed to be compatible with both tracks and wheels, thereby providing a platform well suited to evaluating these technologies. Extensive testing was performed at several different analogue sites using pneumatic rubber tires as a baseline.

For many planetary ISRU and land-forming tasks, achieving adequate tractive effort will be a priority. Most research in this field suggest that traction forces are more negatively affected by low gravity than are excavation forces, meaning that planetary mobility traction systems will need to be especially effective. For terrestrial earth-moving applications in which traction and flotation are a priority, caterpillar-style tracks are used almost exclusively. Thus, an effort was made to achieve similar traction characteristics with a design more appropriate for the lunar environment.

The metallic track developed by Argo/ODG shares characteristics of both the heavy-duty steel segmented track and the high performance, lightweight rubber track used more commonly in the snowmobile and ATV industry. Several variations of the metallic track were designed and prototyped. In addition to traction characteristics, consideration was given to reliability, durability, failure modes, and efficiency over different terrain. Test results demonstrate the effectiveness of the metal track, as its traction performance has eclipsed that of the baseline low-pressure rubber tire.

The most recent phase of the project has been undertaken in an effort to reduce the mass of the tracks from 147 kg (for a complete set of two tracks) down to 100 kg. This has been accomplished by replacing much of the steel parts with titanium parts and by downsizing parts where possible. Future testing will include characterization of traction on different soil/ground types as well as a long-term reliability study.