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HUMAN EXPLORATION OF THE SOLAR SYSTEM SYMPOSIUM (A5)
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DESIGN AND DEVELOPMENT OF A LUNAR ROVER IN ASSOCIATION WITH THE GOOGLE™ LUNAR X-PRIZE COMPETITION

Abstract

The United States (US) National Aeronautics and Space Administration (NASA) has not returned to the moon via a manned lunar mission since the completion of the Apollo program in 1972. While on the moon, the Apollo astronauts utilized a motorized, two-person lunar rover to efficiently navigate the lunar surface and perform experiments that accelerated human knowledge of the lunar environment. Since the Apollo missions, no manned or unmanned rovers have been utilized by NASA to explore the lunar surface and, as NASA continues to experience a decrease in its budget, the feasibility of returning to the lunar surface is diminished. However, the X-Prize Foundation and Google™ have collaborated and are providing a $30 million prize referred to as the Google™ Lunar X-Prize in order to instigate a new era of lunar exploration. The goal of the Google™ Lunar X-Prize is to motivate privately funded teams to safely land an unmanned rover on the lunar surface that is capable of traversing 500 meters and transmitting high definition video, images, and data back to earth by the end of 2015. One such team is the Rocket City Space Pioneers (RCSP); comprised of companies including Dynetics, Teledyne Brown Engineering (TBE), Andrews Space, Spaceflight Services, Draper Laboratory, Pratt Whitney Rocketdyne (PWR), Moog, the University of Alabama in Huntsville (UAH), and the Von Braun Center for Science Innovation (VCSI). Additionally, twenty-five other teams aim to develop a rover and landing system to accomplish the tasks set forth by the Google™ Lunar X-Prize competition. In order to aid the RCSP in their endeavor, UAH Mechanical and Aerospace Engineering (MAE) students were tasked with designing and fabricating a ground-based lunar rover. The test article is designed to manipulate its center of gravity (cg) for optimum balance and traction, using 4 adjustable legs, as it traverses terrain similar to that encountered on the moon. The UAH design is referred to as the Leg-Wheeled Lunar Rover (LWLR). The UAH team employed the NASA Systems Engineering (SE) handbook as a guide throughout the design process and performed extensive technical analysis including material stresses and deflection, motor and servo torque calculations, as well as conducting numerous operational tests. The present paper focuses upon the unique LWLR design with an emphasis on the design process, analysis, modeling, fabrication, and testing results of LWLR system and sub-systems.