THE SOONER LUNAR SCHOONER MISSION. M. J. Roman, T. S. Hunt, J. Yoon, D. P. Miller, *School of Aerospace & Mechanical Engineering, University of Oklahoma, Norman, OK 73019*.

Sooner Lunar Schooner: an Educational Design Project

The Sooner Lunar Schooner is a multi-disciplinary ongoing project at the University of Oklahoma to plan, design, prototype, cost and (when funds become available) build/contract and fly a robotic mission to the Moon. The goal of the flight will be to explore a small section of the Moon; conduct a materials analysis of the materials left there by an Apollo mission thirty years earlier; and to perform a selenographic survey of areas that were too distant or considered too dangerous to be done by the Apollo crew. The goal of the Sooner Lunar Schooner Project is to improve the science and engineering educations of the hundreds of undergraduate and graduate students working on the project. The participants, while primarily from engineering and physics, will also include representatives from business, art, journalism, law and education. This project ties together numerous existing research programs at the University, and provides a framework for the creation of many new research proposals.

In the Fall of 2002 a dozen students designed the mission framework for SLS creating an initial requirements document. They also created initial designs for each of the major robotic elements of the mission. The next section outlines the student defined mission to which future parts of the SLS program will be devoted.

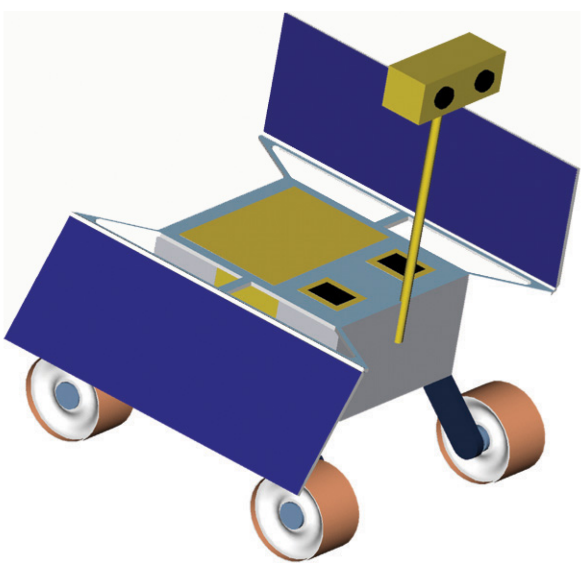

Figure 1: *Long Range Rover to Examine the Luna 21 Landing Site*

The SLS Mission

The proposed space exploration mission developed at the University of Oklahoma is to return to the Moon. The mission will gather scientific information to compare to the data gathered from the lunar surface 30 years ago during the Apollo 17 mission. Two specific sites were chosen to explore, Apollo 17 (30.77 E, 20.19 N) Taurus Littrow and Luna 21 (30.38 E, 25.51 N) Mare Serenitatis. The mission will begin at the Apollo 17 landing site because the surface material of the lunar module (LM) was documented prior to flight. The Data gathered from the lower part of the LM can be compared to these existing documents. The second site, Luna 21, was a Russian Lander that deployed Lunakhod 2 approximately 172 km from Apollo 17 site. This site will be photo-documented.

The mission will be completed during the daylight hours of one lunar day ($\approx$ 14 Earth days). 100kg of equipment will be soft landed on the moon from a decent module. The lander will deploy two rovers to complete the mission tasks on the lunar surface. The two robots will have direct communication with earth to send and receive data. Solar energy will be used as the main source of power for the rover's mobility, navigation, and communication systems

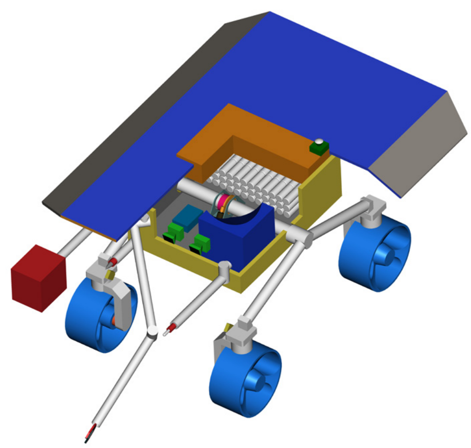

Figure 2: *Cutaway of Science Rover to Examine Apollo 17 Lander*

One rover will immediately start moving toward the Luna 21 site in search of the Lunakhod 2 rover. (See Figure 1) The long-range rover will use a semi-autonomous system based on images received from a stereo camera pair. Route planning around obstacles and navigation toward the goal will be computed onboard. Higher levels of hazard may require remote operation from earth. The rover must travel at approximately 28-cm/s average speed to allow time for recording and sending data back to earth near the end of the mission. The wheels are independently mounted to the chassis through a torsion spring to allow for damping when encountering obstacles. A large percent of the robots travel will be spent moving straight so skid steering will be used to change course because it will more efficient overall. The rover will use 80 Watts of power of operation and mass 40 kg.

The second rover will stay near the Apollo 17 landing site to analyze and photograph the surrounding area (see Figure 2). This rover will have scientific instruments attached that will conduct experiments on the surface of the lower LM. A material hardness test and a fatigue test will be done on a sample retrieved from the metal surfaces of the LM. The rover will use an onboard cutting device, a probe, a robotic arm and a microscope to analyze this sample. Navigation to the LM will be similar to the long-range rover but with a lower average speed of 15 cm/s. The mobility system of the robot consists of four independently driven and steered wheels to allow for increased maneuverability for instrument positioning. The chassis is connected to the suspension through a differential to increase stability while traversing over obstacles. The differential is connected to a motor that will allow the chassis to pitch up and down. This action will be used for two reasons, to increase the reach of the instruments and increase the incident solar flux to the solar panels for recharging the batteries. The overall system will mass 60kg and require 100W of power.