LUNAR SURFACE EXPLORER: A ROVER-BASED SURVEYOR SUITABLE FOR MULTIPLE MISSION SCENARIOS. David A. Kring[1], Joel Rademacher[2], Ben Dobson[3], John Dyster[2], John Kopplin[2], Dave Harvey[3], and Chris Clark[2], [1]Lunar and Planetary Laboratory, University of Arizona, 1629 E. University Blvd., Tucson, AZ 85721 (kring@LPL.arizona.edu), [2]General Dynamics C4 Systems, 1440 N. Fiesta Blvd., Gilbert, AZ 85233, [3]Aerospace & Deployable Structures Division, Foster-Miller, Inc., 350 Second Ave., Waltham, MA 02451.

Introduction: An important component of NASA's Vision for Space Exploration involves a series of robotic missions on the lunar surface, beginning with analyses of permanently shaded regions at the lunar poles to determine if water is stored in the regolith. We propose a lander and rover concept that will generate direct *in-situ* analyses of any volatile components in multiple samples of the regolith. The rover-based mission architecture is robust and affordable and can be used repeatedly for other scientific and testbed lunar missions.

Mission Architecture: Sampling the regolith in permanently shaded craters places operational constraints on the sampling unit. It must rely on either batteries or energy provided from a remote lander in sunlight. Also, the sampling unit must be able to operate in the cold of the shaded region that can approach 40 K. A means of communication with Earth from the shaded region, which may or may not have a line of sight to Earth, must also be provided.

We propose a small rover, deployed from, and in communication with, a lunar lander, which can then relay data to a lunar orbiter and on to Earth (Fig. 1). The lander can provide tethered power and local communications to the rover which is released into shaded lunar craters. The rover can be untethered for missions where solar arrays can be illuminated. Power required by the rover is minimized by offloading data storage and most communication tasks to sunlit elements on the lander, allowing the rover subsystems to be sized to perform only their payload sampling and analysis tasks.

The rover with science payload weighs a total of 50 kg including 30% margin. The electrical power system consists of a single solar array, a charge control unit, and a rechargeable battery. The rover communicates with the lander over a wireless link; the lander stores and relays the data. This lander-rover approach offers the ability to select and negotiate a path to sampling sites in a rugged terrain. The rover battery can be recharged for longer mission requirements via a lander tether or an onboard solar array.

Rover: Utilizing its extensive experience with terrestrial rover design, Foster-Miller, Inc. (FMI), has developed a concept for a general purpose lunar rover. FMI currently produces a line of small rover vehicles for various military and civilian applications. Of these, the Talon robot vehicle is the most widely used, with hundreds of units deployed around the world with the U.S. military, performing reconnaissance and ordnance disposal missions. This experience suggests two design principles need to be emphasized on the Moon. First, the rover must be operationally robust to provide a platform for diverse instruments and operate in a severe environment. Second, the rover must be reliably mobile, with the rover design driven largely by mobility system requirements, which ensures that the rover will remain mobile even if navigational or human errors occur in difficult terrain.

The rover consists of two tractive modules, each of which is a sealed unit enclosed by an elastic loop, or track. The tracks will provide superior traction, operational efficiency, and operational simplicity, especially in uneven terrain, as compared with a wheeled rover. Any additional mass and small losses of turning precision due to tracked vehicle design are offset by the increased reliability of the resulting mobility system. The tractive modules are slightly separated and connected by a single large spar that provides a bridge for power and data. The spar also includes a joint that allows relative pitch between the modules. The spar serves as a mounting location for a multi-stage arm that stows between the tractive modules. This arm can be fitted with various sampling tools and analytical instruments, and it provides much of the required operational flexibility. Additional static instruments can be mounted to the outsides of the tractive modules.

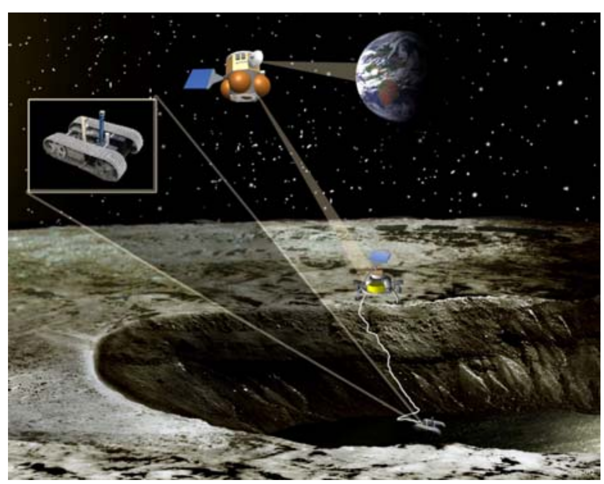

Fig. 1. Lander-Rover concept with wireless and/or tethered communication and power systems.