SAMPLR MISSION PROGRESS REPORT. S.G. Mende[1], S.P. Dougherty[2], and A.G. Levi[3], [1]Maxar Space Robotics, 1250 Lincoln Ave, Pasadena CA 91103, Scott.Mende@maxar.com; , [2]Maxar Space Robotics, 1250 Lincoln Ave, Pasadena CA 91103, Sean.Dougherty@maxar.com; [3]Maxar Space Robotics, 1250 Lincoln Ave, Pasadena CA 91103 Alejandro.Levi@maxar.com

Introduction: The Sample Acquisition, Morphology Filtering, and Probing of Lunar Regolith (SAMPLR) Project is a five degree-of-freedom (5DOF) robotic arm that will collect samples of lunar regolith for other on-board instrument analysis, demonstrate the use of a robotic scoop that can filter and isolate particles of different sizes, and utilize a penetrometer to help determine properties of the regolith. The sampling technology leverages flight heritage from the Mars Exploration Rover project. Partners include the Colorado School of Mines (CSM). The SAMPLR payload is manifested as part of NASA's CLPS (Commercial Lunar Payload Services) Program.

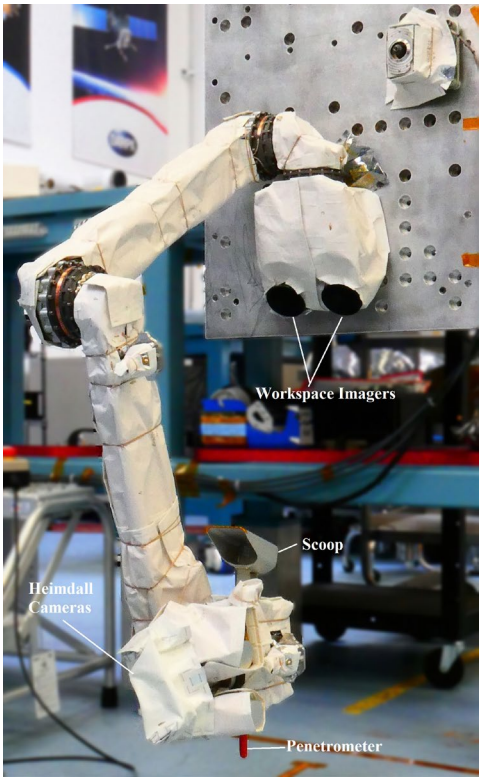

Figure 1: SAMPLR demonstrating penetrometer plunge trajectory

Background: The mission has the following primary objectives:

1. Demonstrate use of the arm on the lunar surface to qualify its mechanisms and topology for use in future missions at varied locations and for use with additional payloads (turret-mounted or unused mounting interface).

2. Capture regolith geotechnical data with a novel penetrometer design leveraging a cone probe proven in a simulated lunar environment (in cooperation with CSM) and a flight force-torque sensor (in production for DARPA RSGS and NASA OSAM-1)

3. Demonstrate the use of the Mars Phoenix lander derived regolith scoop design with integrated sieves to acquire regolith samples and filter them to isolate size distributions of particles (a valuable capability for future payloads)

In addition to addressing the primary mission goals outlined above, SAMPLR will extend the mission capabilities of adjacent instruments and the CLPS lander by enabling optional secondary mission objectives including:

4. Imaging, assessment, and/or mapping of the surrounding terrain and the lander or payloads using arm- and base-mounted visible light cameras.

5. Remove surface regolith using an arm-mounted scoop and study the variation by depth of geotechnical properties using the regolith penetrometer

6. Deliver samples to other lander payloads using regolith scoop and integrated sieves

7. Support turret mounted hosted payload (Heimdall) mission objectives with collaborative operations and instrument pointing.

8. Demonstrate use of variable autonomy technologies to aid telerobotic missions

Features: The modular design allows for a swappable end-effector interface, enabling a wide array of science and infrastructure activities with the current arm layout and associated workspace. Further, this modularity allows for additional extension of workspace/dexterity/flexibility and expanded operational options tailored to specific mission needs.

Status: SAMPLR was originally slated to fly on Masten Space Systems XL-1 to the Lunar South Pole, scheduled for launch November 2023. Unfortunately, Masten filed for bankruptcy in July 2022 (later acquired by Astrobotic Technologies in September of that year) and all payloads were de-manifested and placed on other flights. As of this writing, SAMPLR has completed environmental testing and is in preparation for its upcoming Systems Integration Review /Acceptance Review with NASA.

Acknowledgements: The authors would like to thank the National Aeronautics and Space Administration as well as the SAMPLR Co-I's including Dr. Chris

Dreyer, Dr. Angel Abbud-Madrid, and Dr. Barbara Cohen.

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