THE SILICA INSTRUMENT SUITE FOR LUNAR SCIENCE AND EXPLORATION. T.D. Glotch[1], M. C. McCanta[2], J. T. Cahill[3], L. Jozwiak[3], B.T. Greenhagen[3], P. G. Lucey[4], D. J. Lawrence[3], K. Stockstill-Cahill[3], S.-E. Hamran[5], and K. Carroll[6], [1]Dept. of Geosciences, Stony Brook University, Stony Brook, NY, timothy.glotch@stonybrook.edu, [2]University of Tennessee Knoxville, [3]Johns Hopkins University Applied Physics Laboratory, [4]University of Hawaii Manoa, [5]University of Oslo, [6]Canadensys Aerospace.

Introduction: The Science Investigation for Lithology and Igneous Composition Analysis (SILICA) instrument suite provides integrated imaging, mineralogical, geochemical, and geophysical analyses of future lunar landing sites. The suite is configurable for different mission scenarios and architectures, but the core instruments include (1) a thermal infrared (TIR) hyperspectral imaging system, (2) a gamma ray and neutron spectrometer (GRNS), (3) a ground penetrating radar (GPR)/passive microwave radiometer, (4) a high-resolution stereo camera system, and (5) multispectral microscopic imagers. For missions including a rover, a RoverCam is also available for navigation and regolith characterization.

Instruments: We have performed detailed studies of instrument mass, power, and communication requirements. Here, we provide brief descriptions of the SILICA instruments and the science and exploration activities enabled by their use.

CHILI. The Compact Hyperspectral Infrared Lunar Imager (CHILI) is a hyperspectral TIR imager covering the ~5-20 μm (500-2000 cm^{-1}) range with a spectral sampling of 10 cm^{-1}. It can be used to characterize surface mineralogy, thermophysical properties, and with RILAX, the surface heat flow.

GRNS. The GRNS can detect and measure the abundances of O, Mg, Si, Ca, Ti, Fe, K, and Th using gamma ray spectroscopy and detect and quantify H abundances down to 15 ppm using detections of epithermal neutrons. These capabilities enable the SILICA instrument suite to quantify endogenous or exogenous hydration in lunar surface regolith and characterize major and trace element chemistry in lunar igneous rocks and regolith.

RILAX. The Radar Imager Lunar Subsurface Experiment (RILAX) is a ground penetrating radar that operates from 150-1200 MHz, enabling detection of subsurface reflectors at ≥ 15 m depth, depending on the regolith composition. This enables characterization of landing site subsurface structure and physical properties. RILAX can also operate in a passive listening mode. Passive microwave radiometry measurements, used in combination with a thermal model and surface temperature measurements from CHILI, enable characterization of heat flow at a landing site.

LanderCam/RoverCam. The SILICA imaging suite provides high spatial resolution stereo imaging of a landing site for surface characterization, rock/vesicle size frequency distributions, rover navigation, and hazard avoidance. The stereo Landercam system can provide digital terrain models of the immediate region surrounding the landing site with a spatial sampling of 50 cm/pixel at 50 m distance. RoverCam provides imaging in the immediate vicinity of a rover with a spatial sampling of 300 μm/pixel at 2 m distance.

RMM. The Rover Multispectral Microscope enables characterization of regolith physical and mineralogical characteristics at a resolution of 70 μm from a 20 cm working distance. Mafic mineralogy and space weathering can be characterized through multispectral analysis covering 8 wavelengths from 300-1000 nm.

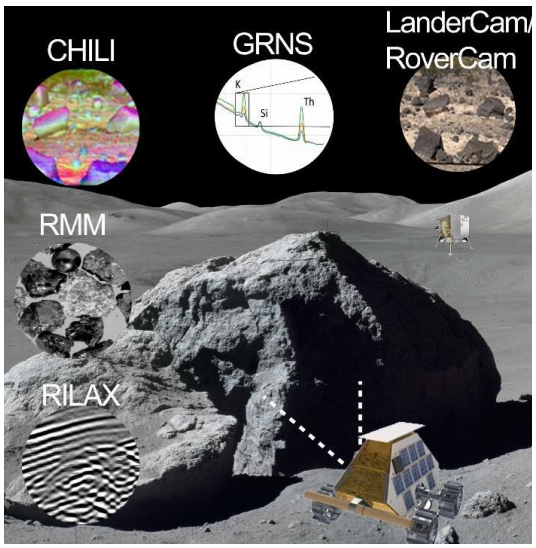

Figure 1. The SILICA instrument suite is designed to provide a comprehensive understanding of a landing site's geochemistry, mineralogy, structure, formation, and evolution through time.

Looking Forward. The SILICA instrument suite is ideally suited for characterization of landing sites by small CLPS missions that include mobility. The suite can be upgraded and augmented for larger missions (Discovery) that require additional surface and subsurface characterization, potentially utilizing multiple rovers.