GEOLAB CONCEPT: THE IMPORTANCE OF SAMPLE SELECTION DURING LONG DURATION HUMAN EXPLORATION MISSIONS. M. J. Calaway[1], C. A. Evans[2], M. S. Bell[1], and T. G. Graff[1]. [1]Jacobs Technology (ESCG) at NASA Johnson Space Center, Astromaterials Acquisition and Curation Office, Houston, TX 77058, michael.calaway@nasa.gov, [2]NASA, Johnson Space Center, Astromaterials Acquisition and Curation Office, Houston, TX 77058.

Introduction: In the future when humans explore planetary surfaces on the Moon, Mars, and asteroids or beyond, the return of geologic samples to Earth will be a high priority for human spaceflight operations. All future sample return missions will have strict down-mass and volume requirements; methods for in-situ sample assessment and prioritization will be critical for selecting the best samples for return-to-Earth [1,2].

Analog Studies: We conducted our first sample characterization tests during the 2010 Desert Research and Technology Studies (DRATS) field campaign near Flagstaff, AZ. The test involved two rovers and a supporting habitat; the rovers conducted scientific traverses for six days and then docked to NASA's Habitat Demonstration Unit 1 – Pressurized Excursion Module (HDU1-PEM). A first generation geological laboratory, GeoLab, was integrated into the HDU1-PEM. GeoLab activities tested HDU1-PEM science operations conducted by astronauts, and preliminary examination of samples to assist scientists making decisions about sample return priorities and concerns [3,4].

GeoLab Hardware: GeoLab was designed to provide a workstation and analog isolation containment system for preliminary examination, curation decisions, and return to Earth prioritization of geologic material collected on a planetary surface [3,4]. This first generation GeoLab was developed around a custom built positive pressure nitrogen environment glovebox equipped with three pass-through antechambers through the shell of the HDU1-PEM. The pass-through antechambers allowed geologic samples to enter (and exit) the main Glovebox chamber directly from the outside, minimizing potential contamination from inside the habitat. The glovebox also incorporates a state-of-the-art environmental monitoring system that can be remotely controlled. Four video cameras provide live situational awareness of the GeoLab workstation and EVA porch area. The 2010 suite of instruments included a stereomicroscope for microscopic inspection of collected samples and image capture; image data was downlinked to the science team. A handheld XRF spectrometer was integrated into the GeoLab for whole rock geochemical fingerprinting; data was also downlinked to the science team. The glovebox also contained a mass balance and ruler for collecting sample mass and dimensions. All instrumentation and cameras are controlled at the workstation with two touch screen computers which are integrated into the HDU1-PEM avionics system and can be fully viewed and controlled in real-time on the remote network for collaboration between the astronaut crew and a supporting science backroom.

Sample Handling and Examination: The first GeoLab tests tried to apply, to the extent possible, extraterrestrial sample handling protocols based on current JSC Astromaterials Curation practices, and proposed sampling methods for future exploration missions providing pristine and working ("sacrificial") subsets of geological samples collected during exploration activities [2]. During the 2010 DRATS tests, the GeoLab team treated the samples collected and chosen for examination in GeoLab as representative "sacrificial" subsamples, assuming that the other "pristine" portion of a sample was already contained in appropriately sealed containers for possible Earth return (minimizing sample contamination and compromise). The DRATS astronauts analyzed samples chosen by the science team; the data collected from GeoLab sample examination was used to help refine the working hypotheses regarding the geologic history of the area and to prioritize the pristine samples that would be selected for Earth return. From the point of collection until samples are delivered to Earth based laboratories for detailed analyses, the use of specialized sealed pristine sample containers, and a glovebox for manipulation of "sacrificial" samples are extremely important for protecting geologic material from contamination and preserving the scientific integrity of each extraterrestrial sample.

Future Plans: GeoLab is a unique workstation design that incorporates a curation glovebox and configurable analytical instrumentation for preliminary examination and characterization of samples for prioritization and curation of collected samples. GeoLab will remain integrated in the habitat for the 2011 DRATS field campaign. We plan to continue using GeoLab as a testbed with new instruments and evolving interfaces for the astronauts and supporting scientists.

References: [1] Shearer, C. et al. (2010) Review of Sample Acquisition and Curation During Lunar Surface Activities, CAPTEM and LEAG Analysis Report. [2] Treiman, A.H. (1993) Curation of Geological Materials at a Lunar Outpost, JSC-26194 and Office of the Curator Publication #187. [3] Evans et al. (2010) *LPSC XLI,* Abstract #1480. [4] Calaway et al. (20102) *LPSC XLI,* Abstract #1908.