LUNAR FIELD EXPLORATION SCENARIOS FOR THREE SORTIES. J. Bleacher[1], P.E. Clark[2], S. Mest[3], N. Petro[1], and L. Leshin[1], [1]NASA/GSFC, [2]Catholic University of America (Physics Department), [3]Planetary Science Institute; all@NASA/GSFC, Greenbelt, MD 20771, Pamela.E.Clark@NASA.gov.

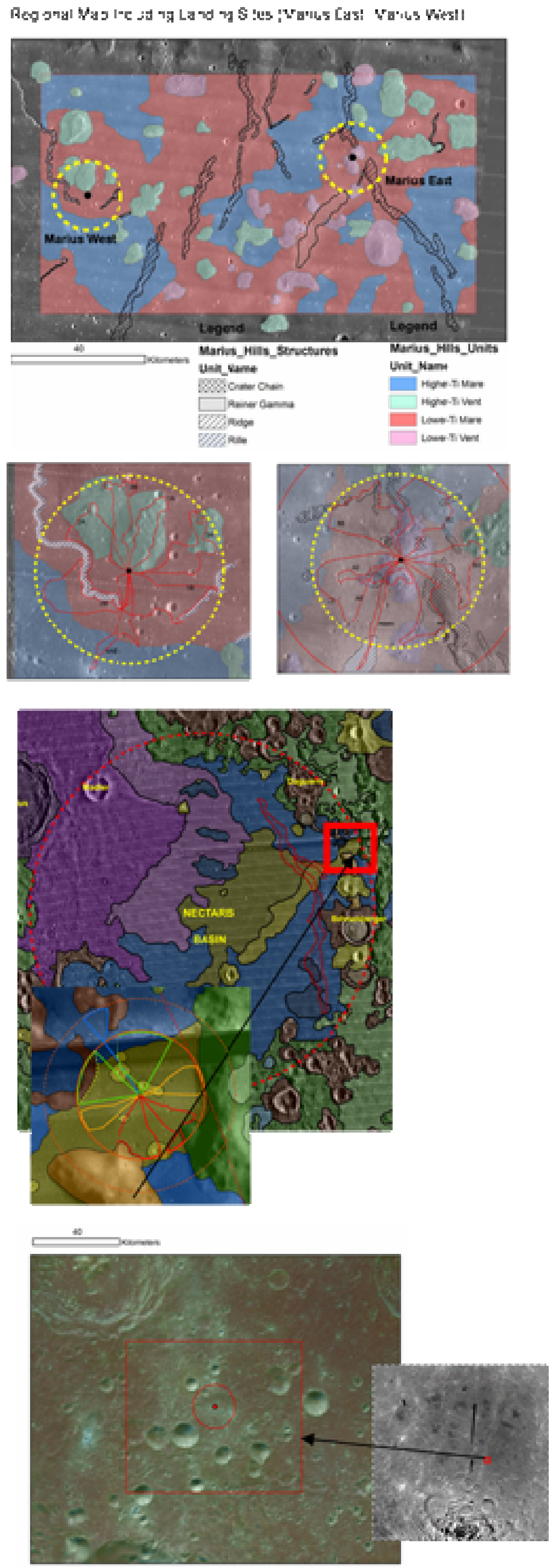
Purpose: The work reported here responds to the need to provide the Constellation Program Office Lunar Surface Systems Project with science requirements for lunar surface system architecture and metrics for lunar surface system operations, and to do so in a way that addresses lunar science goals, as most recently stated by the Lunar Exploration Working Group (LEAG) [1]. In response, the Surface Science Scenarios Working Group (chaired by Laurie Leshin) of the NASA HQ Outpost Science and Exploration Working Group (OSEWG) is attempting to develop science-driven lunar surface activity scenarios utilizing a small of lunar scientists with combined expertise for planning and executing lunar field studies on scales ranging from tens to hundreds of kilometers [2,3,4]. Here, we are reporting the planning of 3 representative science objective-driven Apollo J scale (10 km radius) sortie missions to sites of potentially high science yield to supplement outpost activity [2]. The sites include Marius Hills, Nectaris Basin Edge, and Olivine Hill.

Approach and Methodology: NASA has considered a variety of exploration strategies for the return to the Moon, ranging from an outpost model 'in the middle of nowhere' from a science standpoint, but potentially allowing for field exploration of progressively greater duration and mobility, to variable duration sorties involving landing at sites of particular scientific interest. Local scale (Apollo J mission) sorties require careful advance planning and a degree of luck to select an optimal site to 'sample' a particular feature. Contextual to regional scale field studies significantly enhance what is learned locally, while providing flexibility and enhancing insight into major science questions using carefully selected sites.

We plan extended routes using standard field geology methodologies. Our preliminary reconnaissance is based on assessment of digital remote data and interpretive maps. Stations for study are located at representative or anomalous deposits represent formations or terranes and at contacts and local outcrops illustrating underlying structures. Such exposures would be likely to occur at boulders, distinctive, fresh deposits, and at or near the walls of craters or volcanic structures. In Situ surveying and sampling, including subsurface sampling, techniques, would be used. Regolith samples would represent underlying bedrock composition. Scenarios are asuumed to include 4 astronauts operating out of 2 unpressurized rovers for 1 week, performing 4 8 hour EVAs each. Rover speed and field operations are assumed to occur at the same pace indicated in the Apollo Surface Log [5]. Scenarios scientific merit is considered in terms of the advancement of high priority science objectives, as identified in the latest LEAG roadmap.

Scenarios: (1) We selected two potential landing sites at Marius Hills with access to features that would reveal the full range of lunar mare volcanism styles and ages [6-13]. Features include two major mare formations of different ages (Flamsteed and Marius), the largest variety of volcanic features and deposits seen anywhere on the Moon, including shields, domes, cones, and rilles, as well as the full range of basin-related tectonic features including wrinkle ridges, fractures, and faults. One site would give access to Reiner Gamma magnetic swirl anomaly, the other extended access to a partially roofed lava tube. (2) We selected a landing site at Olivine Hill [14], an anomalously olivine-rich desposit centrally located near Bose Crater and near exposed basin floor in the center of South Pole Aitken Basin. The site is also crossed by a well-defined ray from a crater in the central farside highlands. This site could reveal the age and potential involvement of the mantle in the largest, oldest confirmed basin, as well as the composition of the surrouding farside highlands. (3) We selected a landing site at Nectaris Basin Edge [15] to establish an absolute basis for lunar chronology by establishing the age of the basal event for the Nectarian period. The landing site includes exposed highland basin massif, basin floor, and mare basalt fill and pyroclastics, and could help to establish the the genetic relationship between basin formation and volcanic activity.

Conclusions: Local (Apollo J level) studies at selected sites can yield high science if landing site is carefully selected for access to representative features. and if the site is known with sufficient detail so that no unforeseen mobility access problems arise. Marius Hills had two or three potential sites, Nectaris one preferred site, over the tens of thousands of square kilometers represented in those features. All of these scenarios accomplished (return to habitat) within 1 week using a crew of 4 and 2 unpressurized rovers. A minimum of 500 kg payload plus rovers, minus any stand alone instrument packages, will be required for full up science. The availability of high quality topography and surface roughness data will greatly enhance the capability to plan field study scenarios. LRO will provide considerably improved data of that nature, but, for detailed route planning, such data with resolution on the scale of a meter or less will be crucial.



Three Sorties as Described in the text.

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