EXPLORING HABITABILITY, HYDROLOGY, AND CLIMATE CHANGE ON MARS AT COLUMBUS CRATER. K. L. Lynch[1], J. J. Wray[2], [1]Department of Civil and Environmental Engineering, Colorado School of Mines, Golden, CO (klynch@mymail.mines.edu), [2]School of Earth and Atmospheric Sciences, Georgia Institute of Technology, Atlanta, GA.

The Terra Sirenum region of the martian highlands contains some of the most diverse aqueous environments on the red planet [1,2]. As such it would be an ideal center of focus for human missions, and the Columbus crater is an excellent candidate Exploration Zone for the first human mission to Mars. Columbus crater is a groundwater-fed paleolake basin located in the northwest region of Terra Sirenum (29° S, 166° W), is 110 km in diameter and the basin floor has an average elevation of 920 ± 30m, which is within the elevation criteria for a crew lander. The northeastern section of the basin floor is relatively flat, contains materials of medium to high thermal inertia and would be a plausible location for the primary landing site and habitation zone (Figure 1a) [3].

Columbus crater is known for hosting a large diversity of aqueous deposits and therefore hosts a variety of science ROIs and potential resource ROIs. The first potential science ROI is located in the northeast corner of the basin rim, approximately 13 km northeast from the proposed LS/HZ center (Figure 1b). The largest diversity of hydrated minerals is located in this region of Columbus crater, including the only detection of jarosite and alunite, thus suggesting a diverse aqueous history and groundwater/mineral interaction at this location; this would also be a location that would have a comparatively high probability for biosignatures. The hills on the north central crater floor, located ~7-10 km from the center of the proposed EZ/LS, serve as a potential resource ROI as they contain numerous hydrated minerals, including aluminum and Fe/Mg bearing phyllosilicates and polyhydrated sulfates (Figure 1c). The characteristic bathtub ring and other stratigraphic deposits in the crater rim serve as an ROI for the study of not only groundwater/mineral interactions but also for global climate changes on Mars. Finally, the crater floor is largely covered by a darker rock unit interpreted as a lava flow, variably draped by fine-grained materials interpreted as regional aeolian loess. These have been dated to the Early and Late Hesperian (respectively), while Columbus crater itself and its aqueous mineral deposits respectively date to the Middle and Late Noachian periods, collectively sampling a significant range of martian geologic time in rock units datable via crater counting [3]. These are only a few key examples of relevant ROIs present in Columbus crater and more will be addressed in the presentation.

In summary, Columbus crater meets the basic criteria for an exploration zone, presents diverse science and basic resource ROIs, and should be considered as a viable candidate landing site for the first human mission to Mars.

References: [1] Glotch T. D. et al. (2010) *GRL, 37*(16), L16202. [2] Wray J. J. et al. (2009) *Geology, 37*(11), 1043–1046. [3] Wray J. J. et al. (2011) *JGR, 116*(E1), E01001.

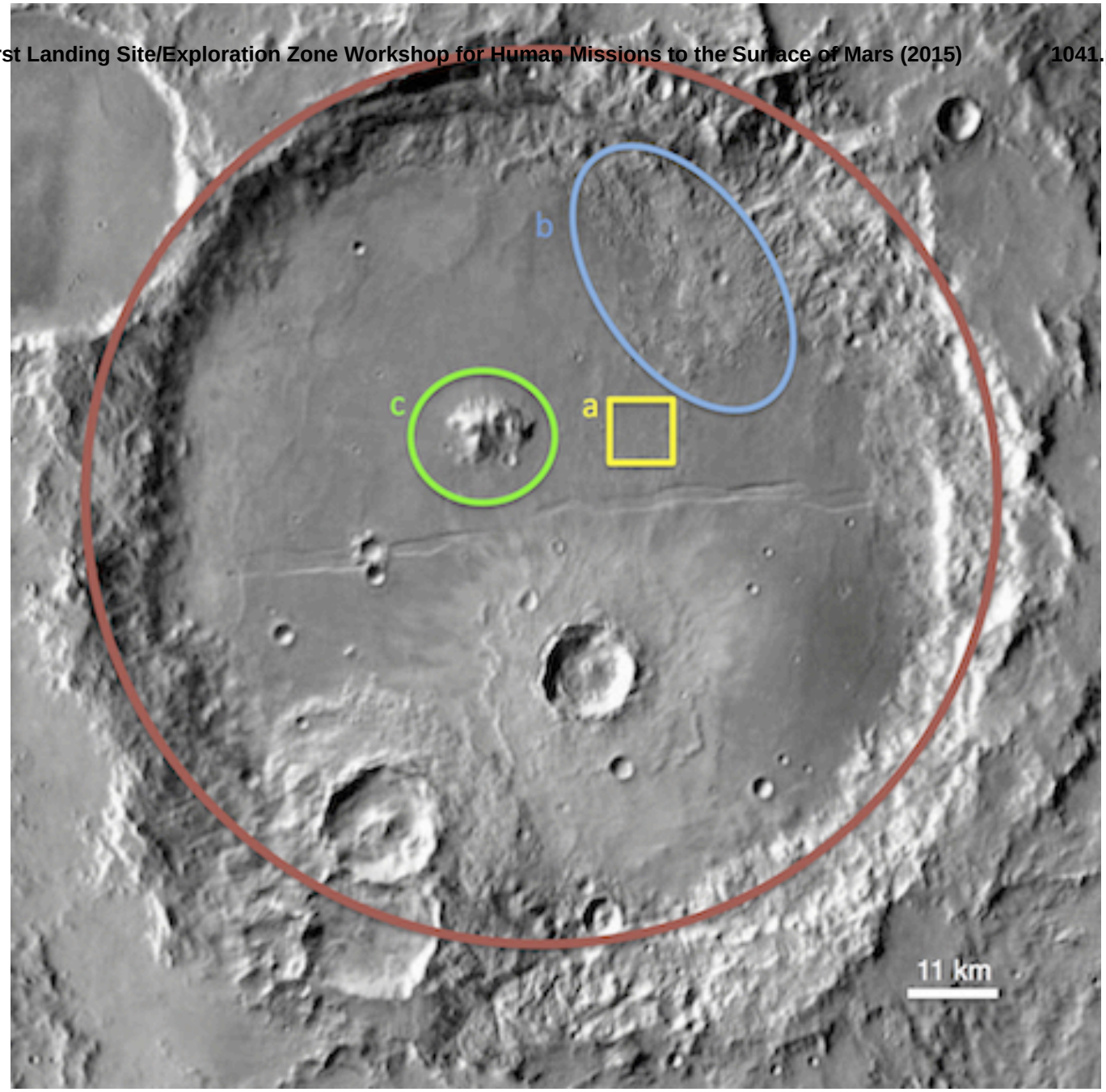

Figure 1. THEMIS daytime IR Mosaic of Columbus Crater . (a) Landing Site/Habitation zone 5 X 5 km. (b) Science ROI. (c) Potential Resource ROI