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Hydrologic Orbiting Observatory (H2O) for Mars

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Anticipated human exploration of Mars will require landing sites near sources of water (comments at MEPAG, 2/24/15; http://mepag.nasa.gov/meetings.cfm). Equatorial or mid-latitude landing sites are more favorable for launch, solar power, and thermal management than polar sites. The best candidates for non-polar water are sites with Recurring Slope Lineae [1] or shallow ground ice down to 39 N latitude [2]. However, little is known about the source, quantities, or salt content of water associated with RSL, or the potential habitability of such sites. There is a clear need for more and better information, both to locate water resources and to address potential special regions for planetary protection [3]. Such data will inform selection of the "megasite" envisioned for repeated human missions. Understanding present-day water is also key to the search for extant life, and a future orbiter may help locate landing sites for a JAXA mission seeking extant life [4]. The Hydrologic Orbiting Observatory [5] has been suggested as a small (Discovery-class) mission designed to better understand RSL [6] and mid-latitude ice. This concept is for a 150 x 530 km orbit, ~45 degree inclination (~sun-synchronous periapse), observing local times from 7AM to 3 PM multiple times per season. Water from RSL should be much more stable (or metastable) at the surface in the morning, but the Mars Reconnaissance Orbiter observes mid-afternoon. The science payload envisioned for H2O includes a near-IR spectrometer and thermal imager that will be able to resolve RSL (<3 m/pixel), very high-resolution imaging, and a sub-mm spectrometer to measure relative humidity and winds near the surface. SAR imaging to detect shallow ice and changes in soil moisture would be a great addition, if affordable. The Mars program also has technology objectives to use solar electric propulsion and deep space optical communication, both of which would be very beneficial to the high-data-rate instruments envisioned for the H2O mission. [1] McEwen, A. et al., Nature Geo. 7, 52, 2014. [2] Dundas, C. et al., JGR 119, 109, 2014. [3] Rummel, J. et al., Astrob. 14, 887, 2014. [4] Satoh, T. et al., Int. Astrob. Workshop, p. 1049, 2013. [5] Paige, D. et al., LPI Contr. 1679, #4235, 2012. [6] McEwen, A. et al., LPI Contr. 1679, #4284, 2012.