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PLUTONS - PITS AND LUNAR LAVA TUBE EXPLORATION FOR PERMANENT SETTLEMENTS

Abstract

Most of the literature and proposals on lunar habitats to date have focused on lunar surface habitats and their evolution into permanent lunar surface settlements. It has been established at least as long as F.Horz(1985) that lunar lava tubes would offer several advantages over surface habitats, especially for building and servicing permanent settlements. They include protection from solar and galactic cosmic radiation, micrometeoritic showers, moderately steady temperature (-20 C) throughout the extreme lunar diurnal cycle, and perhaps a much less dusty interior floor and surface, devoid of the "gardening" process caused by the constant pummeling of micrometeorites and electrostatic charging by the solar wind. It is possible that lunar lava tubes also have features and resources that could support long term human habitation. Haruyama et al.,(2008) using high resolution imagery from JAXA's Selene lunar orbiter discovered naturally occurring breaches on lunar lava tubes. These breaches were further confirmed by the Lunar Reconnaissance Orbiter. They appear to have been made by meteoritic impacts. NASA's GRAIL mission(M.Zuber 2012) pointed to a large distribution of subsurface cavities all over the mid latitudes and the intriguing lack of such features in the lunar polar regions. Recent studies by P.Spudis et al., suggest shield volcanoes and ISU lecturer J.Melosh of Purdue has argued that lunar lava tubes are very sturdy structures. D.Kring of LPI also suggest that lunar lava tubes offer the next frontier for employing advanced technologies for exploration. Recent studies and proposals to explore these features like caves, pits and lava tubes by W.R.Whittaker of CMU have garnered interest, and teams from CalTech and Michigan Tech University and USC have proposed using tethered robots to descend to the interior to explore these subsurface cavities. Analog studies are ongoing in Iceland and Hawaii and around the globe. It is long past time to boldly propose exciting and innovative lunar exploration missions. PLUTONS project concepts presentation lays out ample opportunities to consider fresh approaches to the exploration of lunar lava tubes using state-of-the art technologies coupled with existing hardware.