MOONRAKER AND TETRIS: JAPANESE MICROROVERS FOR LUNAR CAVE EXPLORATION.
Kazuya Yoshida1, Nathan Britton1, John Walker1, 1Space Robotics Laboratory, Tohoku University, Aoba 6-6-01, Sendai, Japan, yoshida@astro.mech.tohoku.ac.jp
Toshiro Shimizu2, Toshiki Tanaka2 and Takeshi Hakamada2, 2ispace technologies inc., Azabudai, Minato-ku, Tokyo, Japan

Abstract: A Japanese team HAKUTO, led by the Space Robotics Laboratory of Tohoku University is developing a low-cost microrover system for exploration of Lunar lava tubes. The development project is motivated by Google Lunar XPRIZE (GLXP). The prize requires 500 m travel on any surface of Moon, but the team is interested in going down through a skylight into undiscovered geological structures underneath the lunar surface.

Skylights are collapses that occur over subsurface caverns or lava tubes. First three such holes were discovered by Japan’s Kazuya orbiter in Malius Hill, Mare Tranquilinitatis and Mare Ingenii [1][2] and more holes were identified by USA’s LRO mission [3]. These places are considered important targets for future lunar exploration and possible human habitation.

The rover system is composed by a four-wheeled rover, Moonraker (Fig. 1) and a two-wheeled rover Tetris (Fig. 2). The total mass of the system is designed to be less than 10 kg [4]. Both rovers are connected by a tether and travel in tandem to approach to a lunar skylight, then on its edge, Moonraker stays as an anchor and Tetris will go down into the hole. See Fig. 3 for a schematic illustration.

The team HAKUTO developed a proof-of-concept model (Engineering Model) of rovers in 2013 and a pre-flight model (PFM) using flight-ready components in 2014, then conducted extensive realistic field tests in a sand dune area in Hamamatsu, Japan. The team is currently working with Astrobotic Technology, an American team challenging to the GLXP based in Pittsburg, to land together in the vicinity of a skylight in Lacus Mortis. HAKUTO and Astrobotic Technology will compete on Moon for the goals of the GLXP, but then cooperate for cave exploration.

References: