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LAVA TUBE-BASED LUNAR/MARS ANALOG STATION IN JEJU ISLAND

Abstract

NASA's Moon to Mars (M2M) plan is expected to be expanded as an international program where participating countries work together to achieve their common goals. NASA recently identified 63 M2M goals falling under four categories, including science; infrastructure; transportation and habitation; operations.

We, scientists and engineers in the government-funded research institutes of South Korea for astronomy and space science, aerospace engineering, geology, food research, energy- and construction- engineering, launched a multi-disciplinary study group to identify our potential contribution to the M2M as an effort to accomplish its exploration goals on the Moon, Mars, and beyond in the coming decades.

Due to the lower near-surface gravity, Martian and lunar lava tubes are respectively 100 and 1,000 times wider than those on Earth, which typically have a diameter of 10 to 30 meters. The large natural structures can provide astronauts with shelter from radiation and meteorite impacts as well as exploration opportunities. Scientists have compiled the catalogs of collapsed lava tubes to build their digital terrain models which can be used for the future site construction.

On Earth, lava tubes are found in Hawaii, the Canary Islands, Australia, Iceland, and Jeju Island in Korea. Jeju Island was formed from the eruption of an underwater volcano 2 million years ago, and it is

well known as a natural World Heritage Site, the Jeju Volcanic Island and Lava Tubes, with more than 170 identified lava tubes. We plan to build a lunar/Martian analog station in one of the lava tubes in Jeju to prepare for the M2M era. Our long-term goal is to build an underground lava tube station using in-situ materials, grow and 3D print foods, manage water and air, generate energy, extract and utilize resources, maintain healthy and safe environment, and operate communication between the underground analog station and the ground control. Through our simulation here on Earth, we want to achieve the capability to construct and operate a self-sustaining habitat based on the principles of circular-economy. In this presentation, we invite scientists and engineers in the field of space science, aerospace, and the other related research area to join this early-stage international endeavor to expand human presence in space.