

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 3 (2C)

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HOW TO BUILD A LUNAR ICE WATER MINE

Abstract

With the Artemis missions on the horizon, Perseverance on Mars, and private space companies bringing space exploration back into vogue, once again the world's eyes now look into space. This modern space age brings promises of returning to the Moon and establishing a human presence beyond Earth's gravity well. The Moon is an ideal testing bed and gateway to the Solar System: mastering resource exploitation on the Moon will allow space to be more than a mere curiosity. Inspired by NASA's Break the Ice Challenge, our team of mining engineers seeks to investigate how a lunar mine could operate. The easiest to obtain, and arguably most vital resource for humans planning to live on the moon is water. Water is necessary for life support, agriculture, hygiene, in addition to serving as rocket fuel. To date, all water used by humans in space has been brought from Earth. However, this strategy is ill suited for a potential lunar colony – water will need to be obtained via other methods. One potential source of water on the Moon is icy lunar regolith, found in permanently dark craters at the lunar poles. This icy regolith will have to be extracted, transported, and processed into water, in a similar fashion to metal ore processed on Earth. Our current focus is on a solution that combines conventional blasting for water ice fragmentation combined with light rail for material haulage to a theoretical water processing facility. Many factors will need to be considered for lunar mining that are not important on Earth. In addition to the limited power, extreme temperatures, permanent darkness, hard vacuum, and reduced gravity, NASA has also identified lunar dust as a significant obstacle. We aim to investigate whether conventional solutions can be used—or whether unconventional solutions will be needed—to excavate and haul modest quantities of icy lunar regolith.