Developing the case for mining resources on the Moon

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ABSTRACT

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Off-Earth industry is expanding at an unprecedented rate. Space tourism and the satellite industry in particular are expected to grow rapidly over coming decades. Exploration and human settlement of the Moon is becoming a high priority on both international government and private organisation's agendas. These ventures and others will require materials for construction, manufacturing and transport fuel. There are three potential sources for these raw materials; direct launch from the Earth, mining from Near Earth Asteroids or mining from the Moon. Known minable resources of interest on the Moon include but not limited to water and other volatile gasses, titanium (ilmenite), metallic iron and nickel, and the lunar regolith itself.

Historically, the costs related to space operations have been severely underestimated. A high amount of financial risk can be therefore implied for interests in Off-Earth mining. Cost-revenue based approaches such as the Net Present Value are traditionally used to assess mining projects on Earth. However with the high level of uncertainty around costs and revenues for Off-Earth mining, their use is limited. The model presented in this paper instead utilises physical sciences and the definition of opportunity cost. This allows direct comparison of market competitors launching materials from Earth to determine the relative competitiveness of an Off-Earth mining operation. This method can be used as another indicator in determining the economic feasibility of an Off-Earth mine in addition to Net Present Value.

The model demonstrates that for certain resources and space based markets it can be more competitive to mine on the Moon than to launch resources directly from Earth or even to collect the same material from asteroids.