Current and Near-term Business Cases for Lunar Water

N.J. Bennett[1], A.G. Dempster[2] and S. Saydam[3]

1.Ph.D. Student, Australian Centre for Space Engineering Research (ACSER), Sydney, NSW 2033. Email: nicholas.j.bennett@student.unsw.edu.au
2.Professor, Director, Australian Centre for Space Engineering Research (ACSER), Sydney, NSW 2033. Email: a.dempster@unsw.edu.au
3.Position title, Australian Centre for Space Engineering Research (ACSER), Sydney, NSW 2033. Email:
…etc

Keywords: Space Resources, Space Mining, Business Case, GEO, Space-Based Solar Power, Mars

ABSTRACT

Although one can conceive of using the million Earth's worth of available material that exists in the asteroids to grow the economy enough to justify Forbes magazine's ten quintillion dollar valuation of asteroid 16-Psyche, there is current and near-term value in Space Resources.

A recent PWC report, referenced by the DARPA LunA-10 program, corroborates our view that propellants (rocket fuel) will be the first and dominant (95%) large-scale lunar resource. Here, we share some work substantiating these prospects.

We present a lunar water opportunity map. We derive an upper bound on capturable value from demand scenarios, astro-dynamically determined propellant consumption, and mission costs. Within decades, one could see the annual production of tens of millions of tons of lunar water worth hundreds of billions of dollars. We provide context for the map with a brief primer on the utility of lunar water (water = propellant = mobility = value) and then detail some scenarios.

It is a truism that lunar propellant suffers a chicken and egg problem; neither customers nor producers will invest first. We showed that a lunar propellant operation could provide value today by orbit-raising satellites to GEO (Geostationary Earth Orbit). Unfortunately, projected revenue is insufficient to fund the development of a lunar mining capability.

There are prospective high-volume markets - GEO orbit raising of large-scale Space-Based Solar Power (ESA's SOLARIS) and the SpaceX Mars Project (a million people on Mars). Capturable value is limited, but we reduced the required mine output by flipping the usual product/by-product pattern, & using a marine messenger line style logistics. The Mars Project creates demand for 1.5 megatons/year of lunar ice, SBSP could be tens times that size.

We can use the Moon as a fulcrum and its water as a lever arm to expand the economy into the rest of the solar system.