Wald – 3/15/16

Lunar ISRU Efficiency Reviews

* Lunar ISRU sizing current accomplished in Lunar\_ISRU.m function.

Results.Lunar\_ISRU.Mass = (6.50 \* O2\_Per\_Month) + 11800; %kg

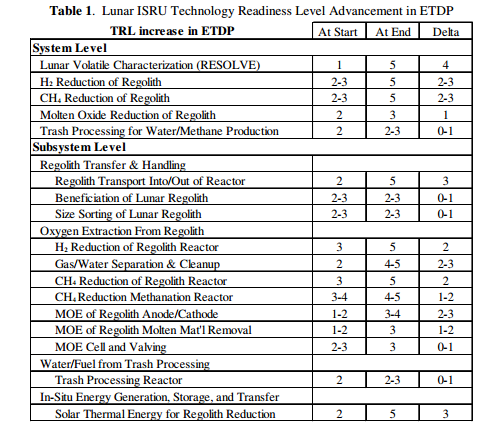
Results.Lunar\_ISRU.Power = (58.2 \* (O2\_Per\_Month/1000)) + 30.8; %kW

This is equivalent to 78 \* O2\_Per\_Year + 11800 kg. We can adjust this sizing to account for potential technology developments in the future.

“Human Exploration Destination Systems” is NASA Technology Area (TA) 7.1 and has a dedicated technology development roadmap covering 2015 – 2035.

**Current Capabilities**

* TRL levels for subsystems required to accomplish lunar ISRU for propellant production are approximately 2 as of 2011.

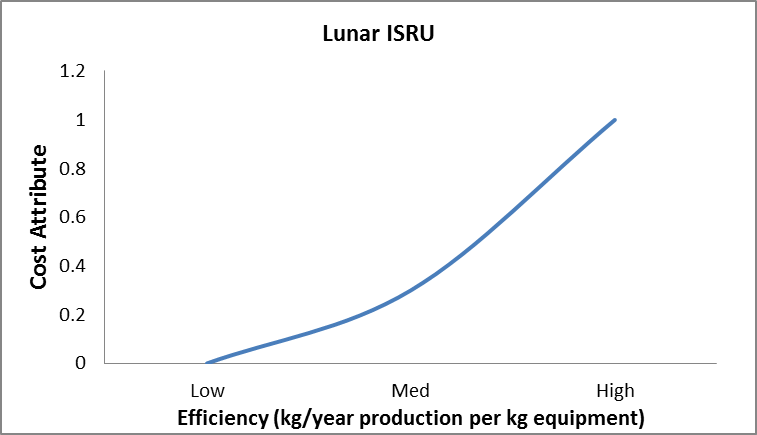


Larson, William, Gerald Sanders, and Mark Hyatt. "ISRU–From Concept to Reality: NASA Accomplishments and Future Plans." *AIA a space 2011 conference and exposition, Long Beach, California, AIAA*. Vol. 7114. 2011.

* Total cost to develop technology for lunar ISRU is approximate $19 billion.
  + Rapp, Donald. Human Missions to Mars. Praxis Publishing Limited, Chichester, UK, 2007.
* Recent similar sensitivity study found break-point to be around efficiency of 1.9 O2\_Per\_Year/ISRU\_Mass.
  + Ishimatsu, Takuto, et al. "A Generalized Multi-Commodity Network Flow Model for Space Exploration Logistics." SPACE (2013).

**Proposed Development Cost Curve**

|  |  |  |  |
| --- | --- | --- | --- |
| Lunar ISRU | |  |  |
| Efficiency | Cost Attriubute | TRL | Cost B$ |
| Low | 0 | 2 | 19 |
| Med | 0.3 |  |  |
| High | 1 |  |  |



**Questions**

* What is the meaning of the “cost attribute”?
* How does cost scale with capacity?