Space Resources Roundtable Title: Enabling Technologies for Asteroid Mining

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Abstract: Asteroids contain various mineral resources that will be useful for space exploration, commerce and settlement. While in the simplest use case the extracted materials may be used without refining or manufacturing, e.g. for radiation shielding, every use case requires a means of delivery that is prohibitive if carrying along earth-launched propellants. Therefore, one of the most important enabling technologies to enable asteroid mining is propulsion based on propellant extraction from the asteroid. The abundance of water in asteroids, and the potential ease of extraction, makes it one of the most attractive propellants. Current commercial water thrusters, including those from Deep Space Industries, are currently small, delivering milinewtons of thrust, and must be scaled up to deliver billions of newton-seconds of total impulse in reasonable timeframes. Given the availability of water and hydrocarbons on Carbonaceous asteroids, other propellant combinations are also possible, with different combinations being more advantageous in different regions of a trade-space that covers energy, storage complexity, specific impulse and thrust. A related enabling technology is solar energy collection, again using asteroid materials. Converted to electricity or thermal energy it can be used to power the thrusters mentioned above, again addressing the transportation challenge. Options under development in this area include direct solar-thermal propulsion and magneto-hydrodynamic electricity generation