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IN SITU RESOURCES ON THE MOON AND MARS: SOME CONSEQUENCES OF THEIR  
APPROPRIATION AND USE

**Abstract**

Numerous human space exploration reports and the history of human exploration and discovery suggest that the use of in situ resources on the Moon or Mars, as well as destinations beyond, will be critical to the transformation of humans from a one-planet species into a spacefaring one. Such resources can be used to support human life in space by being incorporated into mission systems capable of reclaiming breathing gases or re-using human waste, as well as to provide for fuel for travel by rocketry. Increasingly (taking a theme from science fiction) the idea of capturing and trading or selling in situ resources is also growing in favor, and attracting investment funding as well. While it is true that ongoing technology efforts have identified lunar and martian materials that might contribute to resource production on those bodies, it is clear that even if the technology to convert them into usable supplies is perfected, it will not be “free.” For example, ices found at the lunar poles may preserve a record of lunar impacts, and martian ices may preserve a record of martian organics, so their use as bulk commonities needs to be balanced against their scientific value, and the potential for inadvertent exposure to materials that aren’t known to be safe (e.g., possible cyanide in the lunar ices and potential martian life forms buried in the ice). Moreover, martian ices likely cap potential huge (and perhaps inhabited) subsurface aquifers that hold the secrets to life on Mars—and possibly the origin of life in the solar system as a whole. This paper will discuss various forms of in situ resource utilization, and point out the potential benefits and pitfalls of their use, including indirect [1] and direct [2] challenges posed by the Outer Space Treaty, as well as the practical consequences of resource appropriation and use by humans in space. Refs. [1] COSPAR: Planetary Protection Policy (revised 24 March 2011). COSPAR, Paris, France, 2011. [2] United Nations, Treaty on principles governing the activities of states in the exploration and use of outer space, including the moon and other celestial bodies, U.N. Doc. A/RES/2222/(XXI) 25 Jan 1967; TIAS No. 6347, 1967.