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IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Interactive Presentations - IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (IP)

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SUSTAINABLE TRANSPORT CHAINS FOR COMMERCIAL ASTEROID MINING

Abstract

The mining of resources like precious metals and chemicals has been the cornerstone of human civilization for hundreds of years. Since the rise of the Bronze age, humanity has seen a rapid expansion in its development and the demand for natural materials today is peaking more than ever, especially for materials exhibiting superconductive or other desirable properties. With occurrences such as the malicious stockpiling of metals for controlling prices, and the use of political sanctions in the form of restrictions on oil, the stability of a supply of terrestrial resources are under a clear threat. Such pressures give rise to a widely debated concept - Asteroid mining. Asteroid mining is the identification and exfiltration of resources (mostly metallic) contained within the sub-surfaces of an asteroid or a spent comet. In 2001, during what was the first ever landing on an Asteroid, NASA successfully landed the NEAR spacecraft on Eros, a 8.42km long, elongated Asteroid. Such events, combined with legislation such as the U.S. Commercial Space Launch Competitiveness Act of 2015 have given rise to a "second space race" that propels the commercialisation of space, and ultimately leading to asteroid mining. Some of the largest limitations of asteroid mining involve the high cost of spaceflight, asteroid selection for mining and various engineering challenges surrounding ore extraction (the physical mechanism by which asteroids would be mined) as well as transportation of materials (or even asteroids themselves) over long, possibly interplanetary distances. This paper will attempt to address the challenges of asteroid mining surrounding the cost, transport and extraction by proposing a suitable, financially viable chain of transportation for moving payloads from the endpoint (asteroid), through intermediary processing stations, and eventually to Earth or other locations for use. The proposed transport chain will utilise a series of scalable, fixed transport stations funded collectively, ensuring access to all investors, and discouraging separate, dangerous and expensive endeavours where competing companies use their own equipment in a redundant fashion. Instead, taking the opportunity to cooperate in organized systems to increase efficiency. Further features such as autonomous vehicular technology and embedded robotic systems as a component of the

entire transport chain system would reduce the need for physical personnel operating equipment, as well as lessening engineering challenges - resulting in large financial savings that work to ensure that commercialised asteroid mining is accessible to all interested parties as well as accelerating rapid development in the industry.