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SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND
DEVELOPMENT (D3)

Systems and Infrastructures to Implement Future Building Blocks in Space Exploration and Development
(2)

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CONCEPTS AND THEORIES FOR AN ECONOMICALLY ADVANTAGEOUS VENTURE FOR
MINING SMALL SOLAR SYSTEM BODIES

Abstract

This paper summarizes the concepts and the theories for an economically advantageous venture for mining small solar system bodies and dwarf planets developed during a virtual internship by the organization Scientific Preparatory Academy for Cosmic Explorers (SPACE).

Our work focuses on the utilization of the resources in space. A consumption of the mined materials on Earth is only a subsidiary aspect. Our concepts take into consideration the current market in Earth orbit and we assume that this market will develop with growing supply of resources.

Regarding the used technology we developed a concept of modular design. Depending on the venture parameter like type of resource, distance to target body and time frame we use different mining modules for the equipment and cargo module to carry the mined material back to Earth orbit. Both module types can be equipped with an appropriate drive module either to optimize travel time or fuel consumption.

Our concepts cover the various aspects of mining small solar system bodies as they are propulsion, astrodynamics, systems engineering, geology, economics and mining technology. In our work, we propose to give a survey of progress in each of the before mentioned fields.

After that we will develop a framework for mining small solar system bodies. We introduce a number of parameters that can be tuned for future economic analysis of mining projects.

To demonstrate the functionality of our framework, an example will follow. In this example, we select water as the resource and a specific asteroid as the target. We employ low thrust trajectories and also investigate innovative propulsion techniques. Furthermore we have a special focus on earth or space based mining technologies that can be used for the venture.

In a next step, the concepts and theories of our project will lead to a software tool that can be used to make decisions by an asteroid mining company for their ventures. This tool will accept input parameters

like type of resource or time frame of the venture and recommends suitable small solar system bodies and appropriate modules using our framework as well as a database that we will create.