

17th IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE (D4)
Interactive Presentations - 17th IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE
FUTURE (IP)

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PROSPECT COMMERCIAL ROUTES IN THE EARTH-MOON SYSTEM'S SERVICE VOLUME

Abstract

The analyses of samples gathered during Moon exploration missions over the last 50 years, together with several orbital prospections, have shown that the composition of Lunar soil and rocks have in some cases a higher concentration of minerals compared to Earth's. In a foreseeable near-future scenario in which space is a crucial element of the economic system, the mining industry may find useful and more affordable extracting raw materials and resources from the Moon. In addition, processing resources in a microgravity environment in Low Lunar Orbit (LLO) or in Low Earth Orbit (LEO) could result more convenient to the transformation industry. Similarly, flows of materials and goods between Earth and LEO are predictable consequences of current research in the field of microgravity processing, together with a forecasted expansion of human presence in such orbits. Indeed water itself, present on the Moon in the form of water ice, could be a tradable good exchanged in the Earth-Moon System for allowing human life (both on Earth and in space) and for industrial uses (e.g. for food or propellant production). The scenario given in this work foresees a developed market in the Earth-Moon System, in which resources such as water, minerals, processed materials, parts, components, subsystems, systems and final products are gathered, processed, produced, traded and therefore transported among the main hubs, namely Earth, LEO, LLO and the Moon. As long as this work aims to define a link between technical and economic aspects of future trades in the aforementioned System, a regulatory framework based on the existing International and national space laws is thought to sustain the proposed model, and no further speculation on legal aspects is conducted in the study. A technical target of this paper is to assess the sustainability of identified transportation mission profiles, belonging to the described demand-supply model, highlighting the role of Earth-related GNSS (including Galileo) in the utilization of CisLunar Service Volume (CLSV). The authors intend to offer an analysis of the market created by emerging commercial routes connecting the proposed relevant nodes. The hypothetical scenario is then characterised by peculiar technological capabilities and economic factors that mutually enable each other, in the fashion of a closed-system with limited resources.