Paper ID: 63000
student

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

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MOON-TRAM, OR ESCAPE VELOCITY WITHOUT FOSSIL ROCKET PROPELLANT ?

Abstract

The advancement of future Moon exploration will be defined mainly by geopolitic and economic factors. A spacecraft may either be manned or unmanned, but in all cases it will be used for placing payloads, of crew or mineral resources, as was the case in Lunar orbit, all which required fuel and oxidizer.

Considering the risks and estimated costs of the propellant transportation from Earth to Moon, or even the possibility of propellant production from the limited mineral resources (ISRU) and storage on the Lunar surface, it can be concluded that an alternative must be found for the future.

A spacecraft may be launched into outer space from lunar surface using electrodynamic or electromagnetic suspension methods. This approach was already developed in 1960s. Since then, with the rapid advancement of the material science and electric power industry, we are moving closer to the feasibility of an implementation strategy, like the hyperloop project for example.

By developing a lunar tube formed launch system, with its entry side based in a Moon surface crater and an outlet at altitude, a spacecraft can be propelled to achieve escape velocity, minimizing or even eliminating the need for rocket propulsion.

MoonTram is a new concept for launching heavy payloads into Lunar orbit at much lower cost and much greater volume than currently possible. This study focuses on a multidisciplinary approach of the topic and provides an analysis, which starts with an exact Moon surface site based on geographical and topological properties, and continues with considering aspects of physics. Moreover, it examines working principles, raw material needs and structures, and provides concrete calculations.

The MoonTram design is based on existing materials, superconductors and cryogenics, appearing to be technically and economically feasible. It incorporates large safety margins and multiple redundancy for reliability, along with the avoidance of single point failures.

Research objectives is to contribute with additional analysis and perspectives for ongoing and future researches, in order to establish a forthcoming alternative launching system on the Moon and beyond.