

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Small Launchers: Concepts and Operations (7)Author: Mr. Rafael Jorda-Siquier
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ROCKOON SUITABILITY FOR LAUNCHING SMALL SATELLITES INTO LEO ORBITS

Abstract

The access to Space for small payloads is limited by the lack of operational flexibility in heavy lift launchers, high specific costs and pollution constrains. Therefore, an efficient, low-cost and sustainable solution should be found to guaranty the viability of pico, nano and micro payload launches into orbit.

A stratospheric balloon assisted launch (rockoon) allows a light rocket to be lifted up to 100,000ft from where payloads lighter than 50kg could be put into LEO orbits. The balloon release can be performed from any location with nearly non-existent infrastructure and could be reusable in a period of 48h.

From an operational point of view: Firstly, drag losses are minimized thanks to the fact that 98.5% of the atmospheric air mass is below the launch altitude. Secondly, nozzles can be optimized for vacuum conditions increasing the rocket efficiency and finally the required rocket ascent is smaller. This leads to energy savings of 24-30% depending on the propulsion systems and the rocket configuration used, with a consequent reduction of carbon footprint emissions (25%) and competitive cost/kg ratios (6,600 \$/kg).

The operation results are obtained using an in-house c++ software for the balloon trajectory simulation and an open source mission analysis software for the rocket. Comparison with experimental soundings from NESLAB (Near Space LABoratory) has been done with positive results.

All of this leads to the firm conclusion that rockoons are a competitive approach when launching small payloads into LEO orbits and that their performance in critic drivers such as efficiency, cost and sustainability is excellent. A positive impact could be achieved on Space exploration if universities, space entrepreneurs and research groups could access inexpensive small payload launching systems.