SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Small Launchers: Concepts and Operations (7)

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FEASIBLITY OF A LOW-COST SOUNDING ROCKOON PLATFORM

Abstract

This paper presents the results of analysis and simulations for the design of a small sounding platform, dedicated to conducting scientific atmospheric research and capable of reaching the Kármán line by means of a rocket launched from it. While recent private initiatives have opted for the air launch concept to send small payloads to Low Earth Orbit, several historical projects considered the use of balloons as the first stage of orbital and suborbital platforms, known as rockoons. Both of these approaches enable the minimization of drag losses. This paper addresses the issue of utilizing stratospheric balloons as launch platforms to conduct sub-orbital rocket flights. Research and simulations have been conducted to demonstrate these capabilities and feasibility. A small sounding solid propulsion rocket using commercially-off-the-shelf hardware is proposed, including new low-cost concepts. Its configuration and design are analyzed with special attention given to the propulsion system and its possible mission-orientated optimization. The cost effectiveness of this approach and its impact on the environment is discussed. Performance calculation results and comparisons with existing commercial vehicles are shown. Additionally, sensitivity study results for different design parameters are given. Minimum mass rocket configurations for various payload requirements are presented. The ultimate aim is to enhance low-cost experimentation maintaining high mobility of the system and simplicity of operations. An easier and more affordable access to a space-like environment can be achieved with this system, thus allowing for widespread outreach of space science and technology knowledge. This project is based on earlier experience of the authors in LEEM Association of the Technical University of Madrid and the Polish Small Sounding Rocket Program developed at the Institute of Aviation and Warsaw University of Technology in Poland.