

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

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DESIGN STUDY OF THE SMALL ROCKET LAUNCHER USING AN
ENVIRONMENTAL-FRIENDLY PROPELLANT

Abstract

This paper gives an overview of the results of conceptual design study of a small rocket launcher that was performed at the Institute of Aviation in Warsaw, Poland. A launcher for small satellites needs to follow the design philosophy that should result in simplicity, reliability and cost efficiency to be able to compete successfully at a global commercial market level. The discussed issue will be the application of innovative and low-cost propulsion approach to various pressure-fed space transportation systems, including those for first and upper stages. The analysis of the rocket configuration, propellant considerations, existing tools for launcher design, manufacture and testing are presented shortly in the article. The development and operations costs along with payload market analysis are also included.

Two possible configurations of the rocket have been considered for evaluation it as a launcher capable of delivering a nano/small satellites to LEO orbit. The two stage rocket with the first stage propelled by a turbo-pump rocket engine has been considered. The second option that has also been investigated is the three stage rocket with all pressure fed liquid engines. The results of propellants trade-off studies are presented as well. Their maturity status in space propulsion technologies, availability and advantages in comparison with the currently used propellants has been discussed. All considered propellants have been assumed with the use of the High Test Peroxide as an oxidizer. A reasonably wide range of expertise gained, also at Space Technology Department during the development of various propulsion systems based on highly concentrated hydrogen peroxide – that is hybrid, mono- and bi-propellant rocket engines and sounding rockets – has been summarized and highlighted too. The importance of such experience and knowledge, especially in the context of small rocket launcher design, manufacture and exploitation has been encompassed.