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Small Launchers: Concepts and Operations (7)

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MULTI-CRITERIA DECISION-MAKING PROCESS FOR SMALL LAUNCHER CONCEPTS

**Abstract**

A three-staged launcher weighing 200 tons at liftoff, capable of transporting 1.5-ton payload from the NARO space center in Korea to 700 km Sun-Synchronous Orbit entered the final phase of development, success of which greatly relies on the performance and reliability of newly-developed Lox/Kerosene engines with 7-ton and 75-ton thrust forces. Both engines successfully passed qualification phase. As part of this Korean Space Launch Vehicle program, the second stage was modified into a single-staged test vehicle equipped with one 75-ton force engine, the performance of which was flight-proven in 2018.

This study will be an exploratory research, in which various concepts of launchers including one that uses the test vehicle as a first stage. The goal is to design various small launcher configurations and pick the one that can carry 500 kg to 500 km in the most economical way in order to provide more flight opportunities for the growing sector of small satellites. In this article, we focus on tuning the Multi-Criteria Decision Making (MCDM) process for our selection of launcher concepts. A systematic approach has been devised to evaluate launcher concepts in terms of development and production cost, manufacturability, operability, availability, reusability and payload mass ratio. These conflicting attributes of different criteria are weighted and the small launcher concepts are compared based on our MCDM process composed of the Technique for Order Preference by Similarity to the Ideal Solution and Analytical Hierarchy Process in order to clearly describe the decision rationale behind the chosen concept. In the full paper, we will elaborate on the analysis results of small launcher concepts including staging and cost estimation and the results of comparing launcher concepts using MCDM in details.