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A REUSABLE LAUNCH VEHICLE DEMONSTRATOR FOR THE FUTURE TECHNOLOGY DEVELOPMENTS IN KOREA

Abstract

Developing a series of demonstrators that have increasing size and complexity is a fairly popular approach among those who seek to realize futuristic concepts step by step. We flew a suborbital vehicle with a 75-ton Lox/Kerosene engine successfully and passed the qualification phase for a 7-ton engine, both of them are combined to form a three-stage vehicle. The launch range of the NARO space center is filled with a group of islands sporadically located, which not only limits the azimuth angle, but also staging options for multi-staged, expendable launchers. Staging a two-stage launcher with 75-ton and 7-ton engines can be demanding under this geographical constraint as a half of mission Delta-V must be allocated to the first stage in order to have the jettisoned first stage fly over an area, located 1400 km downrange. Improving the specific impulse of the engine significantly by switching to a different engine cycle and reducing the structure-to-propellant ratio by adopting new lightweight materials can be risky and expensive. Alternatively, a demonstrator model equipped with auxiliary control such as grid pins can be used to test aerodynamically steered descent of the jettisoned first stage, which reduces the size of impact point dispersion area in an order of magnitude and relaxes the impact point requirement.

A Korean-version of the future launcher preparatory program is highly desirable as it might expand space mission capabilities. To develop and demonstrate launcher reusable technologies, we propose a small low-cost vehicle model, which is composed of 1) 2 5 kN class pressure-fed LOX/LNG engine, 2) composite tanks and light weight fuselage, 3) gas thrusters for RCS, 4) integrated avionics, and 5) aerodynamically

steerable fins. By using this demonstrator, we are going to develop and test the GNC algorithms for vertical take-off and vertical landing at low altitude and speed. In parallel, a numerical model can be used to investigate the feasibility of reducing final dispersion of impact point significantly via simulating the unpowered, aerodynamically steered descent phase of a jettisoned first stage.