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Author: Mr. Ryoma Yamashiro

Japan Aerospace Exploration Agency (JAXA), Japan, yamashiro.ryoma@jaxa.jp

Dr. Shinichiro Tokudome

Japan Aerospace Exploration Agency (JAXA), Japan, tome@isas.jaxa.jp

Dr. Kazuhiko Yamada

Japan Aerospace Exploration Agency (JAXA), Japan, yamada.kazuhiko@jaxa.jp

Mr. Takayuki Imoto

Japan Aerospace Exploration Agency (JAXA), Japan, imoto.takayuki@jaxa.jp

SYSTEM DESIGN OF MULTIPURPOSE REUSABLE ORBITER SUITABLE FOR SMALL LAUNCH  
VEHICLE

**Abstract**

Many small launch vehicles are being developed and operated to meet the explosively increasing demand for small satellites. Taking this opportunity, we are studying a multipurpose reusable orbiter to be launched by a small launch vehicle. Such orbiter will add further value to small missions and promote space utilization. In this paper, we report the results of the system investigation on a 1.5-ton class reusable orbiter to be launched by the Epsilon Launch Vehicle and then return to the sea after performing its mission in orbit.

Generally, mass design for a reusable orbiter is difficult because it needs a propulsion system for deceleration to reentry speed and a TPS (Thermal Protection System) required for reentry. Additionally, a conventional reusable TPS has a downside in operational performance as demonstrated by the Space Shuttle. In order to solve these problems, we conducted a trade-off study of propellant and evaluated the application of our innovative aeroshell system based on its sub-size flight test. These results are also included in this paper.