

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

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SYSTEM STUDY OF REUSABLE ORBITER FOR EPSILON LAUNCH VEHICLE

Abstract

Since its debut in 2013, the Epsilon, alongside the H2A/B launch vehicles, has been playing a central role as a Japanese flagship space transport system.

The fundamental purpose of the Epsilon is "to increase players in space development by the small launch vehicle with excellent operability." To this end, the Epsilon successfully launched two science satellites "Hisaki" and "Arase" on the first and second flights respectively, one commercial satellite "ASNARO-2" on the third, and a ridesharing mission of seven satellites from universities and a startup on the fourth. These launches contributed to an increase in newcomers to space.

To provide users with easy access to space at low cost and with high operability, we have started a project, temporarily called the Synergy Development, focusing on fundamental renewal of the third stage and the payload-mount stage. This project also includes development of some components such as Epsilon's first stage motor and avionics devices to be shared with the H3 launch vehicle, the successor of H2A/B.

One of our future concepts is the system with a reusable orbiter that can perform operations in space and return to the earth. Such a system will allow more people to participate in space development. We are now studying several versions of this system which differ depending on which part of the present Epsilon is to be replaced. This paper discusses four versions of the system: the version 4, an orbiter mounded on the same position as the current main payload; the version 4A, a version 4 derivative with an aeroshell system; the version 5, an orbiter as a replacement upper part including the PBS (Post Boost Stage) and the payload-mount stage; and the version 6, an orbiter as a replacement upper part including the third stages, the PBS and the payload-mount stage. Also described here are several elemental technologies such as a light and highly-operative liquid rocket engine or a structure with generative design to realize these versions.