SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Upper Stages, Space Transfer, Entry and Landing Systems (3)

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REENTRY DEMONSTRATION OF DEPLOYABLE AND FLEXIBLE AEROSHELL FOR FUTURE ATMOSPHERIC-ENTRY VEHICLE USING SOUNDING ROCKETS

Abstract

A flexible aeroshell for atmospheric entry vehicles has attracted attention as an innovative space transportation system because the aerodynamic heating during the atmospheric entry can be reduced dramatically due to its low ballistic coefficient. We have been researched and developed a capsule-type vehicle with a flare-type deployable and flexible aeroshell sustained by an inflatable torus from since 2000 in order to apply its concept to future missions, for example, a reentry and recovery system from LEO and/or a planetary entry probe. We will carry out a reentry demonstration using a sounding rocket as an important milestone in the development in this year.

The experimental vehicle which has a 1.2-meter diameter flare-type thin membrane aeroshell sustained by an inflatable torus was already developed and is ready to flight for the reentry demonstration. The experimental vehicle consists of a capsule-type main body, a thin membrane flare and an inflatable torus which made from mainly ZYLON textile. The total mass of the experimental vehicle is less than 20kg and its ballistic coefficient is about 15 kg/m2.

In the reentry demonstration, the experimental vehicle reenters the atmosphere from an altitude of 150 km and experiences a hypersonic free flight where the Mach Number is 4.5 and the moderate aerodynamic heating where the heat flux at a stagnation is about 20kW/m2. In the final of the demonstration, the experimental vehicle makes a splashdown with the terminal velocity in 17m/s in 1000 seconds after passing the top of the trajectory. In the free flight, the various data which include the behavior of deployable and flexible aeroshell, the flight trajectory of the vehicle, the attitude of capsule-type main body, the temperature on the aeroshell and so on, were measured by on-board sensors in order to confirm the performance of the flexible aeroshell as a decelerator. All of the flight data and the aeroshell images will be transmitted to the ground station by a data transmitter and a video transmitter.

In this paper, the design and development of the experimental vehicle for this reentry demonstration using a sounding rocket is introduced and the preliminary results of this reentry demonstration will be reported.