

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)  
Future Space Transportation Systems (4)

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SYSTEM STUDY OF UPPER-STAGE REUSABLE LAUNCH VEHICLE WITH SOLID ROCKET  
BOOSTER**Abstract**

Although reusable launch vehicle's necessity and significance, being cost-effective, eco-friendly and reliable, have been recognized in a long time, practical system still has never been realized except the Space Shuttle. There are two main reasons in this. One reason is that reusable vehicle's recurring cost is high. The other reason is that reusable vehicle, especially that upper stage, have the problem of aerodynamic heating during re-entry. We are considering new upper stage reusable launch vehicle with solid rocket booster, which clear these problems concerning reusable launch vehicle. For the first problem on the recurring cost, the application of the auto inspection system which is cultivated in solid rocket motor's development and launch operation is being considered. That is expected to reduce the inspection cost drastically after the vehicle flight. For the second problem on the re-entry, challenging technologies are applied in the upper stage. Those are material and structure with heat tolerance and lightness, active-cooling system to share the hydrogen with the liquid propulsion system, advanced guidance and control system, and so on. On the other hand, to the lower stage or booster, application of solid rocket is considered. Since the challenging upper stage's size is expected to vary through the iteration of design cycles, the lower stage should be stable and flexible with the thrust level in development phase. Because solid motors of various sizes are developed in JAXA/ISAS since the first small solid motor started to be developed in 1954, those development method has been efficiently accumulated. Then this legacy's utilization for the new system is expected to be quite beneficial. On these technological backgrounds, this paper describes the system study for new upper-stage reusable launch vehicle with the solid rocket booster.