

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

Author: Mr. Ma Chao

China Academy of Launch Vehicle Technology (CALT), China, machao@ase.buaa.edu.cn

Mr. Pan Hongjiu

Beijing Institute of Nearspace Vehicle's Systems Engineering, China, hr910@163.com

FUTURE INVESTIGATION OF CREW RE-ENTRY VEHICLE (CRV) FOR SPACE STATION

Abstract

Along with utilizing and exploring the space in depth, human already has the high thrust launch vehicle and the international space station, and has to face the challenge that how to transfer the crew safely, reliably, rapidly, and efficiently. Based on analyzing the present and future designs of re-entry vehicles (CRV) in several countries, an innovative scheme of lifting re-entry vehicle based on lifting-body configuration was proposed, which doing hypersonic and long-range flight by means of thin atmosphere environment, controlled by aerodynamic surfaces or the thrust-vectoring device combined, and applying lifting re-entry and vertical launch/recovery techniques. The lifting-body configuration vehicle is more adaptive for the future manned spaceflight missions, which requires reusable crew transfer vehicles, and pursues the lower launch cost. Different from the traditional manned capsule design which applied the spherical segment cone configuration, the lifting-body vehicle not only has better re-entry flight quality, but also has higher precision landing capability and large-scale maneuverability, and the thermal protecting system has better maintainability. The primary design of the crew re-entry vehicle based on lifting-body configuration was introduced, and the characteristics of the lifting re-entry trajectory were analyzed mainly, which was compared with ballistic and semi-ballistic re-entry. The technical approach of lifting-body vehicle was discussed, and two key technical aspects were analyzed, which were aerodynamic configuration and flight control. Several key techniques were analyzed, such as thermal protecting system, and landing system. Finally, the development approach of this re-entry vehicle for crew transfer was discussed, and the future research direction of which was proposed. By means of lifting re-entry flight technique, the next-generation safer and lower-cost space transportation system can be realized as soon as possible.