HUMAN SPACEFLIGHT SYMPOSIUM (B3)
Advanced Systems, Technologies, and Innovations for Human Spaceflight (7)

Author: Mr. Jian Guo
Beijing Institute of Aerospace Technology, China

Dr. Hongwen Zhang
China
Dr. Chengqi Guan
Beijing Institute of Aerospace Technology, China
Dr. Jian Zhuang
Beijing Institute of Aerospace Technology, China
Dr. Zhiyong She
Beijing Electromechanical Engineering Institute, China
Dr. Xingdan Wang
Beijing Electro-Mechanical Engineering Institute, China

RESEARCH ON THE CONCEPTUAL DESIGN OF THE TSTO COMMERCIAL CREWED SPACE PLANE POWERED BY TRRE

Abstract

Manned space flight is a important field for the application of the aerospace technologies. Since Yuri Gagarin fulfilled the first LEO task for humankind, the crewed space transportation system has been mainly evolved through three phase. The first is the development of the expandable rocket and small manned spacecrafts such as Soyuz, which is still the most mature manner for the International Space Station maintenance. The second is delegate to the space shuttle, a half-reusable rocket-power vehicle, which was hosted with demands of lower cost, more convenience and multi-task. However, the operation of space shuttles violated the original design intention. The third phase is delegate to the reusable manned spacecrafts deployed by expandable rockets, which aims to reduce the launch cost and avoid system risk of large RLV. The potential of air-breathing launch vehicle for space transportation has been increasingly attracted more attention during past decades. The technical breakthrough of ramjet, scramjet and combined engine researches provides firm confidence on hypersonic air-breathing launch vehicle in recent future, although there are still many technical issues to deal with. The purpose of this paper is to investigate the application of the TRRE to the first stage of a TSTO Crewed Space Plane. The mission of the vehicle is to deliver 6 person and 5 ton cargo at the same time to the space station. The second stage rocket separated at Mach 6-8 and carried payloads to fulfill the transportation task. The first stage fly back to the original launch site. This paper is organized as follows. In section II, the flight profile of the delivery task is introduced. In section III, the TRRE and the reusable rocket engine are preliminarily designed for the first and the second stage of the TSTO system. In section IV, the trajectory for the launch mission is designed and compared with the TSTO RLV powered by RBCC engine. Results shows that the application of TRRE could effectively decrease the fuel consumption and the gross weight of the vehicle.