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

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RE-ENTRY AND LAUNCH PROPOSALS FOR AN ADVANCED ISS CREW TRANSPORTATION SYSTEM

Abstract

The termination of the Space Shuttle program corresponds to a radical change of the Space scenario for human Space flight activities. In fact, the Shuttle was the only available human-rated vehicle able to provide human access to Space and to perform a non-ballistic re-entry into the Earth atmosphere. Human access to Space with air launch of a winged crew vehicle to LEO (e.g. to the ISS) and its Earth re-entry as a conventional glider are considered in this paper. A high lift-over-drag Spaceplane has been preliminarily considered in the frame of a joint research project between DIAS (University of Naples) and OHB-System (Bremen). Its high aerodynamic efficiency and relatively low wing loading allow to perform a non conventional atmospheric re-entry with relatively high down and cross range and with reduced sensed deceleration, aerothermal and mechanical loads. These performances are beneficial to significantly increase flexibility, comfort for the astronauts during re-entry, for ill or de-conditioned crew members and, eventually, to open opportunities to Space tourism. The very recent activities at Stratolaunch system (Huntsville) and at the Space Port (New Mexico) confirm the renewed interest for manned missions that will take full advantages of the aerodynamic lift forces during both the ascent and re-entry phases of airplane-like vehicles. The air launch is very attractive because the airplane may be seen as a Flying Launch Pad that can serve any location on Earth, will save a large amount of propellant mass, can reduce the boosters dimensions, is exposed to a reduced dynamic pressure, takes full advantage of the mother airplane speed, orientation and altitude at the time of the release. Finally, the propulsion system of the launch vehicle (LV) can benefit from the lower ambient pressure and the overall system efficiency might be increased. On the other hand, good propulsion efficiency and very low structural coefficients of the LV are required to launch a sufficient useful final payload mass. The study shows that a payload mass in the order of 7 tons can be placed into low Earth orbit using a multistage propulsion system with a total mass of 220 tons (i.e. a rocket in the class of a subscaled Soyuz launcher), air-launched from an altitude of about 10 Km at a velocity of 200 m/s.