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NEW BALLISTIC APPROACH TO SOLVING TASK OF THE RETURNED DESCEND VEHICLE (RDV) IN THE MOMENT OF EXACT ACCURACY OF RDV ARRIVAL AT THE RUSSIAN SPACEPORT "VOSTOCHNIY" LATITUDE

Abstract

This report presents the results of ballistic design studies on a feasibility of a new approach to the direct landing of the returnable descend vehicle (RDV) problem solution ensuring high precision of RDV arrival at the spaceport "Vostochniy" latitude. A new approach to solve the specified task is to form the correct ballistic angular spatial position of the apsidal line of elliptical orbit of the returnable spacecraft (SC). The main criterion for the quality (feasibility) of the angular position of the apsidal line of the returning spacecraft's (SC) orbit is to ensure the requirements of the latitudinal location SC on entering the Earth's atmosphere. In this case it is necessary to keep the entry point latitude φ(e) of SC (in absolute value) less than the latitude of the required landing site. The report contains ballistic research project, which is addressing the problem of direct RDV landing in the required region of the spaceport "Vostochniy" territory for the two types of devices: for small-sized automatic spacecraft during the descent from the elliptical orbit of Earth's satellite; for manned spacecraft, which is an integral part of the prospective manned transportation system (PMTS), during the descent from an elliptical orbit on the returning stage of the Moon-Earth mission completion. The decisions has been made to adopt maximum allowable value of latitudinal error of closure as a criterion for the accuracy $\Delta=\{\varphi\text{-}\varphi(\text{p})\}$ is less than 0.025 degree, where φ(p) is a latitude of the required landing area for RDV of the spaceport "Vostochniy" territory. To consider options for a small-sized spacecraft, the best numerical value of the criterion is within the range of $\Delta\varphi$=(-0.0037)-(+0.0033) degree. To consider options for RDV, which is part of the PMTS, the best numerical value of the criterion is within the range of $\Delta\varphi$=(-0.0215)-(+0.0160) degree. The presented results of ballistic design solutions of these two considered options of RDV, which would ensure direct and accurate latitudinal landing each of the devices in the correct place of the spaceport "Vostochniy" territory, demonstrate constructive and feasible approach to solving the considered task.