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SPACE LAUNCH GROUP PLANNING TECHNIQUE FOR MANNED SPACE STATION CONSTRUCTION

Abstract

The launch missions for the manned space station construction are characterized by strong constraints of spacecraft orbit and launch site, as well as tight coupling between multiple launch missions. It is a huge challenge for space launch planning to meet the overall requirements of engineering for reliability, safety, and efficiency. The space launch group planning technique is proposed based on the constraints of space rendezvous and docking and the coupling relationship between space launches using different types of launch vehicles, with the background of manned space station construction. The objective is to design a space launch program that meets the requirements of reliability, safety, and efficiency within the specified timeframe. First and foremost, the four-dimensional space launch group-planning diagram is designed using isochrones, which refers to the in-orbit space station, two launch sites, and the aerospace manufacturing plants. In the second place, a reliability evaluation function based on reliability growth, launch opportunity increase, and launch window lengthening is proposed. Additionally, a safety evaluation function based on emergency rescue launch, and a benefit evaluation function based on parallel operation of multiple launch sites are introduced. Ultimately, taking the construction of the Chinese space station as an example, the feasibility of this technology was verified. The result indicates that the space launch group planning designed using the technology proposed is highly consistent with the engineering practice results.