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CISLUNAR SPACE TRANSPORTATION SYSTEM OF LARGE-SCALE CISLUNAR EXPLORATION AND EXPLOITATION IN FUTURE

Abstract

Nowadays, the global space science and technology are developing rapidly, and the global space has entered a new era which is represented by large-scale internet constellations, space resources exploitation and utilization, human lunar exploration, and large-scale deep space exploration. Simultaneously, the scale of access to space increases quickly, space technology and human society are extensively and deeply integrated, and space technology is profoundly influencing and promoting the progress of human society.

As the first stop for human beings go to deep space, cislunar space has various scarce strategic resources such as minerals, energy, environment, and locations. It is a strategic space for human survival and development for a long time in the future. Cislunar exploration and exploitation is moving towards large-scale and industrialization. Large-scale cislunar exploration and exploitation will promote human civilization into a new era.

In this paper, a new architecture of future large-scale cislunar exploration and exploitation are proposed firstly, which includes three major hardware facility systems, such as cislunar space transportation system, cislunar resources detection and exploitation system, and cislunar space infrastructure system. The cislunar space transportation system is an important component of large-scale cislunar exploration and exploitation, supporting all kinds activities of cislunar exploitation and exploration.

Then the concept and composition of the cislunar space transportation system are introduced. The cislunar space transportation system consists of a global express transportation system, a Earth-to-orbit round-trip transportation system, a cislunar space shuttle system, and a lunar exploration transportation system. The development status and trends of the global cislunar space transportation system are summarized and analyzed, and the future development is predicted in this paper. The analyzed result shows that the global demand for cislunar space transportation will exceed 100,000 tons per year in this mid-century, and Chinese demand will also exceed 10,000 tons. The demand is subdivided according to different cislunar exploration and exploitation missions, and future technical indicators of cislunar space transportation system is analyzed, including the launch frequency, the launch cost, the number of reusability, reliability and safety.

Finally, a development route of the future cislunar space transportation system is proposed. Then two solutions for future cislunar space airline-flight-mode transportation system are proposed, including one-stop type and relay type. And key technical difficulties of the two solutions are given. According

to different needs and technical foundations, both of them can become options for future cislunar space airline-flight-mode transportation system.