

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Going To and Beyond the Earth-Moon System: Human Missions to Mars, Libration Points and NEO's
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Author: Dr. Bilei Zhou
Shanghai Institute of Satellite Engineering, China, bilei_zhou@126.com

CONCEPT PLAN OF CREWED ASTEROID EXPLORATION MISSION

Abstract

Asteroids are solid minor celestial bodies in the solar system; they are smaller than planets and larger than meteoroids. Asteroids are objects of fundamental scientific importance for several reasons. They are the remnant debris from the formation of the inner solar system. They offer therefore the unique opportunity to study the original materials and the mechanisms which formed the terrestrial planets. Moreover, they can be the objects of a strong interaction with Earth's biosphere. Asteroids may have played a role in bringing water and organic substances on the Earth, influencing the formation of life. With catastrophic impacts they may have changed in the past the evolutionary path of life forms and may still constitute a serious threat to the human presence on the planet. Finally, asteroids represent an extraordinary source of minerals which can be exploited for the increasing necessities of our civilization and for the future exploration and colonization of the solar system. In the last twenty years asteroids passed from being distant point-like light sources in our telescopes to revealing themselves as intriguing complex worlds thanks to the vast amount of scientific results coming from dedicated space missions. The in-situ exploration combines the advantages of observing in a wide range of wavelengths, overcoming the limits imposed by Earth's atmosphere, to the high resolution possible only with close encounters. There are nine space probes that have explored asteroids so far, and crewed asteroid exploration mission has been planned. Crewed asteroid exploration missions can lead to important scientific findings of asteroids and our solar system, and the project scale and difficulty of crewed asteroid exploration mission is between crewed lunar exploration mission and crewed Mars exploration mission, thus to carry out crewed asteroid mission is valuable for future crewed Mars exploration mission and other crewed planetary missions. This paper focused on the crewed asteroid exploration mission, researched the existing crewed asteroid exploration plans, and proposed a concept plan of crewed asteroid exploration mission. This paper also raised some key technologies of crewed asteroid exploration mission. This concept plan may provide supports and references for Chinese crewed asteroid exploration in the future.