

SPACE EXPLORATION SYMPOSIUM (A3)  
Mars Exploration – Part 1 (3A)

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## DESIGN FOR MARS PLURAL MODE COMBINATION EXPLORATION MISSION

**Abstract**

The opportunity of Mars exploration activity is strictly limited. Plural mode combination exploration is the present direction of Mars exploration, so that more exploration results can be obtained and the combined effect of exploration activity can be heightened. Focusing on the requirements of science and Mars exploration mission innovations, and exploring advanced exploration modes, a novel scenario of Mars plural mode combination exploration mission is proposed. Its characteristics rest with the combination of several exploration modes such as Mars orbit, balloon, rover and penetrator. Therefore, Mars can be explored in three-dimensional plural mode combination exploration, which not only develop the capability and technology of exploration activity but also help to get a good grasp of Mars. The plural exploration units such as Mars orbit, balloon, rover and penetrator are involved in Mars plural mode exploration. Mars orbit and Mars rover are common exploration modes that have already been realized. Balloon has the ability to carry out immediate observations on Mars middle-level atmosphere, and utilize the flotage of Mars atmosphere to fly a distance to some area with high value of research and complex geography. This kind of area is difficult for traditional exploration modes to arrive to carry out some science observation. The Balloon exploration could fill up the blanks between the orbit and rover exploration. Penetrator could realize the exploration of the chemistry, structure and variation in temperature under the ground. In this paper, the factors in impacting on flight of Mars balloon are analyzed and the key techniques of the balloon exploration engineering are discussed. Also, the key techniques in impacting on the good or ill success of Mars penetrator are discussed. On the other hand, a method of communications and navigation through the exploration units that working together in combination is provided. This provides references for further research into Mars plural mode exploration.