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DESIGN AND DEVELOPMENT OF MULTI-MANEUVERING SATELLITE SYSTEM FOR GAS PLANETS AND THEIR MOONS

Abstract

In the last three decades, space agencies have been planning to send satellites and rovers to moons of Jupiter and Saturn. However, no lander is sent on these planets as previous missions have found that these planets are made up of gases and don't have a well-defined surface. Moreover, their atmosphere exerts a very high pressure [O (100 Million bar)] as well as their gravity is very high. This has been the main problem stopping us and limiting us from further Jupiter or Saturn explorations. Therefore, we know a lot less about such planets. So, to overcome this challenge, alternate ways need to be identified to analyse lower atmospheres of gas planets and their moons. In view of this, in the present paper, we put together a concept of multiple time maneuvering in Jupiter's atmosphere by using its gravity assist as well as with the help of its moons. In this concept, we propose to make multiple trajectories of satellites between moons of Jupiter and each time we pass using the gravitational assist of Jupiter while moving from one moon to another through Jupiter's upper atmosphere. The study therefore would be in two parts, the first part is the Study of Jupiter, where we will be able to analyse the data of lower atmospheric regions, and the second part is the study of Jupiter's Moons' surfaces. For this reason, we studied the feasibility of following aspects essential for the design and development of a multiples satellite and lander components. First, we evaluated sensors required for the analysis of the lower atmosphere while maneuvering through the gravity assist. Second, we illustrated the feasibility of low density balloons that can be successfully deployed in the dense gaseous environment. Third, we evaluated the arrangements for orbiting and landing on Jupiter's moons namely, landing leg, rover assembly, etc. Fourth, we assessed the requirement of solar charging systems as well as availability of alternate power resources. Finally, we probed the viability of using micro-robotic rovers for surface analysis of the moon. These rovers will have sampling and analysis facilities. Dropping these rovers on the moon's surface would be helpful in collecting soil data on their surfaces. The findings and data collected through this study will contribute towards the possibility of sending such rovers to Jupiter and its moons in near future. This paper will also outline the Concept of Operations of the proposed design.