

From Earth Missions to Deep Space Exploration (05)  
International Plans and Concepts (4)

Author: Mr. Rohan M Ganapathy  
Hindusthan College of Engineering and Technology, India, rohan2692@yahoo.in

Mr. Sakthi Guhan  
India, sakthiiguhan@gmail.com  
Prof. PRADHAPRAJ M  
India, nmpradhap@gmail.com

## TECHNOLOGY CHALLENGES OF EUROPA AND TITAN EXPLORATION MISSIONS

**Abstract**

This paper discusses requirements for autonomy technology that arise from the unique attributes of imagined exploration missions to Titan, a moon of Saturn, and Europa, an ice crusted moon of gas giant Jupiter. The mission to Europa tentatively includes a communications station on the surface of the ice, a "cryobot" which will melt through the ice to the ice/water interface, and a "Hydrobot" which would free swim under the water in a scientific research for hydrothermal vents. Autonomous commanding and fault protection technologies would be key requirements of this mission, as well as the ability to conduct science mission with very limited communication to other spacecraft or Earth. The Imagined mission to Titan includes "Aerobot", a robotically controlled lighter-than-air vehicle. Part of the mission for the Titan Aerobot includes sampling and scientific analysis of surface materials. Some of the significant drivers of autonomy requirements on an imagined Titan mission includes the difficulty in selecting sampling sites, the consequences of long round trip light time delays for commanding, and exogenous events such as weather. Autonomous site selection, commanding, science operations, and robust fault detection, isolation and recovery are a few of the imagined mission's critical areas that would be discussed in the full paper.