

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Solar System Exploration including Ocean Worlds (5)

Author: Mr. Vipul Mani
TU Berlin, Germany, mani.vipul7@gmail.com

Mr. Chirag Singh Mukherjee
TU Berlin, Germany, chiragsm05@gmail.com

Mr. Harshit Goel
University of Petroleum and Energy Studies, India, hgoel412@gmail.com

CASE STUDY ON EXPLORATION OF ENCELADUS THROUGH CONSTELLATION OF CUBESATS

Abstract

One of Saturn's many moons, Enceladus is a small, icy body with the whitest, most reflective surface in the solar system. Deep below Enceladus' frozen surface resides a massive liquid saltwater ocean. But the water doesn't stay beneath its icy crust forever. Massive geysers spew water vapor and ice particles hundreds of miles into space. Some of these particles fall back to the moon, giving Enceladus its bright white surface while others escape to form one of Saturn's iconic planetary rings. During its visit to the Saturn system, NASA's Cassini spacecraft flew through and sampled these icy jets of subsurface ocean. These continuously spewing geysers are chock-full of a surprising mix of: volatile gases, water vapor, carbon dioxide, organic compounds (the chemical ingredients needed for life). Cassini also detected materials that point to the existence of deep-sea hydrothermal activity, previously known to exist only on Earth. The fascinating discoveries made at Enceladus all point to the possibility of an ocean world where life could exist. With the use of CubeSats increasing towards enabling a cheaper alternative for space exploration, this study proposes a futuristic case study for multi-agent CubeSat mission to explore the ice-plumes coming out of Enceladus. The study analyses a constellation of CubeSats to be placed in multiple orbits around the Saturn's Moon. The mission architecture has been developed to maximize the variety of data received. Comprehensive Trade and Selection of power supply and thermal requirements of each satellite would be given to account for the power requirements and thus the lifetime of the mission. An idea in terms of cost and time involved with the mission would also be given to argue the possibility of such an exploratory mission in the upcoming decade. The purpose of this paper to provide an overview of the mission architecture, its elements and a path forward.