Paper ID: 71911
student

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Space Exploration Overview (1)

Author: Ms. Maria Regina Apoodaca Moreno
Massachusetts Institute of Technology (MIT), United States, mapodaca@mit.edu

Mrs. Cadence Payne
Massachusetts Institute of Technology (MIT), United States, cbpayne@mit.edu
Prof. Danielle Wood
Massachusetts Institute of Technology (MIT), United States, drwood@media.mit.edu

INVESTIGATING FEASIBILITY OF CUBESAT VENUS MISSION FOR ATMOSPHERIC SURVEYING

Abstract

Approximately 33 years ago was the last designated American mission to Venus. In the last year NASA has launched a new trend in planetary exploration towards this under-surveyed planet, approving two new medium-scale missions to Venus expected to launch between 2028 and 2030. Unfortunately, medium-to-large missions (e.g., 300 - 5000 kg) due to their long development timelines and high costs, tend to prioritize scientific goals that risk adverse or require special mission constraints. This slows the development of the field, limits mission creativity and raises the financial bar to inaccessible levels, removing the competitive edge for smaller research institutions for grant applications. Unlike Earth Observing (EO) missions, interplanetary missions still largely remain beyond the reach of academic institutions. The game changer for EO missions becoming more accessible was the development of CubeSats, i.e the CubeSat revolution. A new CubeSat mission to Venus would not only help further our understanding of this planet, particularly its atmosphere but will challenge the interplanetary compatibility of the CubeSat form factor, a boundary crossed only once before by the Mars Cube One mission. Astrobiology is a rapidly growing field that pushes the boundaries of planetary science towards the potential detection of life. Though the intersection is currently heavily theoretical, there is promising experimental potential via combining commonly used sampling techniques with methods used in biology and aerospace engineering. The science payload's novel component involves in-situ atmospheric sampling for the detection of gasses proposed as signatures of life, such as Phosphine Gas (PH3), at varying altitudes upon descent. This interest in Phosphine Gas was inspired by Jane S. Greaves et al. who proposed that Earth-detected PH3 is primarily produced and attributed to biological mechanisms, or life as it is currently defined. The paper suggests that ground-based observations show that the presence of PH3 in the Venusian atmosphere cannot be conclusively attributed to any geological or chemical explanation. Thus, leading to the need for development of in-situ testing instrumentation for future space missions. This work involves an investigative trade study to understand and quantify the feasibility of adapting the constrained CubeSat form factor for the purpose of surveying the venusian atmosphere. Preliminary findings and requirements for both the CubeSat form and the scientific instrument payload are presented in this paper.