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

Author: Mr. Pierre W. Bousquet
Centre National d'Etudes Spatiales (CNES), France

Dr. Gregg Vane
United States
Mr. John Baker
JPL, United States
Dr. Julie Castillo
United States
Dr. Carol A. Raymond
National Aeronautics and Space Administration (NASA), Jet Propulsion Laboratory, United States

PLANETARY CUBESATS: MISSION ARCHITECTURES

Abstract

Miniaturisation of technologies over the last decade has made cubesats a valid solution for deep space missions. For example, a spectacular set 13 cubesats will be delivered in 2018 to a high lunar orbit within the frame of SLS' first flight, referred to as Exploration Mission-1 (EM-1). Each of them will perform autonomously valuable scientific or technological investigations. Other situations are encountered, such as the auxiliary landers / rovers and autonomous camera that will be carried in 2018 to asteroid 1993 JU3 by JAXA's Hayabusas 2 probe, and will provide complementary scientific return to their mothership. In this case, cubesats depend on a larger spacecraft for deployment and other resources, such as telecommunication relay or propulsion. Teams of cubesats can also be deployed and perform advanced tasks such as telecommunications relays or distributed scientific measurements. This may involve surface networks, constellations of orbiters, or the combination of both.

For this various situations, we will describe in this paper how cubesats can be used as remote observatories (such as NEO detection missions), as technology demonstrators, and how they can perform or contribute to all steps in the Deep Space exploration sequence:

- Measurements during Deep Space cruise
- Body Fly- by
- Body Orbiters
- Atmospheric probes (Jupiter probe, Venus atmospheric probes, ..)
- Static Landers
- Mobile landers (such as balloons, wheeled rovers, small body rovers, drones, penetrators, floating devices, . . .)
- Sample Return

We will begin by identifying the science goals and investigations where cubesats and smallsats can make a unique contribution as science enablers and enhancers. The second part of the presentation will elaborate on mission architectures for the most promising concepts where cubesat size devices offer an advantage in terms of affordability, efficiency, and capacity to take risks.