Paper ID: 73862
oral

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

Author: Mr. Eric Bertels
ISIS - Innovative Solutions In Space B.V., The Netherlands

CUBESATS BEYOND LEO – NEW ENVIRONMENT, OLD PARADIGM

Abstract

Following the success of the MarCO flyby mission as part of the InSight mission and the NCLE instrument, a Chinese-Dutch collaboration part of the Chang'e 4 lunar lander, CubeSats and their CubeSat technology have finally taken their first steps beyond Low Earth Orbit (LEO).

Major strides have been made into the development of subsystems which adhere to the CubeSat philosophy: implementing cutting edge technology, at an affordable price, while still being able to survive the harsh environment of deep space. This approach opens the possibility for many new deep space applications at a much lower cost. While developments are ongoing to deliver small payloads beyond LEO, there are currently no low-cost solutions or standards which facilitate easy access to destinations beyond LEO. In this paper we propose to move the CubeSat paradigm to interplanetary probes with the development of a Deep Space Deployer (DSD). The DSD acts as the mechanical and electrical interface between a host spacecraft and CubeSat or other high-risk payload, protecting the CubeSat during launch and its deep space journey up until deployment, and protecting the mother spacecraft from the extra risks taken with CubeSats.

Interplanetary scientific experiments may benefit immensely from this paradigm and will improve capabilities significantly. One example would be the proposed Orbital Low Frequency Array (OLFAR) where multiple satellites outfitted with RF detectors increase the measurement baseline, allowing for improved sensitivity. It's also possible to have a larger temporal or spatial resolution by having many different elements image a planetary body, allowing a mothership to scan the surface prior to landing, thus maximizing scientific return by selecting the optimal spot.

When the CubeSats are still stowed in the mothership, the DSD will allow communication and power to flow from the mothership to the CubeSats. This functionality ensures occasional health checks can be executed on the CubeSats, and that their batteries remain charged. Here, the use of a safety board minimizes the impact of a potential fault in the CubeSat on the main spacecraft. Lastly, the DSD can be outfitted with a CubeSat Release System (CRS) which allows the CubeSat to be precisely deployed with velocities below 5 cm/s. This functionality prevents the satellites to flyaway in low-gravity environments.

The DSD is currently in development and has been baselined on ESA's HERA spacecraft. HERA is slated to launch in October 2024, and is expected to arrive at the binary asteroid Didomos/Ddidomoon in 2026.