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CUBESATS IN DEEP SPACE – NEW ENVIRONMENT OLD PARADIGM

Abstract

Following the success of the MarCO mission and the NCLE instrument, CubeSats and their technology have tentatively taken their first steps beyond low earth orbit (LEO). Major strides have been made into development of subsystems which still follow the CubeSat philosophy of using cutting edge technology while still staying at moderate cost while still being able to survive the harsh environment. This allows for many new deep space applications at a much lower cost then what can currently be achieved. Here, one can think of scientific measurements having an increased baseline allowing for improved measurements (e.g., OLFAR) or having a larger temporal resolution. Even though developments are ongoing to deliver small payloads beyond LEO there are no low-cost solutions or standards which can be used to allow the satellites to destinations beyond LEO. This forces additional complexity onto the CubeSats. Here we propose to move the CubeSat paradigm to interplanetary probes by the development of a deep space deployer. This deep space deployer reduces the complexity of the CubeSats as it does not need to navigate to the target and has the benefit of a 'mother' spacecraft in the vicinity. The mission of the main probe can be augmented as risks can be taken with a CubeSat that would not be taken with the mothership (e.g., landing on an asteroid) Some novel technologies are being developed to allow for this such as allowing communications with the CubeSats from the mother spacecraft. When the CubeSats are still stowed, batteries still need to be charged and occasional self-checks executed. Here, the use of a safety board minimizes the impact a potential fault in the CubeSat on the main spacecraft. Lastly, the deep space deployer can be outfitted with a CubeSat release mechanism (CRS) which allows the CubeSat to be deployed with a velocity below 5cm/s. This prevents the satellites to flyaway when the host spacecraft is in a low gravity environment as can be found around near-Earth objects. The deep space deployer is currently in development and has been baselined on ESA's HERA spacecraft. HERA is slated to launch October 2024 and will arrive at the binary asteroid didomos/didomoon in 2026.