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BIRDY-T – Interplanetary CubeSat to small body of the Solar System

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Abstract

We are developing the Birdy concept of a scientific interplanetary Cubesat, for interplanetary cruise, or proximity operations around a Small body of the Solar System (asteroid, comet, satellite). The scientific aim is to characterise the celestial body's shape, gravity field, and internal structure through imaging and radio-science techniques. Radio-science is now of common use in planetary science (flybys or orbiters) to derive the mass of the scientific target and possibly higher order terms of its gravity field. Its application to a nano-satellite brings the advantage of enabling low orbits that can get closer to the body's surface, hence increasing the SNR for precise orbit determination, or possibly two nano-satellites on a leading-trailing trajectory, to improve the gravity field determination. However application of the technique to Cubesat and inter-satellite link has to be proven.

Interplanetary Cubesats however need to overcome a few challenges to go successfully to deep-space: link to ground-segment, energy supply, protection against radiation, etc. Besides, the Birdy Cubesat — as a basis concept — is accompanying a mothercraft and relies on the main space probe and mission for reaching the target, as well as data-link with the Earth. However, all constraints to the mothercraft needs to be reduced, by having the Cubesat as autonomous as possible. In this respect, propulsion and auto-navigation are key aspects, that we are studying in a Birdy-T engineering model.

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